1 | SEM image of the OsteoBiol® cortico-cancellous bone matrix  
Source: courtesy of Prof Ulf Nannmark, University of Göteborg, Sweden

2 | SEM image of OsteoBiol® cancellous block  
Source: courtesy of Prof Ulf Nannmark, University of Göteborg, Sweden

3 | OsteoBiol® dual-phase bone substitutes contain approximately 22% collagen  
Source: Tecnoss media library

4 | SEM image of an osteoblast colonizing an OsteoBiol® Gen-Os® granule  
Source: courtesy of Prof Ulf Nannmark, University of Göteborg, Sweden

5 | The progressive resorption of OsteoBiol® granules allows an adequate colonization of the grafting site by new vessels  
Source: Tecnoss media library

6 | Biopsy retrieved after 4 months from grafting with OsteoBiol® GTO®, showing the gradual resorption of the granule  
Source: Biopsy by Dr Patrick Palacci, Marseille, France and histology by Prof. Ulf Nannmark, University of Göteborg, Sweden
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## MAXILLOFACIAL

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Laboratory tests

OsteoBiol®
by Tecnoss

REGENERATION SCIENCE
INSPIRED BY NATURE
The performance of human periodontal ligament mesenchymal stem cells on xenogenic biomaterials

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

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 coraline) 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 chemical 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 m²/g (Biocoral®) up to 60 m²/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”.

Abstract author: Cristina Rodighiero, dental journalist, free publication, not for resale. Printed by Tecnoss® Dental s.r.l.
Solid-state NMR and IR characterization of commercial xenogeneic biomaterials used as bone substitutes

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”. 
Osteogenic potential of dualblocks cultured with human periodontal ligament stem cells: in vitro and synchrotron microtomography study

ABSTRACT

In order to avoid an autologous approach for the treatment of large bony maxillofacial defects, bone tissue engineering combined to gene therapy and stem cell biology seems to be a promising alternative. In vitro cell cultures are an ideal tool to investigate and compare different biomaterial scaffolds. In this context, the current study investigated the early stages of in vitro bone formation in collagenated porcine scaffolds cultured with human periodontal ligament cells. 

The scaffold material here tested is named OsteoBiol® Dual-Block (Tecnoss®, Giaveno, Italy). It is a collagenated porcine block constituted by natural cancellous and cortical bone. In this product, the cortical bone is naturally anchored to cancellous bone to provide stability after grafting. Thanks to its rigid consistency, this scaffold guarantees that the original volume of grafting site can be preserved. Therefore, it is indicated for horizontal crest reconstructions.

For the test purposes, in vitro cultures of human periodontal ligament cells were seeded on to the collagenated porcine blocks and 3D images were obtained by synchrotron radiation micro-CT and processed with a phase-retrieval algorithm based on the transport of intensity equation. Starting from the second week of culture, newly formed mineralized bone was detected in all the scaffolds and bone mineralization was proved to occur preferentially in the trabecular portion and in differentiating media.

CONCLUSIONS

Based on the results of this study, the Authors affirm that “this study describes and demonstrates the osteogenic potential of Dual-Blocks cultured with PDLSCs since the early stages of culture and shows the feasibility of synchrotron radiation phase contrast micro-CT analysis to study new bone formation on collagenated bioscaffolds”.

ORIGINAL ARTICLE

Journal of Periodontal Research
2016 Feb;51(1):112-24
Characterization and angiogenic potential of xenogeneic bone grafting materials: role of periodontal ligament cells

ABSTRACT

In case of intrabony defects, grafting materials are frequently applied in order to fill the defect and support bone regeneration, with the aim to favour the migration of bone forming cells into the bone defect. As an adequate revascularization is a prerequisite for successful healing of periodontal bone defects, it is necessary that the grafting material used is capable of promoting a rapid revascularization. In literature, there is a clear evidence that the use of bone grafting materials with an angiogenic potential for treatment of periodontal bone defects can improve the clinical outcome.

The aim of this study was to characterize three different xenogeneic bone grafting materials and evaluate their angiogenic potential: Bio-Oss® cancellous anorganic bovine bone grafting material (Geistlich Pharma, Wolhusen, CH); OsteoBiol® Gen-Os® (Tecnoss®, Giaveno, Italy) cortico-cancellous collagenated bone grafting material of equine origin, and OsteoBiol® Gen-Os® cortico-cancellous collagenated bone grafting material of porcine origin. The hypothesis of this study was that the material may influence periodontal ligament (PDL) cell angiogenic activity, which is a prerequisite for successful bone regeneration. The three bone grafting materials were characterized by scanning electron microscopy (SEM), energy dispersive spectroscopy (EDS), X-ray diffraction (XRD) analyses and Fourier transform infrared (FT-IR) spectroscopy. In this way, the precise material chemistry was determined, allowing the interpretation of the materials’ effects on cellular behavior. With reference to the effect of bone grafting materials on VEGF secretion by PDL cells, results showed that all three bone grafting materials significantly increased VEGF secretion by PDL cells and that this increase was significantly higher with OsteoBiol® Gen-Os® from porcine and equine origins. A significant increase in endothelial cell proliferation was observed in cultures with both OsteoBiol® Gen-Os® conditioned media, but not with that of Bio-Oss®. Moreover, results showed that angiogenesis was stimulated by both OsteoBiol® Gen-Os® conditioned media as demonstrated by an increased formation of capillary-like structures.

CONCLUSIONS

As stated by the Authors, “Our results clearly indicate a significant increase in VEGF secretion and a higher angiogenic potential of both OsteoBiol® Gen-Os® materials from porcine and equine origins, compared to Bio-Oss®. Indeed, VEGF secretion by PDL cells increased when cultured in OsteoBiol® Gen-Os® conditioned media. This was associated with increased endothelial cell proliferation and formation of capillary-like structures. The formation of these structures reflects angiogenesis in vivo”. Consequently, their conclusion is that “Within the limits of this in vitro study, it was demonstrated that both OsteoBiol® Gen-Os® materials have a higher angiogenic potential compared to Bio-Oss®. Both OsteoBiol® Gen-Os® materials have the ability to induce VEGF secretion by PDL cells which is an interesting feature since it mitigates the need for exogenous growth factor delivery. Furthermore, angiogenesis was induced which suggests that the use of OsteoBiol® Gen-Os® materials will favour the bone regeneration process by stimulating early revascularization within the grafted material”.

Abstract author: Cristina Rodighiero, dental journalist, free publication, not for resale. Printed by Tecnoss® Dental s.r.l.
Expression of SP7, RUNX1, DLX5, and CTNNB1 in human mesenchymal stem cells cultured on xenogeneic bone substitute as compared with machined titanium

ABSTRACT

After tooth extraction, a negative bone remodelling occurs, with important dimensional changes. Consequently, one of the major clinical objectives is to prevent or limit the alveolar bone loss, maybe through an implant inserted immediately after one of the available augmentation techniques, such as the use of growth and differentiation factors, particulate and block grafting materials, distraction osteogenesis, and guided bone regeneration. Alveolar bone resorption and remodelling involve genes and a greater knowledge about factors expressed during bone repair could be useful in order to individuate novel therapeutic alternatives in this field. The aim of this research was to investigate the gene expression profile of 4 transcription factors in human mesenchymal stem cells (hMSC) cultured with an organic bone substitute consisted of cortical porcine bone (CPB) (OsteoBiol® Lamina, Tecnoss®, Giaveno, Italy) and a titanium surface consisted of Machined Titanium in the form of Disks (MTD) (Biotec, Vicenza, Italy). In vitro studies were performed on hMSC cells, which grew in contact with CPB and MTD for 10 days. RNA quantification for genes DLX5, CTNNB1, RUNX1, and SP7 was assessed by quantitative real-time polymerase chain reaction. For cells supported by titanium, immunocytochemistry of osteocalcin (OC) was also performed. In the osteoblast-induced cells (OIC), DLX5, CTNNB1, and RUNX1 were significantly upregulated (+2.38-, +3.51-, and +7.08- fold, respectively), whereas SP7 was downregulated (-26.32-fold). None of the genes seemed to be upregulated or downregulated by the cortico-cancellous porcine bone. In cells grown on titanium support, DLX5 and RUNX1 were respectively upregulated (+3.12-fold) and downregulated (-2.14-fold).

CONCLUSIONS

The 2 genes RUNX1 and SP7 resulted differently expressed in cells cultured on metallic supports if compared with their expression recorded for induced osteoblasts. An induction of the osteogenic phenotype was observed when cells were cultured on machined titanium, but not on xenogeneic material. Cortical porcine bone seemed to have minimal impact on gene expression. An induction of the osteogenic phenotype was observed when cells were cultured on machined titanium.
Graphene oxide improves the biocompatibility of collagen membranes in an in vitro model of human primary gingival fibroblasts

ABSTRACT

In case of guided tissue regeneration (GTR) and guided bone regeneration (GBR) interventions, barrier membranes play an important role for periodontal bone and peri-implant defects treatment, and for bone augmentation. The membrane application helps to prevent the ingrowth of soft connective tissue into bone defects, creating a protected space into which only bone cells can migrate.

The aim of this study was to study the biocompatibility behaviour of collagen membranes coated with graphene oxide (GO). Collagen membranes (OsteoBiol® Derma®, Tecnoss®, Giaveno, Italy), derived from porcine dermis after removal of the epithelial layer, were coated with GO by drop casting the aqueous GO solution of proper concentration on the membrane. It was verified that coating was stable and did not leak graphene oxide in the bulk medium. It has been evidenced that the GO coating changes some features of the membrane, such as stiffness and adhesion of the membrane.

Collagen membranes coated with different GO concentrations were then tested in a human gingival fibroblasts biological model in order to check their early adhesion and proliferation on barrier membranes which switch on a healing process after surgical procedures.

CONCLUSIONS

This study evidenced that the coating with GO of commercial collagen membranes was relatively homogeneous and easy to obtain. The presence of GO increases the roughness and the total surface exposed to the cells as demonstrated by AFM analyses. The obtained material is biocompatible and does not induce inflammation in the tested cells. Moreover, GO coating enhanced the proliferation rate of fibroblasts.

As the Authors stated: “These results may be connected with the demonstrated ability of GO to favour protein adsorption, an essential step for regulating cell functions and mediate cell adhesion and morphology. This means that the presence of GO should favour cell adhesion and the subsequent cells growth. This study paves the way to the further investigation of this novel coated membranes in terms of promotion of osteoblast differentiation and/or bacteriostatic activity”.

Abstract author: Cristina Rodighiero, dental journalist, free publication, not for resale. Printed by Tecnoss® Dental s.r.l.
Porcine bone scaffolds adsorb growth factors secreted by MSCs and improve bone tissue repair

ABSTRACT
When bone regeneration is needed, tissue engineering represents an ideal approach to restore critical-sized defects by means of biomaterials, cells, and biologicals. Biomaterials provide a three-dimensional (3D) substrate with specific engineered characteristics for cells to attach and proliferate and growth factors can be added in order to improve the migration and differentiation into the required tissue type. In order to improve or accelerate the bone healing process, new tools are offered to produce scaffolds that act as carriers for growth factors with bone-related biological properties, such as bone morphogenetic proteins (BMPs) and VEGF. The aim of the present study was to elucidate whether bone substitutes adsorbed with growth factors secreted by stem cells could represent a good natural delivery system able to stimulate vascularization and promote bone repair. In the vast panorama of bone substitutes, porcine-derived scaffolds are showing great results in terms of human bone regeneration, as confirmed by several studies. In the present study, porcine-derived bone granules with dimensions of 250-1000 µm (OsteoBiol® Gen-Os®, Tecnoss®, Giaveno, Italy) were loaded with MSCs, in particular those isolated from human dental pulp in order to investigate the ability of the porcine-derived bone granules impregnated with growth factors to promote and facilitate bone tissue regeneration in critical-size calvaria defects in rats.

CONCLUSIONS
Based on the results, the Authors determined that “bone tissue formation and markers for bone and vascularization were significantly increased by the growth factor-enriched bone granules after implantation. This suggests that the controlled release of active growth factors from porcine bone granules can enhance and promote bone regeneration”.

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Graphene oxide enrichment of collagen membranes improves DPSCs differentiation and controls inflammation occurrence

ABSTRACT

In oral surgical procedures, barrier membranes are necessary for the treatment of periodontal bone defects and peri-implant defects as well as for bone augmentation using guided tissue regeneration (GTR) and guided bone regeneration (GBR). Collagen membranes have several advantages such as easy manipulation, weak immunogenicity, direct effect on bone formation and chemotaxis of gingival and periodontal ligament fibroblasts. The aim of this study was to confirm that the properties of collagen membranes can be improved by coating them with graphene oxide (GO). In particular, the authors investigated the biocompatibility of collagen membranes coated with GO on human dental pulp stem cells (DPSCs) focusing on biomaterial cytotoxicity, ability to promote DPSCs differentiation process and to control inflammation event induction. As collagen membrane, OsteoBiol® Derma, (Tecnoss®, Giaveno, Italy), derived from porcine dermis after removal of the epithelial layer, was used. DPSCs were cultured on uncoated membranes and on both 2 and 10 lg mL⁻¹ GO coated membranes up to 28 days. Alamar blue and LDH cytotoxicity assay, PGE2 ELISA assay, real time RT-PCR for RUNX2, BMP2, SP7, TNFα and COX2 genes expression were performed.

CONCLUSIONS

The examined membranes proved their role as good barrier membranes, showing that the cells grew only on the surface of both uncoated and coated membranes and no cells were found in the collagen layer. The GO coated membranes were able to fasten and favour osteoblastic differentiation process and, at the same time, to effectively control the inflammatory events occurrence. All of these characteristics make the GO coated collagen membranes a good alternative to conventional membranes, as confirmed by the authors’ statement: “Our study showed that the GO coating on collagen membranes, on one hand actually promoted DPSCs attachment and proliferation, and on the other hand, not only had not cytotoxic effects on the cells but also improved at the late stages membranes biocompatibility.”.
Biofunctionalized scaffold in bone tissue repair

ABSTRACT

The aim of bone tissue engineering is to provide the right microenvironments to promote cell differentiation together with optimal scaffold development. In order to favour bone regeneration, the scaffolds need to be biocompatible, to lead the progenitor cells to commit to an osteogenic lineage and to avoid the possible host tissue inflammation or reaction. Moreover, they should provide an optimal microenvironment to support bone growth and development, the vascular network formation and cell recruitment. Different materials are used for the creation of the scaffolds. They can be tissue-derived materials, components of extracellular matrix (ECM), hydrogels or synthetic polymers. In this study, the Authors investigated the effect of human periodontal ligament stem cells (hPDLSCs) and their conditioned medium (CM) on bone regeneration using a commercially available collagen membrane scaffold OsteoBiol® Evolution (EVO) (Tecnoss®, Giaveno, Italy) with a high consistency dense collagen fiber derived from equine mesenchymal tissue. Collagen fibers constitute one of the main components of bone matrix and collagen-based scaffolds have been used and seem promising in bone tissue regeneration. Collagenous membranes were reported to induce osteogenesis in situ and collagenized porcine bone xenografts were demonstrated to be biocompatible, bioabsorbable, and osteoconductive in animal models. EVO alone or EVO + hPDLSCs with or without CM were implanted in Wistar male rats subjected to calvarial defects. In vivo bone regeneration in the grafted sites was evaluated after 6 weeks of implantation using fuchsine acid and methylene blue stained sections. The in vivo results revealed that EVO membrane enriched with hPDLSCs and CM showed a better osteogenic ability to repair the calvarial defect. These results were confirmed by acquired micro-computed tomography (CT) images and the increased osteopontin levels.

CONCLUSIONS

The results of this study revealed that EVO enriched with hPDLSCs and CM was able to almost completely repair the rat calvarial defect, showing a higher osteogenic ability compared with the other complexes. Moreover, the group EVO + CM + hPDLSCs showed the best regenerative capacity, indicating a synergistic effect of CM and hPDLSCs. In particular, CM played a key role and could have a very high potential for the induction of bone regeneration. These results suggest a promising potential application of CM from hPDLSCs and scaffolds for bone defect restoration and in particular for calvarial repair in case of trauma. Nevertheless, further investigations will be necessary to explain how the CM enhances the bone regeneration process.
Plasma of argon enhances the adhesion of murine osteoblasts on different graft materials

ABSTRACT

It has been demonstrated that the amount of bone regeneration is strictly correlated to the interaction between the graft material and the osteoregenerative cells and that the process of new bone formation and graft material resorption depends on the physico-chemical properties of the material itself. As acceleration of osseointegration of graft particles may depend on the optimization of the biomaterial rather than on an actual increase in the rate of bone response, the alteration of the physical surface characteristics might positively affect early bone response. Plasma treatment demonstrated to activate surfaces at the atomic and molecular level, producing hydrophilic surfaces and enhancing their wettability. Thus, plasma application can lead to an improved adhesion of cells. Following these considerations, the aim of the present study was to test the effect of plasma treatment on different graft materials regarding a change in surface characteristics and assessing protein adsorption and osteoblast growth. Four different classes of graft materials, representing commonly used classes of bone substitute material, were used: synthetic pure hydroxyapatite discs (Sintlife, Finceramica, Faenza Italy) (Mg-HA); biphasic calcium phosphate (60% HA, 40% β-TCP) discs (SUN-STAR Degradable Solutions AG, Schlieren, Switzerland) (BCP); cancellous xenogeneic (porcine) bone matrix discs (Osteobiol® Sp-Block, Tecnoss®, Giaveno, Italy) (CaBM) and cortical xenogeneic (porcine) bone matrix discs (Osteobiol® Cortical Lamina) (CoBM). All specimens were manufactured for the purpose of the study and were non-commercial products. Fifty serially numbered disks with a 10 mm-diameter from each graft material were randomly divided into two groups: test group (argon plasma treatment) and control group (absence of treatment). Cell morphology (using pre-osteoblastic murine cells) and protein adsorption were analyzed at all samples from both the test and control group. Differences between groups were analyzed using the Mann–Whitney test setting the level of significance at p < 0.05. Plasma treatment significantly increased the protein adsorption and cell adhesion in all groups. Cancellous and cortical BM grafts showed higher values in total protein adsorption compared to BCP and Mg-HA samples, both in the control and the test group. In group BM, a higher number of cells were embedded in the pores of the rough surface.

CONCLUSIONS

Outcomes of the present study confirm that bio-activation of graft material (independent of their physical characteristics) can positively influence cell and protein behaviour at substitute surfaces. Actually, bio-functionalization increased protein adsorption by up to 60% compared to untreated graft samples and a similar behaviour was observed analyzing cell adhesion (at least 30% higher cell adhesion for all graft materials). In their conclusions, the Authors affirmed that “Within the limitations of the present study, the data obtained confirm that non-atmospheric plasma-of-argon treatment is capable of increasing protein adsorption and cell adhesion to different classes of graft materials. Further research is required to assess whether these results might be beneficial in clinical settings”.

Abstract author: Cristina Rodighiero, dental journalist, free publication, not for resale. Printed by Tecnoss® Dental s.r.l.
Comparison of two xenograft materials used in sinus lift procedures: material characterization and in vivo behavior

ABSTRACT
Loss of teeth in the posterior maxillary area can lead to severe maxillary sinus pneumatization, and in this anatomical situation, it can be very difficult to obtain a suitable primary stability of implants. Maxillary sinus augmentation is a predictable method to increase posterior maxillary bone height, allowing to place dental implants in case of a residual alveolar ridge with a reduced bone volume. In sinus lift procedures, several types of graft materials can be used. The aim of this study was to characterize the physico-chemical properties of two xenografts deproteinized at different temperatures and compare how the physico-chemical properties influence the material’s performance in vivo by a histomorphometric study in retrieved bone biopsies following maxillary sinus augmentation in 10 clinical cases. The two materials were a bovine HAs scaffold (BBM) consisting of a highly porous network with an average pore size of 0.5 mm, and a porcine HAs scaffold (PBM) formed by small grains of 500 µm on average. The X-ray diffraction analysis revealed the typical structure of hydroxyapatite (HA) for both materials. Both xenografts were porous, with intraparticle pores. Strong differences were observed in terms of porosity, crystallinity, and calcium/phosphate ratio. Histomorphometric measurements on the bone biopsies showed statistically significant differences. Both xenografts showed to be characterized by an excellent biocompatibility, with similar characteristics to natural bone. At the 6 months follow-up, the success rate of the 10 partially edentulous patients was 100%. By the end of the healing period, the increased bone volumes were stable and it was evident a bone gain for both xenografts. At the moment of implant insertion, the augmented sites treated with PBM showed less dense new bone than BBM. The sintered HA xenografts exhibited greater osteoconductivity, but were not completely resorbable. The non-sintered HA xenografts induced about 25.92 ± 1.61% of new bone and a high level of degradation after six months of implantation. Differences in the physico-chemical characteristics (porosity, crystallinity and composition) found between the two HA xenografts determined a different behaviour for this material.

CONCLUSIONS
At the end of the study and after the evaluation of the results, the Authors concluded that “the HAs assessed herein are shown to be biocompatible and osteoconductive when used for maxillary sinus elevation purposes. PBM displayed a high level of degradation over the study period”. Anyway, more histological and histomorphometrical studies are needed to better understand the resorption times of these biomaterials.
LABORATORY TESTS

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Grafted with
BONE SUBSTITUTE
OsteoBiol® Dual-Block

Human periodontal ligament stem cells cultured onto cortico-cancellous scaffold drive bone regenerative process

ABSTRACT

In case of bone diseases or defects, the approach based on tissue engineering involves mainly tissue regeneration rather than tissue replacement. Consequently, new therapies have been proposed, which use scaffolds able to integrate with the surrounding tissue. Key factors in tissue engineering are cellular component and an adequate 3D scaffold, supporting cell colonisation, migration, growth and differentiation. As autologous bone grafting, considered as the gold standard in this context, is linked to donor-site morbidity, suitable alternatives have been proposed. The aim of this work was to test, in vitro and in vivo, a new scaffold material, OsteoBiol® Dual-Block (OsteoBiol®, Tecnoss®, Giaveno, Italy), which is a collagenated porcine block constituted by natural cancellous and cortical bone, and xeno-free ex vivo culture of human Periodontal Ligament Stem Cells (hPDLSCs). hPDLSCs cultured in xeno-free media formulation preserved the stem cells’ morphological features, the expression of stemness and pluripotency markers, and their ability to differentiate into the mesenchymal lineage. The peculiarity of OsteoBiol® Dual-Block (DB) is represented by the cortical bone which is naturally anchored to cancellous bone in order to provide stability after grafting. Thanks to its rigid consistency, it guarantees the preservation of the original volume of the grafted site. The outcomes of the tests performed suggest that DB is a biocompatible, osteoinductive and osteoconductive biomaterial, making it a promising tool to regulate cell activities in biological environments and for a potential use in the development of new custom-made tissue engineering. Actually, transmission electron microscopy analysis suggested that after one week of culture, both non induced and osteogenic differentiation induced cells joined and grew on DB secreting extracellular matrix (ECM) that in osteogenic induced samples was hierarchically assembled in fibrils. Quantitative RT-PCR (qRT-PCR) showed the upregulation of key genes involved in the bone differentiation pathway in both differentiated and undifferentiated hPDLSCs cultured with DB (hPDLSCs/DB). Functional studies revealed a significant increased response of calcium transients in the presence of DB, suggesting that the biomaterial could drive the osteogenic differentiation process of hPDLSCs.

CONCLUSIONS

Based on the outcomes, the Authors concluded that “in synthesis, the highly efficient cell proliferation, together with osteogenic and vascular differentiation and functional response, make the living construct composed by xeno-free hPDLSCs/3D porcine DB an innovative biocompatible system potentially useful in the reconstructing of skeletal segmental defects in tissue engineering”.

ORIGINAL ARTICLE

European Cells and Materials
2016;32:181-201
Role of cortico-cancellous heterologous bone in human periodontal ligament stem cell xeno-free culture studied by synchrotron radiation phase-contrast microtomography

ABSTRACT

Nowadays, the bone tissue engineering challenge is to find a suitable solution for bone regeneration following skeletal bone diseases. This solution must guarantee cell attachment, allowing in the meanwhile their differentiation into osteogenic lineage. As the use of autologous bone presents some limitations, the focus is concentrated on allogenic biomaterials as a viable alternative. Among allogenic biomaterials, OsteoBiol® Dual-Block (Tecnoss®, Giaveno, Italy), is constituted by natural cancellous and cortical porcine bone and as a scaffold, thanks to its properties, seems to be an ideal support for bone regeneration. This biomaterial was selected in particular because it possesses a cortico-cancellous structure similar to human bone. The cortical bone is naturally anchored to cancellous bone in order to provide stability after grafting. This scaffold guarantees, due to its rigid consistency, that the original volume of grafting site can be preserved and it is indicated for horizontal crest reconstructions.

The aim of this study was to demonstrate, through 3D images and Synchrotron Radiation Phase-Contrast Microtomography (SR-PhC-MicroCT), the osteoinductive properties of OsteoBiol® Dual-Block cultured with human Periodontal Ligament Stem Cells (hPDLSCs) in xeno-free media. In a previous study, the same authors reported the early stages of in vitro bone formation in collagenated porcine DBs cultured with human Periodontal Ligament Stem Cells, with detection of newly formed mineralized bone starting from the second week of culture. The difference and limitation of the previous study was the use of a non xeno-free media. In this study, the authors presented the use of Synchrotron Radiation-based phase-contrast MicroCT to quantitatively investigate in 3D the kinetics of the early stages of the mineralization process. This study disclosed bone deposits, in the shape of spots or fibrils, detected already from the first week of culture and the presence, after three weeks, of big mineralized nuclei, with a highly significant bone thickness increment from the first to the third week of culture. Also Bone Mineral Density was shown to increase from the first to the third week.

CONCLUSIONS

Based on the result of their investigation, the Authors concluded that “this work showed in 3D that the DB guides the osteogenic differentiation of hPDLSCs in xeno-free cultures, in agreement with 2D observations and functional studies previously performed by some of the authors”. Moreover, “the role of DBs in guiding the osteogenic differentiation of hPDLSCs was here demonstrated in xeno-free cultures, thereby helping to reduce concerns regarding PDLSC applications and encouraging further promising preclinical and clinical studies”.

Abstract author: Cristina Rodighiero, dental journalist, free publication, not for resale. Printed by Tecnoss® Dental s.r.l.
SEM-EDX study of the degradation process of two xenograft materials used in sinus lift procedures

ABSTRACT

In case of an implant rehabilitation in the upper jaw, maxillary sinus grafting, combined with Schneiderian membrane elevation, has been proposed to re-establish the ideal quantity and quality of bone prior to implant placement. In order to ensure positive results, the grafting material should provide good mechanical support, while maintaining bioactivity, and must biodegrade later at a tailorable rate. Therefore, the grafting material is an important determinant of bone augmentation procedures being a success or a failure. The objective of this study was to compare the physico-chemical properties of two deproteinized HA materials, assessing their influence on the degradation process of the materials’ performance in retrieved bone biopsies following their use in maxillary sinus augmentation. The raw materials employed in this study were two different types of commercial deproteinized HA materials used in dentistry: OsteoBiol® (Tecnoss®, Giaveno, Italy), a deproteinized porcine hydroxyapatite (DPHa) processed at 130 °C, and Endobon®, a deproteinized bovine hydroxyapatite (DBHa) processed with pyrolysis at 900 °C following ceramization at 1200 °C. Ten partially edentulous patients (six women and four men), whose ages ranged from 41 to 71 years, were subjected to maxillary sinus augmentation with a split-mouth design. Six months after the healing period, a biopsy was taken for histology purposes at the time of implant placement. From the results of the analysis, the fastest resorption rate of the material was in DPHa group and was related to physico-chemical characteristic of this xenograft. A significant difference in resorption time and stability of the material was found in DBHa, which showed greater stability and less resorption than the DBHa group. The HA of porcine origin is non-sintered presents high porosity, low crystallinity, low density, high surface area, and low calcium/phosphate ratio, low stability and high resorption rate.

CONCLUSIONS

In their conclusions, the Authors affirm that their study demonstrates that variations in the physical properties of a bone substitute material clearly influence the degradation process and, as a consequence, biomaterials can be chosen depending on the resorption rate, dimensional stability, and handling needed for each case. Anyway, further studies are required to establish to what extent the rate of resorption affects the capacity of the augmented area to receive and integrate dental implants.
A novel role in skeletal segment regeneration of extracellular vesicles released from periodontal-ligament stem cells

ABSTRACT

The combination of biomaterials and stem cells represents a common strategy for bone-tissue-engineering applications and collagen membranes show ideal biological properties, supporting infiltration and proliferation of osteoblasts and promoting bone regeneration. In this interesting study, the Authors aimed to develop a new biocompatible osteogenic construct composed of a commercially available collagen membrane (OsteoBiol® Evolution, Tecnoss®, Giaveno, Italy), human periodontal-ligament stem cells (hPDLSCs) enriched with extracellular vesicles (EVs), or polyethylenimine (PEI)-engineered EVs (PEI-EVs). Evolution membrane was chosen because it is a high-consistency dense collagen fiber derived from equine mesenchymal tissue featuring a maximum adaptability to hard and soft tissue, easy and secure suturability of nearby tissue, great stability, and sufficient protection of underlying grafts. Moreover, OsteoBiol® Evolution can be used as a drug carrier. OsteoBiol® Evolution enriched with hPDLSCs and EVs/PEI-EVs was investigated in rats subjected to calvarial defects and showed high biocompatibility and osteogenic properties in vitro and in vivo. In addition, quantitative reverse-transcription polymerase chain reaction demonstrated the up-regulation of osteogenic genes, such as TGFβ1, MMP8, TUFT1, TFIP11, BMP2, and BMP4, in the presence of PEI-EVs.

CONCLUSIONS

Based on the encouraging findings of this study, the Authors conclude suggesting that “Evo enriched with hPDLSCs and PEI-EVs is capable of inducing bone regeneration. In particular, PEI-EVs played a key role in the activation of the osteogenic regenerative process. Indeed, the presence of PEI-EVs improved the mineralization process and induced an extensive vascular network, suggesting an osseointegration process”.

Abstract author: Cristina Rodighiero, dental journalist, free publication, not for resale. Printed by Tecnoss® Dental s.r.l.
Experimental studies

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REGENERATION SCIENCE

INSPIRED BY NATURE
The bone tissue responses to prehydrated and collagenated cortico-cancellous porcine bone grafts: a study in rabbit maxillary defects

ABSTRACT

Bone substitutes of xenogeneic origin are frequently used as grafting materials for filling bone defects and maxillary sinus floor augmentation procedures. To be effective, bone substitutes must have osteoconductive properties and be completely replaced with new bone with time. In order to improve the clinical handling, it is possible to add collagen gel to prehydrated and collagenated porcine bone (PCPB) particles, with the result of a sticky and moldable material which facilitates its application in the site to be filled.

As the possible influence of the gel on the bone tissue response is not known, the objective of the study was to histologically evaluate the bone tissue responses to PCPB graft with or without collagen gel and to evaluate the resorption/degredation properties of the biomaterials.

For these study, bilateral bone defects (dimensions: 5x8x3 mm) were created in the maxilla of 14 rabbits. The defects were filled with prehydrated and collagenated cortico-cancellous porcine bone (PCPB) particles (OsteoBiol® Gen-Os®, Tecnoss®, Giaveno, Italy - granulometry: 250-1000 µm) as control material, or PCPB particles mixed with collagen gel (OsteoBiol® mp3®, Tecnoss®, granulometry: 600-1000 µm) as test material. A collagen membrane (OsteoBiol® Evolution, Tecnoss®) was used to cover the defect and to prevent migration of the particles and the wounds were closed with resorbable sutures. Animals were killed after 2 (n=3), 4 (n=3), and 8 weeks (n=8) for histological and morphometrical evaluations.

According to the results of these evaluations, there was no obvious difference between the test and control materials. There were no signs of adverse reactions, and both osteogenesis and angiogenesis followed ordinary time frames. Both materials showed bone formation directly on the particles by typical osteoblastic seams. The bone area increased with time (2-8 weeks) for both sides, from 16,2% (control) and 19,2% (test) to 42,7 and 43,8%, respectively. The PCPB, whether mixed with collagen gel or not, was resorbed by osteoclasts as well as part of remodeling with the formation of osteons within the particles. Morphometry showed a decrease of PCPB area from 19,4% (control) and 23,8% (test) after 2 weeks to 3,7 and 9,3% after 8 weeks, respectively. The histology showed that the membrane had fulfilled its function and was well integrated with the overlaying soft tissues.

CONCLUSIONS

From the findings of this study, it is possible to conclude that mixing collagen gel and PCPB to facilitate the clinical handling does not influence the bone tissue responses to the material, which exhibited osteoconductive properties and was resorbed with time. Both graft materials exhibited osteoconductive properties as bone formation with typical osteoblastic seams observed directly on the surface of the grafted particles. The morphometric measurements showed increased bone area with time in parallel with a decrease of the graft area. The Authors concluded that “collagenated porcine bone exhibits good biocompatibility and osteoconductive properties, whether mixed with collagen gel or not. In this model, the material was resorbed by surface osteoclasts as well as part of remodeling with the formation of osteons”.

Abstract author: Cristina Rodighiero, dental journalist, free publication, not for resale. Printed by Tecnoss® Dental s.r.l.
Short communication: collagenated cortico-cancellous porcine bone grafts. A study in rabbit maxillary defects

ABSTRACT

In a previous study, the Authors evaluated the bone tissue responses to collagenated porcine bone (CPB), with and without prehydration, finding that CPB exhibits good biocompatibility, osteoconductive properties, and that the material was resorbed by surface osteoclasts as well as part of the remodeling with the formation of osteons. Moreover, they found that the dehydration process made the graft material sticky, facilitating clinical handling. As the influence of different ratios between bone particles and collagen on bone response is not known yet, the aim of this short communication was to evaluate the bone tissue response to CPB, with different collagen gel content, when placed in defects in the rabbit maxilla. In this study, bilateral bone defects, 5x8x3 mm, were created in the maxilla of 8 rabbits. The defects were filled with prehydrated (20% collagen I/III) collagenated cortico-cancellous porcine bone mix (OsteoBiol® Putty, Tecnoss®, Giaveno, Italy – granulometry up to 300 µm) (A) or prehydrated (40% collagen I/III) collagenated cortico-cancellous porcine bone mix (OsteoBiol® Gel 40, Tecnoss® - granulometry up to 300 µm). Animals were killed after 8 weeks for histological and morphometrical evaluations that evidenced that both materials showed a high degree of new bone formation, 42% and 46%, respectively, and clear signs of resorption at the time of animals sacrifice.

CONCLUSIONS

The present study clearly demonstrates that CPB with different collagen gel content induces bone formation in defects in rabbit bone and that resorption of the porcine bone particles takes place. The high presence of collagen might induce adhesion of both mesenchymal cells and osteoclasts to the surface of the material because these cells are shown to link to different proteins. Also, collagen has been shown to have a chemotactic and differentiation effect on mesenchymal stem cells.

On the basis of the findings of this study, the Authors concluded that “CPB with different ratios of collagen exhibits good biocompatibility and osteoconductive properties. In this model, the two materials were equal with respect to both bone formation and resorption which had started at the endpoint at 8 weeks”.

Abstract author: Cristina Rodighiero, dental journalist, free publication, not for resale. Printed by Tecnoss® Dental s.r.l.
Comparison of a xenogeneic and an allogeneic material used in dental implants in terms of physico-chemical characteristics and in vivo inflammatory response

ABSTRACT

When the bone volume available is not sufficient for the proper rehabilitation of the patient, it is possible to use bone grafts of different types (autogenous bone, allografts xenografts and synthetic materials), all with specific advantages and disadvantages. In most cases, because of the lack of reliable information on their indications and effectiveness, as well as of comparative studies, the choice of the grafting material is left to the surgeon’s preferences.

In this study, the Authors evaluated two commercial bone grafts used in dentistry: OsteoBiol® Gen-Os® (Tecnoss®, Giaveno, Italy) a xenograft of porcine origin, formed by hydroxyapatite (HA) and collagen type I, having 80% of cancellous bone and 20% of cortical bone; and Bonelike® (Medmat Innovation, Porto, Portugal) a synthetic bone substitute, formed by a patented glass-reinforced hydroxyapatite.

These two biomaterials were evaluated in terms of chemical composition, crystallinity, particle size and size distribution, porosity, surface area and density. Moreover, they were tested in vivo with reference to their inflammatory response after intramuscular injection in rats.

The evaluation revealed that Bonelike® and OsteoBiol®, although used in the clinical practice for the same purposes, possess markedly different chemical and physical properties and that they induce different inflammatory responses after their implantation.

CONCLUSIONS

The results of this study show that these two biomaterials have quite distinct properties and the tissue response elicited by Bonelike® granules was consistently more intense than that triggered by OsteoBiol® granules, particularly in terms of collagen production and formation of fibrous capsule.

Consequently, the Author concluded that “the thorough characterization of these materials revealed substantial differences in their physico-chemical properties that seem to explain, at least partly, the more intense inflammatory response of Bonelike®.”
Porcine dermal matrix in the treatment of dehiscence-type defects - an experimental split-mouth animal trial

ABSTRACT

In case of gingival recessions, the surgical treatment can employ different techniques, such as free grafts, pedicle flaps and tissue regeneration. With reference to recession coverage and gain in keratinized tissue, subepithelial connective tissue graft (CTG) is considered to be the gold standard. In any case, CTGs require a second surgical site and there is an increased risk of patient morbidity and intra-surgical complications. In order to avoid these drawbacks, a porcine derived dermal matrix (PDX) has been introduced to correct dehiscence-type defects. The aim of this study was to histologically compare the use of a porcine dermal matrix (PDX) and subepithelial connective tissue (CTG) in the treatment of dehiscence-type defects.

OsteoBiol® Derma (Tecnoss®, Giaveno, Italy) is derived from porcine dermis after removal of the epithelial layer. The processing technique is performed at low temperature (cold process) and leaves behind an acellular porcine collagen tissue matrix without chemical cross-linking.

For this study, buccal dehiscence defects were created on both upper canines of Beagle dogs. The defects were covered in a split-mouth design either with a porcine dermal matrix or subepithelial connective tissue.

After 4 months histometrical outcomes (tissue thickness, tissue height) were evaluated and no inflammatory/foreign body reaction neither in the connective tissue nor in the perivascular areas was evident. Histometrically, no significant difference was found for tissue thickness and height between both treatment groups and the porcine dermal matrix was well tolerated by the host.

CONCLUSIONS

Within the limits of this animal study setting, as the tissue thickness showed only modest differences between porcine dermal matrix and subepithelial connective tissue, the authors concluded that “a porcine dermal matrix can safely be used as an alternative to subepithelial connective tissue grafts… This may be seen as a relevant clinical finding, as the main purpose of using soft tissue grafts for recession coverage is thickening of the surrounding tissues”.

OsteoBiol®
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Grafted with
MEMBRANE
OsteoBiol® Derma
ABSTRACT

After tooth extraction, the physiological socket remodelling results in marked volumetric changes in both the hard and soft tissue of the alveolar ridge. The possibility to maintain hard and soft tissue volume after tooth extraction is important in order to avoid a more complex treatment, as augmentation procedures.

To reduce hard tissue loss after tooth extraction it has been suggested to interfere pharmacologically with bone remodelling with, for example, a systemic administration of bisphosphonates.

The aim of this study was to evaluate the influence on extraction socket healing of local administration of pamidronate, adsorbed on a collagenated porcine bone substitute. Two American Fox-hound dogs were subjected to tooth extraction and the sockets were then loosely filled, in a split-mouth fashion, with a collagenated porcine bone substitute (OsteoBiol® Gen-Os®, Tecnoss®, Giaveno, Italy; CPB), rehydrated either with 90 mg/ml pamidronate (Aredia®; test) or with sterile saline (control).

After 4 months of healing, the Authors proceeded with the histological evaluation revealing substantial differences in healing patterns: control sites presented with various amounts of newly formed bone and no evidence of CPB inside the socket; in contrast, limited amounts of bone were observed at test sites, which were filled with CPB mainly embedded in connective tissue.

CONCLUSIONS

Based on the results of the histological evaluation, the Authors conclusion is that “local administration of pamidronate adsorbed on a collagenated porcine bone substitute in particulate form appeared to delay extraction socket healing, but may also reduce post-extraction dimensional changes in terms of horizontal bone width. Additionally, pamidronate appears to obstruct resorption of the porcine bone substitute”.

Abstract author: Cristina Rodighiero, dental journalist, free publication, not for resale. Printed by Tecnoss® Dental s.r.l.
Experimental evaluation of the effects of ankaferd blood stopper and collagenated heterologous bone graft on bone healing in sinus floor augmentation

ABSTRACT
In case of missing teeth, the use of dental implants is generally more difficult in the edentulous maxilla than in the edentulous mandible because of various complicating factors, as limited bone volume due to maxillary sinus pneumatization and alveolar resorption after tooth loss and poor bone quality. Maxillary sinus augmentation has frequently been proposed as the best option for attaining sufficient bone height and volume for implant placement in the posterior maxilla and for this procedure several grafting materials have been used for augmentation. The aim of this study was to evaluate the effect of collagenated heterologous bone graft (CHBG) and Ankaferd Blood Stopper (ABS), a plant extract, on bone healing after sinus floor augmentation. To the authors’ knowledge, this is the first study of the effects of ABS on bone healing in sinus augmentation procedures. In 36 New Zealand rabbits 72 bone defects were created and bilateral sinus augmentation was performed. The maxillary sinuses were grafted with four different biomaterials: blood clot (control group), CHBG (OsteoBiol® Apatos Mix, Tecnoss®, Giaveno, Italy) (graft group), ABS (ABS group), and ABS + CHBG (ABS + graft group). Material selection was done according to the blocked randomization method. Equal doses of graft materials were used, and mixed homogenously and the bone windows were covered with resorbable collagen membrane (OsteoBiol® Evolution, Tecnoss®). Twelve rabbits each were sacrificed at 1, 4, and 8 weeks after surgery and on all samples histochemical and immunohistochemical examinations were performed, showing that all the materials used in this study were biocompatible and did not elicit any foreign-body reaction. New bone formation started at the fourth week adjacent to the cortical bone walls, and by the eighth week it was seen in the center of the cavity in all groups. At the fourth week, new bone formation was greater in the ABS and ABS+graft groups than in the other groups. There were osteoclasts around the bone graft materials, but degeneration of the graft was seen only in the ABS+graft group at 4 and 8 weeks.

CONCLUSIONS
In bone regeneration procedure, collagenated heterologous bone graft (CHBG) has been used, thanks to its osteoconductive properties. CHBG proved to integrate well at host sites. In this study, this bone substitute was used alone and in combination with ABS. When used alone, there was no bone formation at the first week, but it increased gradually 1 to 8 weeks. Osteoclast numbers were high at the first week and declined thereafter. When used in combination with ABS, the bone formation rate was similar. Osteoblast density increased 1 to 8 weeks and osteoclast numbers were high in the first week and declined to 8 weeks. From the results it is evident that in the ABS and the ABS+graft groups, new bone formation was rapid from 1 to 4 weeks, but by the end of the eighth week, new bone formation was similar in all groups. In all groups, new bone formation was increased from 1 to 8 weeks. According to these results, the Authors concluded that ABS may accelerate bone healing.
Bone regeneration in iliac crestal defects: an experimental study on sheep

ABSTRACT
Successful implant placement requires adequate alveolar ridge dimensions and, if the implant site presents a lack of bone, Guided Bone Regeneration (GBR) is the surgical procedure commonly performed in order to provide an augmentation in terms of volume for the insertion of dental implants. Several types of membranes and biomaterials have been proposed for GBR techniques and the selection of the most appropriate grafting material is one of the key factors in achieving adequate bone formation.

The aim of the present study was to determine the in vivo tissue responses and gap healing patterns around dental implants treated with cortico-cancellous porcine bone blocks, collagenated cortico-cancellous porcine bone versus only membrane in a standardized sheep peri-implant gap-defect model. In the iliac crest of six sheep 4 defects were created for the insertion of an implant and the defects were filled with 1) control, only membrane (OsteoBiol® Evolution, Tecnoss®, Giaveno, Italy); 2) 250–1000 µm cortico-cancellous particulate porcine bone mix (OsteoBiol® Gen-Os®, Tecnoss®) + resorbable equine pericardium membrane (OsteoBiol® Evolution) (test 1); 3) cancellous equine bone blocks (OsteoBiol® Sp-Block, Tecnoss®) + resorbable membrane (OsteoBiol® Evolution) (test 2); 4) pre-hydrated collagenated cortico-cancellous porcine bone mix (90% granulated mix, 10% collagen gel) (OsteoBiol® mp3®, Tecnoss®) + membrane (OsteoBiol® Evolution) (test 3). The animals were sacrificed after a 4-month healing period and all specimens were processed and analyzed with histomorphometry, with the result that all experimental groups showed an increase of new bone. From the findings it is evident that particles of cortico-cancellous porcine bone 250–1000 µm particulate mix (CCPB) favour bone formation with a result similar to those obtained with pre-hydrated collagenated cortico-cancellous porcine bone mix (PCCPB). All biomaterials used in the present study were characterized by the presence of bone formation and absence of inflammatory cell infiltrates. However, the defect treated by membrane alone was characterized by the presence of soft tissues and a little immature bone.

CONCLUSIONS
As stated by the Authors, “the function of the graft is not only to improve the space-making capabilities of the membrane, but also to provide additional points on which osteoblasts can start forming new bone. We have shown that CCPB and PCCPB promote bone regeneration in large defects (7 mm wide and 4 mm deep) around dental implants”. In conclusion, this study demonstrates that particulate porcine bone mix and porcine cortico-cancellous collagenated pre-hydrated bone mix, used as scaffolds, induce bone regeneration and these findings suggest that these biomaterials are characterized by a high biocompatibility and can induce a faster and greater bone formation.
Influence of a collagen membrane positioned subjacent the sinus mucosa following the elevation of the maxillary sinus. A histomorphometric study in rabbits

ABSTRACT

In order to allow implant placement in the posterior maxillary regions, it is necessary to increase bone volume by means of sinus floor elevation. This procedure is widely applied and various biomaterials have been recommended to fill the elevated space. In case of a perforation of the sinus mucosa, it has been suggested to apply resorbable collagen membranes to protect the perforation. In order to have further information about the role of a collagen membrane placed subjacent the sinus mucosa, this study aimed to evaluate the healing after elevation of the sinus mucosa when a collagen membrane was placed between the sinus mucosa and a xenograft used as filler. In this study, 18 rabbits were used. Sinus mucosa elevation was performed bilaterally. After elevation of the sinus mucosa, a small piece of equine collagen membrane (OsteoBiol® Evolution, Tecnoss®, Giaveno, Italy) was placed subjacent the sinus mucosa at one site (test site), while no membranes were placed within the sinus at the control sites. At both sites, a collagenated cortico-cancellous porcine bone (OsteoBiol® Gen-Os®, Tecnoss®) was placed within the elevated space. The subsequent analysis showed that the elevated area was reduced between 2 and 8 weeks of healing by about 25% at the test and 47% at the control sites. After 8 weeks of healing, the mineralized new bone within the elevated space was 18.2±5.5% at the test and 26.7±7.7% at the control sites. Within the available space at the test site, the percentage was 27.3±7.0% after 8 weeks of healing. At 2 and 8 weeks of healing, within the elevated space, the xenograft proportion was 30.9±4.4% and 6.9±2.8% at the test, and 35.2±7.3% and 9.6±4.9% at the control sites, respectively. When the marrow spaces were counted together with the mineralized bone, the total bone formed within the available space after 8 weeks was 46.71% and 55.14% at the test and control sites, respectively.

CONCLUSIONS

From the results of the present study, new bone appeared to form from the native bone of the sinus walls and then propagated toward the middle and the submucosa regions. The collagen membrane contributed to maintain the available area, but the morphometric analyses of the healing in the elevated region after sinus membrane elevation were very similar when an internal collagenous membrane was placed as without the membrane placement. Likewise, the healing process in the elevated region appeared to be largely unaffected by the application of an internal collagenous membrane.
Reposition of the bone plate over the antrostomy in maxillary sinus augmentation: a histomorphometric study in rabbits

ABSTRACT

After sinus floor elevation, it is common to use membranes in order to cover the lateral access window and this approach showed better results than leaving the antrostomy uncovered. In literature different results have been reported following the two approaches and so the Authors of the present study evidenced the need of further data to describe the influence on healing of the closure of the bone window on the lateral antrostomy and on the integration of the bone window plate to the adjacent bone when ethyl-2-cyanoacrylate is used as fixative. Therefore, the aim of this experimental study was to test if the repositioning of the bony plate secured with a cyanoacrylate (test site) over the antrostomy in maxillary sinus augmentation was superior to the coverage of the antrostomy with a collagen membrane (control site) in terms of bone augmentation area and bone density. Moreover, the Authors assess tissue composition and healing processes 2, 4 and 8 weeks after sinus mucosa elevation within the elevated area and in the antrostomy. Eighteen male New Zealand white rabbits were selected and divided in three groups of different periods of healing, i.e., 2, 4, and 8 weeks, of six animals each. After the exposure of the nasal bone, a rectangular access window was prepared, removing the bony plate. A bilateral sinus mucosa elevation was performed, and the space filled with a collagenated cortico-cancellous porcine bone (OsteoBiol® Gen-Os®; Tecnoss®, Giaveno, Italy). At the test site, the bone plate was repositioned and secured to the walls of the antrostomy with drops of ethyl-2-cyanoacrylate adhesive. At the contra-lateral control sites, an equine collagen membrane (OsteoBiol® Evolution, Tecnoss®) was used to cover the antrostomy. Per group, 6 animals were sacrificed after 2, 4, and 8 weeks of healing, respectively. The histological evaluation showed that the augmented area after elevation decreased between 2 and 8 weeks from 9.4 ± 1.8 to 4.8 ± 2.8 mm² at the test and from 9.5 ± 2.6 and 5.1 ± 1.6 mm² at the control sites. Small amounts of new bone were seen after 2 weeks in both groups forming from the bony sinus walls and the area of the remaining defects decreased over time at both test and control sites. New bone density increased over time in both groups, with no statistically significant differences. Small residual defects were present both at the test sites in the margin of the bone plate, and at the control sites in the center of the antrostomy.

CONCLUSIONS

The bone healing in the elevated sinus space was similar irrespective of the coverage of the antrostomy. Even if the inference of the results from the present animal study to similar clinical situations in humans has to be considered with care, the Authors concluded that “the protection of the antrostomy by either repositioning the bony plate or covering the window with a collagen membrane resulted in similar outcomes in terms of new bone formation and xenograft resorption inside the available area. After 8 weeks, the bony plate was well incorporated into the subjacent new bone, while at the control sites, the healing was still incomplete. Residual defects were present in both groups”. 

Abstract author: Cristina Rodighiero, dental journalist, free publication, not for resale. Printed by Tecnoss® Dental s.r.l.
Histological and micro-computed tomography evaluations of newly formed bone after maxillary sinus augmentation using a xenograft with similar density and mineral content of bone: an experimental study in rabbits

ABSTRACT

It has been demonstrated that new bone forms after sinus floor elevation, but the tendency of the maxillary sinus to regain the lost space after sinus floor elevation has been documented as well. To counteract the physiological shrinkage of the elevated space, the use of bone fillers has been suggested.

The aim of the present study was to evaluate possible differences in the assessment of bone formation between histological and micro-computed tomography (CT) analyses in maxillary sinuses augmented with a xenograft with similar density and mineral content of bone. Eighteen male New Zealand white rabbits were randomly divided into three groups. After the sinus mucosa elevation, in the test sites an equine collagen membrane (OsteoBiol® Evolution 0.3 mm, Tecnoss®, Giaveno, Italy) was placed subjacent the sinus mucosa and both sinuses were subsequently filled with similar amounts of collagenated cortico-cancellous porcine bone (OsteoBiol® Gen-Os®, Tecnoss®; 250–1,000 µm). Six rabbits per group were sacrificed after 2, 4, and 8 weeks of healing. Biopsies were retrieved, scanned in a high-resolution micro-CT, and subsequently subjected to histological assessments. The histological analyses showed that bone increased over time, from 7.5 ± 2.4% to 27.0 ± 5.3%, between 2 and 8 weeks of healing. After 2 weeks, higher content of xenograft was found at the histological compared with the micro-CT analyses, especially in the middle regions of the sinus. After 8 weeks of healing, higher percentages of bone were found at the histological compared with the micro-CT analyses, being the differences statistically significant.

CONCLUSIONS

Within the limitation of this study, the Authors concluded that “the outcomes of a micro-CT analysis performed in an early phase of healing may be altered when a resorbable bone substitute with similar density and mineral content of bone is applied”.
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Effects of systemic erythropoietin treatment and heterogeneous xenograft in combination on bone regeneration of a critical-size defect in an experimental model

ABSTRACT

In order to fill bone defects, different biomaterials like autogenous, homogenous (allograft) and heterogeneous (xenograft) bone grafts, and synthetic (alloplastic) substitutes can be used, as they all present fundamental osteogenic, osteoinductive and osteoconductive properties. As it has been demonstrated that impaired bone vascularity results in inadequate osteogenesis in bone repair with decreased bone formation, researchers have focused their attention on the possibilities to enhance angiogenesis for proper bone regeneration. In this context, EPO, a physiologic hormone whose essential role is erythrocyte production, has gained more and more interest. Anyway, besides its osteogenic and angiogenic effects in different bone defect models, little is known about potential regenerative effects of EPO on the grafting of defects. Consequently, the aim of the present study was to evaluate the effects of systemic EPO treatment alone or in combination with xenogenic bone graft augmentation on bone regeneration. In this study, 11 adult male rats were subjected to bilateral 5 mm critical size bone defects on the parietal bones under general anaesthesia. Right parietal bone defects were augmented with cortico-cancellous heterologous xenograft bone particles (Osteobiol® Gen-Os®, Tecnoss®, Giaveno, Italy) and bone defects of left parietal bones were left empty. The 11 rats were randomly divided in two groups. One group of rats received (i) vehicle (n = 6) and other group received (ii) EPO (500IU kg/day) (n = 5). EPO treatment was continued for 28 days. After that period, animals were sacrificed and their calvaria were harvested for histomorphometric evaluation. Xenogenic graft augmentation enhanced bone formation and vascularization significantly in either vehicle or EPO treated groups (p < 0.05). Histomorphometric analysis of new bone formation revealed that bone formation in the graft group was significantly higher than in the control (p = 0.036) group. Histomorphometric results show that angiogenesis was similar in the EPO treated group and the control group. However, angiogenesis was significantly higher in the group treated with a combination of systemic EPO treatment with graft augmentation than graft augmentation alone (P < 0.01).

CONCLUSIONS

Within the limitations of the present study, The Authors concluded that “systemic EPO has no effect on angiogenesis and bone formation of critical-size calvarial bone defects at the end of four weeks. Xenograft augmentation for the treatment of bone defects enhances both angiogenesis and bone formation essential for the physiological function of bone. The present findings corroborate the idea that critical size bone defects require a graft for proper bone healing. Furthermore, the present study indicates that xenograft augmentation potentiates the angiogenic effect of the EPO treatment and systemic EPO treatment may be a promising agent for adjuvant therapy during xenograft augmented bone healing”.

Abstract author: Cristina Rodighiero, dental journalist, free publication, not for resale. Printed by Tecnoss® Dental s.r.l.
Alveolar regeneration

OsteoBiol®
by Tecnoss
Clinical and histological study of a xenogenic bone substitute used as a filler in postextractive alveolus

ABSTRACT

The remodeling process following a tooth avulsion results in a three-dimensional modification of the alveolar bone, making the insertion of an implant extremely difficult and requiring an augmentation procedure. The aim of this study was to evaluate the clinical behavior and the resorption times of the graft material (OsteoBiol® Putty, Tecnoss®, Giaveno, Italy), an antigen-free bone paste composed of 80% granulated mix and 20% pure collagen. This product has an average resorption time of less than 4 months. 12 patients were included in the study and all of them required an endosseous implant following the loss of a tooth due to root fracture or periodontal pathology. After the flap elevation and the defect examination, OsteoBiol® Putty was inserted in the cavity by means of a sterile spatula and the flaps were sutured. The histological analysis and the x-ray performed after 3 months showed a complete resorption of the heterologous material and its substitution with trabecular bone tissue.

CONCLUSIONS

The Authors appreciated the ideal malleability and plasticity of the product that allow a very simple application. Moreover, this biomaterial supports a correct bone tissue regeneration, facilitating and accelerating the physiological processes. In the Authors’ opinion, “this material could be the best indication for the insertion of postextractive implants in sites where the bone defects are more than 2 mm”. They also concluded that OsteoBiol® Putty can be used also in not prominent or in 3-wall defects, with the advantage of an easy applicability.
Xenograft versus extraction alone for ridge preservation after tooth removal: a clinical and histomorphometric study

ABSTRACT

In order to allow a proper implant placement from both esthetics and function points of view, it is fundamental to preserve as much as possible the ridge bone volume immediately after tooth extraction. In order to obtain this, different biocompatible materials and autogenous bone have been used to treat the bone atrophy of the alveolar ridges. The purpose of this randomized clinical trial was to compare the bone dimensional changes following tooth extraction with extraction plus ridge-preservation using cortico-cancellous porcine bone and a collagen membrane. Moreover, the Authors analyzed and compared the histologic and histomorphometric aspects of the extraction-alone sites to the grafted sites.

40 patients who required tooth extraction and implant placement were enrolled in this study and randomly assigned to the control group (EXT; extraction alone) or to the test group (RP; ridge-preservation procedure). In this last group, cortico-cancellous porcine bone (OsteoBiol® mp3®, Tecnoss®, Giaveno, Italy) was packed into the socket and collagen membrane (OsteoBiol® Evolution, Tecnoss®) was hydrated in sterile saline and trimmed to completely cover the socket.

The clinical and histologic evaluations showed significant differences between the two treatments. The implants were placed at all sites, although some implants in the extraction-alone group showed a buccal dehiscence that required guided bone regeneration procedures after implant insertion. The bone biopsies taken from the control and test sites 7 months after the surgical treatment and the histologic and histomorphometric analyses showed a significantly greater horizontal reabsorption (4,3±0,8 mm EXT vs. 2,5±1,2 mm RP) and a greater ridge height reduction (3,6±1,5 mm) at the buccal side in the EXT group (RP: 0,7±1,4 mm). The vertical change at the lingual sites was inferior in the ridge-preservation group. The biopsies harvested from the grafted sites revealed the presence of trabecular bone, which was highly mineralized and well structured. The amount of connective tissue was significantly higher in the extraction-alone group than in the ridge-preservation group.

CONCLUSIONS

This study showed that the almost complete incorporation of the cortico-cancellous particles in bone created a dense and hard tissue network in which the porcine bone particles were completely surrounded by vital bone. The results obtained suggest that the ridge-preservation approach using porcine bone in combination with collagen membrane can limit the resorption of hard tissue ridge after tooth extraction. Moreover, the new bone formation observed between the porcine bone particles might indicate that the biomaterial is osteoconductive and acts as a natural scaffold for new bone formation.
Preservation of the postextraction alveolar ridge: a clinical and histologic study

ABSTRACT

When the treatment planning foresees the placement of an implant following a tooth extraction, it is necessary to preserve the dimension of the post-extraction alveolus. In literature different ridge preservation procedures have been proposed and it has been confirmed that filling and covering the post-extraction alveolus preserve the bone volume in a more predictably way compared to the natural healing. However, some controversy exists regarding the quality of the tissue augmented in the extraction site.

The aim of this investigation was to assess the possibility of preserving the buccal and lingual plates of a post-extraction socket from resorption using a bone filler. Consequently, this study investigated the role of a bone substitute material in preserving the ridge after the extraction of posterior teeth. In order to do this, after the tooth extraction, 10 single sockets in the posterior area were filled with a xenograft material (OsteoBiol® Gen-Os®, Tecnoss®, Giaveno, Italy). The granules were then covered with a collagen membrane (OsteoBiol® Evolution, Tecnoss®) and the soft tissues were sutured over the membrane without obtaining primary closure.

The histologic analysis performed 4 months after extraction on the specimens harvested from the area previously augmented with bone filler evidenced that about 85% of the initial ridge dimensions was preserved, allowing for a correct implant placement. From a histologic point of view, new bone formation was detected in all sites.

CONCLUSIONS

The results obtained in this investigation confirm that the resorption of the crestal width can be significantly reduced thanks to the use of a filling material and that the augmentation of the alveolus after tooth extraction seems to increase the probability of maintaining the original crestal form, allowing ideal implant placement with optimal bone and gingival tissues. In the Author’s opinion, “the results promote the use of a bone substitute to fill the post-extraction site of posterior teeth to avoid alveolar bone loss”.

In case of a post-extraction socket, it may be necessary to adopt surgical procedures such as guided bone regeneration, bone allografts, bone autografts, and xenografts in order to ensure the proper biologic and esthetic conditions for the consequent implant placement. For this purpose, different graft materials have been advocated to prevent a bone-volume reduction and the aim of this study was to evaluate radiographic parameters of implants positioned in grafted alveoli with 3 different biomaterials: magnesium-enriched hydroxyapatite (MHA), calcium sulfate (CS), and heterologous porcine bone (PB).

15 patients, 7 women and 8 men, were included in this prospective study, requiring the extraction of 3 teeth for each patient. In total, 45 fresh extraction sockets with three bone walls were selected. 15 sockets received MHA, 15 sockets received CS, and 15 sockets received cortico-cancellous PB (OsteoBiol® Gen-Os®, Tecnoss®, Giaveno, Italy) as a graft material. After 3 months, in all the grafted sites titanium dental implants were placed and the temporary restoration was performed 3 months after the implant placement.

In order to evaluate the marginal bone level, at baseline and 12 and 24 months after implant placement, follow-up examinations, including intraoral digital radiographs, were conducted.

After 24 months, the results were the following: for the MHA group, a mean mesial bone loss of -0,21±0,08 mm and a mean distal bone loss of -0,22±0,09 mm (mean bone loss: -0,21±0,09 mm) were reported; for the CS group, a mesial bone loss of -0,14±0,07 mm and a distal bone loss of -0,12±0,11 mm (mean bone loss: -0,13±0,09 mm) were measured; for the PB group, a mean mesial bone loss of -0,15±0,10 mm and a mean distal bone loss of -0,16±0,06 mm (mean bone loss: -0,16±0,08 mm) were reported. No statistically significant differences were reported among groups (P>0,05).

CONCLUSIONS

The findings of this study at the moment of the 24-month follow-up showed that all the graft materials allowed the proper conditions for the implant osseointegration and that the placement of implants in grafted sockets was not influenced by the three different biomaterials, as they did not negatively impact the clinical outcome. The absence of statistically significant differences of bone level around implants among groups confirmed the results reported by other studies.
Planning implants in the esthetic zone using a new implant 3D navigation system

ABSTRACT

When a dental implant replaces a natural tooth, any deficit of soft or hard tissue makes more difficult to achieve a satisfactory and predictable esthetic results.

Nowadays, guided implant surgery has become a clinical reality in implant dentistry and on the market different navigation systems are available for the planning both of the surgical and prosthetic stages. Moreover, the evolution of digital technology and imaging led to new perspectives in planning modern implant-prosthetic therapy, with interesting effects on implant-guided surgery.

In this article, the Authors present a case report planned and executed with the help of a new procedure for the planning of guided surgery using a hybrid approach as an alternative to current CAD/CAM techniques. This is a low-cost and simple technique, based on a presurgical CT scan, that allows the surgeon and the prosthodontist to work in a team to deliver a fixed restoration at the time of the surgical procedure in a minimally invasive and predictable way.

As after the tooth extraction in an esthetic zone the patient showed a bone deficit, the extraction socket was cleaned carefully, extracting all the residual inflammatory tissue, and was grafted with a porcine cortico-cancellous mixed graft (OsteoBiol® Gen-Os®, Tecnoss®, Giaveno, Italy) and sealed with a fibrin sponge. The healing was uneventful, and despite the expected buccolingual contraction of the soft tissue, the 6-month follow-up radiograph evidenced the ideal integration of the bone graft.

CONCLUSIONS

Based on the satisfactory results obtained in their clinical experiences, the Authors concluded that “minimally invasive approaches are very important when dealing with soft and hard tissue management. The conventional flapless approach is known to have good results with less recession of hard and soft tissues. Therefore, planned flapless surgery may become the gold standard for soft and hard tissue regeneration in the future”.

The procedure described in this article, together with the use of diagnostic three-dimensional software, seems a precise and efficient means of providing a prosthetic device before surgery takes place.
Corticocancellous porcine bone in the healing of human extraction sockets: combining histomorphometry with osteoblast gene expression profiles in vivo

ABSTRACT
In case of tooth extraction, significant structural changes and bone resorption - both horizontally and vertically - have been reported, with the detrimental consequence of important dimensional changes in the alveolar bone. In order to preserve the alveolar bone volume, it is common to graft a biomaterial into the socket immediately following the tooth extraction. The aim of this study was to evaluate the use of porcine bone graft in fresh sockets via histomorphometric and in vivo gene expression profiling.

For this prospective split-mouth study, 15 patients with a mean age of 53.7 years (range: 32-70 years) requiring the extraction of two teeth - one on each side of the arch in the molar or premolar regions - were selected. The inclusion criteria for the sockets were the presence of three bone walls and loss of the buccal plate. Following a split-mouth design, half the sockets received xenogeneic cortico-cancellous porcine bone (OsteoBiol® Gen-Os®, Tecnoss®, Giaveno, Italy) (PB group) and the contralateral sockets were left unfilled (control group). Four months after surgery, four cylindrical specimens were taken from each patient (two from the PB-grafted site and two from the control site) and the samples were processed for osteoblast expansion and in vivo gene expression analysis and for histomorphometry. The healing process occurred without complications and the grafted sites showed statistically significantly higher mean vital bone and lower mean connective tissue values than the control sites. The histological examination revealed an absence of inflammatory cells, along with bone formation in all grafted sites (39.6±9.4% in PB vs. 29.5±5.0% in control group) and the presence of biomaterial particles (34.4%±5.1%) and connective tissue (26.0%±9.9% in PB vs. 57.7%±6.9% in control group). In bone samples taken from PB-group, a better bone matrix formation and a decrease in osteoclastogenesis and bone resorption were observed. The consequent higher amount of new formed bone can be explained by the better mRNA gene expression of proteins such as Osteopontin (OPN) and type I collagen, together with a minor expression of Osteoprotegerin (OPG).

CONCLUSIONS
Due to the absence of inflammatory signs around the graft particles, the close contact between graft particles, and the newly formed lamellar bone present in the specimens, this study suggests that cortico-cancellous PB can be used successfully for ridge preservation. Moreover, the histological examination and the biomolecular evaluation confirmed the good biocompatibility and the high osteoconductivity of xenogeneic porcine bone. At any case, the Authors suggest that further studies are needed to better understand the long-term clinical and biological outcomes of this biomaterial.
Porcine-derived xenograft combined with a soft cortical membrane versus extraction alone for implant site development: a clinical study in humans

ABSTRACT

Following a tooth extraction, there is a significant reabsorption of the alveolar ridge with quantitative and qualitative changes of its profile. Often, the reabsorption is more pronounced on the buccal aspect of the ridge than on its lingual/palatal counterpart, with dimensional changes in size and shape. In this article, the Authors report the results of a study performed on 15 patients who required double extraction of contralateral premolars and delayed implant placement who were randomly selected to receive alveolar ridge preservation (ARP) procedure compared with extraction alone (EXT). In this split-mouth study, the test sites (ARP) included 15 sockets treated according to the GBR principle for the ARP procedure with a cortico-cancellous porcine bone xenograft in combination with a soft cortical membrane. The xenogenic bone substitute consisted of cortico-cancellous porcine bone (OsteoBiol® Gen-Os®, Tecnoss®, Giaveno, Italy) in the form of mixed granules with a diameter ranging from 250 to 1000 µm. The membrane was a soft cortical lamina (OsteoBiol® Lamina, Tecnoss®) with a porcine bone origin and a plastic consistency. Horizontal and vertical ridge dimensions were recorded at baseline and 6 months after extractions. After 6 months of healing, it was possible to place implants in all sockets, although some EXT sites had a slight buccal dehiscence requiring bone regeneration procedures after implant insertion. The use of porcine-derived xenograft as intrasocket graft combined with a membrane reduced significantly the bone loss: the mean width for the ARP sites showed a reduction of 1,8±1,3 mm versus a reduction of 3,7±1,2 mm for the EXT sites. Moreover, a significant vertical reduction was demonstrated in the EXT sites for mid-buccal and mid-palatal/lingual measurements (3,1±1,3 mm and 2,4±1,6 mm respectively), whereas in the ARP sites the ridge height remained relatively unchanged (0,6±1,4 and 0,5±1,3 mm).

CONCLUSIONS

Based on the results of this study, the Authors concluded that “it must be considered that the use of a xenograft in combination with a membrane reduces buccal reabsorption in a ridge crest, which naturally tends to a more palatal/lingual position following tooth extraction, thus decreasing possibility of dehiscence and favoring an ideal implant placement. The ARP approach using porcine bone in combination with a soft cortical membrane significantly limited the bone dimensional changes after tooth extraction when compared with EXT. Therefore, even if some EXT sites allowed an implant placement, the most predictable maintenance of the horizontal and vertical ridge dimensions was achieved only with the ARP procedure”.
A randomized clinical trial to evaluate and compare implants placed in augmented vs. non-augmented extraction sockets. 3-year results

ABSTRACT
As the maintenance of long-term stability of implant solutions depends on the quality and quantity of the available alveolar bone supporting implantation, the preservation of the alveolar crest after tooth extraction is essential for the success of the rehabilitation. In order to evaluate the need for additional augmentation procedures at implant insertion, the aim of this randomized clinical study was to test the hypothesis of no difference in success rate, bone tissue remodelling and need for augmentation procedures for implants placed in grafted sites versus implants placed in naturally healed sites. 40 patients having at least one hopeless tooth were enrolled in the study. Extraction sockets allocated in the test group were grafted with cortico-cancellous porcine bone (OsteoBiol® mp3®, Tecnoss®, Giaveno, Italy) and a collagen membrane (OsteoBiol® Evolution, Tecnoss®) was used to completely cover the socket. In the control group no biomaterial was grafted. The ridge-preservation approach using porcine bone in combination with a collagen membrane significantly limited the reabsorption of hard tissue ridge after tooth extraction compared to extraction alone. All patients were followed up to 3 years. At the end of the study, the results were: one implant failed in the control group at the second stage of surgery (6 months after placement); one implant failed in the test group after 2 years of loading. The cumulative implant success rate at the 3-year follow-up visit reached 95% for both groups. No statistically significant differences were detected for marginal bone changes between the 2 groups.

CONCLUSIONS
Based on the results of the present investigation, it was concluded that implants placed into grafted extraction sockets exhibited a clinical performance similar to implants placed into non-grafted sites in terms of implant survival and marginal bone loss. However, the Authors underlined that “it seems from these findings that extraction alone may lead to unpredictable healing patterns in which the remaining ridge does not often allow for an aesthetic and functional solution without the aid of an additional bone augmentation procedure simultaneously with implant placement.”

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Abstract author: Cristina Rodighiero, dental journalist, free publication, not for resale. Printed by Tecnoss® Dental s.r.l.
Tissue changes of extraction sockets in humans: a comparison of spontaneous healing vs. ridge preservation with secondary soft tissue healing

ABSTRACT

Different ridge preservation techniques are available in order to control the bone remodeling process after a tooth extraction. The aim of these procedures is the maintenance of the alveolar ridge dimensions. Guided bone regeneration techniques have shown better results when compared to tooth extraction alone and the aim of this study was to evaluate the changes of hard and soft tissues in post-extraction sockets treated with a ridge preservation procedure and to compare them with those of post-extraction sockets which had healed naturally. A total of 58 patients (29 controls, and 29 tests) were enrolled in this study and each patient was randomly allocated to a test group or control group using a specific software package. The control sites received suture without any grafting material. The test sites were grafted with cortico-cancellous porcine bone (OsteoBiol® mp3®, Tecnoss®, Giaveno, Italy) and a collagen membrane (OsteoBiol® Evolution, Tecnoss®). At baseline and at implant placement (i.e. at 4 months), vertical bone changes, horizontal bone changes and width of keratinized gingiva were evaluated. The control group showed vertical bone resorption of 1±0,7 mm, 2,1±0,6 mm at mesial and buccal sites, and 1±0,8 mm and 2±0,73 mm at distal and lingual sites respectively. With reference to the changes in horizontal dimension, an average resorption of 3,6±0,72 mm was assessed. The test sites showed a vertical bone remodelling of 0,3±0,76 mm, 1,1±0,96 mm at mesial and buccal sites, and 0,3±0,85 mm, 0,9±0,98 mm at distal and lingual sites respectively. The horizontal bone resorption at the test sites was 1,6±0,55mm.

CONCLUSIONS

The findings of this study let the Authors affirm that “our data clearly indicate that the use of cortico-cancellous porcine substitute and resorbable membrane left exposed succeeded in reducing alveolar contour from remodeling when compared to non-treated extraction sockets. Furthermore, our research shows that the use of a ridge preservation technique may maintain ridge height when compared to tooth extraction alone”.
Flap versus flapless procedure for ridge preservation in alveolar extraction sockets: a histological evaluation in a randomized clinical trial

ABSTRACT

Tooth extraction generally results in a loss of bone volume and remodelling of soft tissues and it is recommended to preserve the alveolar ridge in order to maintain the existing soft and hard tissues, in view of the subsequent rehabilitation treatments. In order to ensure an adequate architecture of the alveolar bone and soft tissues, necessary to obtain a functional and aesthetic prosthetic rehabilitation, the use of various techniques and biomaterials has been proposed over the years.

The aim of this study was to evaluate and compare the histological and histomorphometric features of two different procedures carried out in extraction socket grafting: the flapped and flapless technique. For the study, 34 patients were randomized to receive tooth extraction and ridge preservation with cortico-cancellous porcine bone (OsteoBiol® mp3®, Tecnoss®, Giaveno, Italy), and a trimmed collagen membrane (OsteoBiol® Evolution, Tecnoss®) with a full thickness mucoperiosteal flap and primary soft tissue closure (control group), or, with a flapless procedure and a secondary soft tissue closure (test group). The collagen membrane was covered with an advanced flap in the control sites, whereas no flap was raised and the collagen membrane was left exposed in the test sites.

In order to evaluate the percentages of newly formed bone, residual graft particles and marrow spaces, 3 months after ridge preservation bone core samples were harvested from both groups and processed to be observed under light microscopy.

Histological and histomorphometrical analyses did not report significant differences between the two groups and the mean percentages of newly formed bone, soft tissues and residual grafted particles were 22.5 and 22.5%, 59.3 and 59.4%, and 18.2 and 18.2% respectively for flap and flapless approach.

CONCLUSIONS

The present randomized clinical trial was performed to evaluate clinical and histological differences between flap versus flapless ridge preservation procedure. As no differences in the histologic and histomorphometric analysis were found, the Authors concluded that “this study supported the hypothesis of the non-detrimental effect of collagen membrane exposure on bone regeneration during the ridge preservation procedures with a flapless approach”.

Abstract author: Cristina Rodighiero, dental journalist, free publication, not for resale. Printed by Tecnoss® Dental s.r.l.
Buccal bone deficiency in fresh extraction sockets: a prospective single cohort study

ABSTRACT

After a tooth extraction, architectural changes occur in soft and hard alveolar tissues and these may jeopardize the aesthetic success of implant-supported restorations.

In this prospective single cohort study, the Authors aimed to evaluate the use of xenograft and collagen membranes in treating full or partial buccal bone defects of fresh extraction sockets in the aesthetic zone, which had a partial or complete deficiency of the buccal bone plate and that had been treated with a ridge preservation procedure and delayed implant placement. In 33 patients requiring tooth extraction in the anterior maxillary area and showing a complete or partial buccal bone plate deficiency (more than 2 mm) cortico-cancellous porcine bone (OsteoBiol® mp3®, Tecnoss®, Giaveno, Italy) and platelet-rich fibrin (PRF) with a collagen membrane (OsteoBiol® Evolution, Tecnoss®) were used to graft the extraction sockets, and the membranes were left exposed to the oral cavity with a secondary soft tissue healing.

The parameters investigated were: width of keratinized mucosa, facial soft tissue levels, clinical bone changes (measured with a clinical splint), implant and prosthetic failures, and peri-implant marginal bone changes.

All treated sites allowed the placement of implants and at the time of flap elevation, the augmented tissues seemed to be well vascularized, the presence of residual graft particles seemed well integrated into the augmented sites and all implants were stable after placement. The facial soft tissue level increased over time, the bone level showed an improvement and in the palatal area no bone changes were observed. No implant failed during the entire observation period.

CONCLUSIONS

Based on the findings from this study, the Authors concluded that “within the limit of this prospective cohort study, ridge preservation showed an adequate regeneration of the buccal bone plate and stability of the facial soft tissue level for extraction sockets with large buccal bone defects. Implant installation and prosthetic restoration showed favourable outcomes after 1 year of this ongoing study. These preliminary findings should be confirmed by a longer follow-up study”.

Abstract

A tooth extraction always represents a trauma after which there is a horizontal and vertical volume loss of both hard and soft tissues. In order to reduce these volumetric changes, the placement of biomaterials within the fresh extraction socket has been suggested. As the data reported in literature are not conclusive, the aim of this randomized controlled clinical study was to evaluate to which extent a filler or a soft tissue socket seal contributes to ridge preservation. 30 patients were enrolled in the study and, after tooth extraction, were randomly assigned to the following treatments: Tx1 - xenogenic bone substitute (pre-hydrated collagenated cortico-cancellous porcine bone; OsteoBiol® mp3®, Tecnoss®, Giaveno, Italy) and free gingival graft; Tx2 - free gingival graft alone; Tx3 - xenogenic bone substitute (OsteoBiol® mp3®, Tecnoss®) without gingival graft; Tx4 - no further treatment (control). The dimensional changes were evaluated by means of impressions taken at baseline (before tooth extraction) and 4 months after surgery, with subsequent pouring of cast models. These ones were then optically scanned and analysed using digital imaging analysis. Healing of all treatment groups was uneventful and all groups displayed contour shrinkage at the buccal aspect. Statistically significant differences were found between Tx1 and Tx4 as well as Tx2 and Tx4. A significant positive influence of the free gingival graft on the maintenance of the ridge width was recorded (p < 0.001).

Conclusions

The results of this clinical study show that the investigated alveolar ridge preservation techniques were not able to prevent soft tissue contour alterations entirely after tooth extraction. Because measurements were based on master models, no statements can be made as to whether the documented horizontal volume resorption was caused by loss of soft tissue or underlying bone. The use of a free gingival graft covering the extraction socket was beneficial for maintaining soft tissue volume, but more studies including a higher number of patients or sites are needed to further investigate these findings.
Volumetric analysis of remodelling pattern after ridge preservation comparing use of two types of xenografts. A multicentre randomized clinical trial

ABSTRACT

This paper is a report of the results of a multicentre, single-blind, prospective and randomized clinical trial, performed by the Authors in order to analyse and compare the volumetric changes after ridge preservation procedures using two different biomaterials. Moreover, they evaluated the associations between outcome variables and pristine three-dimensional aspects of the ridges.

For the study, 38 patients subjected to single-tooth alveolar ridge preservation were selected and randomly allocated to each experimental group. The extraction sockets of the coll group were grafted with pre-hydrated collagenated cortico-cancellous porcine bone, with graft particle size between 600 and 1000 µm (OsteoBiol® mp3®, Tecnoss®, Giaveno, Italy). In cort group, the extraction sockets were grafted with cortical porcine bone alone, with particle size between 600 and 1000 µm (OsteoBiol® Apatos, Tecnoss®). A collagen membrane (OsteoBiol® Evolution, Tecnoss®) was used to completely cover the socket, left intentionally exposed to the oral cavity and stabilized with the use of sutures. A secondary soft tissue healing was obtained for all experimental sites. By means of scanned plaster casts, an analysis of volumes and areas was performed, and all measured variables were statistically compared.

Intragroup analyses at 3 months revealed that the two biomaterials showed similar behaviours with a minor loss in volume and ridge surface. Intergroup analysis at 3-month survey revealed that volume resorption of the coll group was significantly lower than that of the cort group.

CONCLUSIONS

Considering the 3rd month analysis, in their conclusions the Authors affirm that "coll group showed a significantly lower reduction of ridge volume and a significantly smaller shrinkage of the basal area when compared to the cort group; moreover, the coll group experienced a smaller superior surface shrinkage when compared to the cort group, even though no significance was evaluated".
Immediate, immediate-delayed (6 weeks) and delayed (4 months) post-extractive single implants: 4-month post-loading data from a randomised controlled trial

ABSTRACT

The aim of this study was to compare the clinical outcome of single implants placed immediately after tooth extraction with an immediate approach (70 patients), an immediate-delayed placement approach (implants placed 6 weeks after tooth extraction - 70 patients), and with a delayed placement approach (implants placed after 4 months of extraction and socket healing - 70 patients). After implant placement and the measurement of the gap between the bony wall and the neck of the implant with a periodontal probe, the operator reconstructed all poorly preserved sockets and partially preserved sockets in the aesthetic areas with a bone substitute. The bone substitute used was a sticky paste made of 600 to 1000 µm pre-hydrated collagenated cortico-cancellous granules of porcine origin, properly mixed with collagen gel in a sterile syringe (OsteoBiol® mp3®, Tecnoss®, Giaveno, Italy). The grafted area was then covered with a resorbable membrane derived from equine pericardium (OsteoBiol® Evolution, Tecnoss®). The membrane was trimmed and adapted to cover the entire socket and at least 2 mm of the surrounding crestal bone, and fixed using titanium tacks. Implants inserted with at least 25 Ncm torque were left to heal unloaded for 4 months, whereas those inserted with less than 25 Ncm were left to heal unloaded for 6 months. Temporary crowns were delivered and were to be replaced by definitive ones after 4 months. Outcome measures were crown and implant failures, complications, peri-implant marginal bone level changes, aesthetics and patient satisfaction.

No statistically significant differences for failures, complications and patient satisfaction were observed when placing single implants immediately, 6 weeks or 4 months after tooth extraction; nevertheless failures and complications were more frequent for immediate and immediate-delayed placed implants. Bone level changes were similar between the different procedures, but the aesthetics showed better results for immediate and immediate-delayed implants.

CONCLUSIONS

When interpreting the results of this study, the Authors recommend to take into consideration that immediate and immediate-delayed post-extractive implant sites were augmented. As they underline, “it is known that site preservation procedures are able to preserve the dimension of the site better compared to when these procedures are not implemented. The immediate or early placement of the implant in a post-extractive site might also contribute and partly preserve the width and height of the surrounding tissues. In order to better understand these mechanisms, more trials with larger sample sizes are needed”.

Abstract author: Cristina Rodighiero, dental journalist, free publication, not for resale. Printed by Tecnoss® Dental s.r.l.
Esthetic outcome of implants placed in fresh extraction sockets by clinicians with or without experience: A medium-term retrospective evaluation

ABSTRACT

Immediate implant placement is often a challenge for the clinician, due to the large number of factors playing a role in the aesthetic outcome of dental implants. Therefore, it is necessary a treatment strategy aimed to reduce the risk of soft tissue recession with immediate implants, including bone fillers with a low substitution rate, flapless surgery, and connective tissue graft. The present study aimed to evaluate and compare the aesthetic clinical outcome of implants placed in fresh extraction sockets up to 3 years after implant placement, performed by experienced versus non-experienced surgeons (residents in implant dentistry). The evaluation focused on the peri-implant tissue remodelling and the subjective aesthetic and functional outcome of implants placed in fresh extraction sockets. To do this, a retrospective chart review study of patients treated at the Versilia General Hospital, and subjected to dental implant positioning for fixed prosthetic rehabilitation between February 2009 and April 2011, was conducted. Treated independent post-extraction areas were divided into two groups according to the operator’s experience: expert versus nonexpert group. After tooth extraction, debridement of the extraction socket was performed, and then the implant bed was prepared. Any vertical bone defect or residual gap between the implant surface and bone wall was augmented with cortico-cancellous porcine bone (OsteoBiol® mp3®, Tecnoss®, Giaveno, Italy). A resorbable membrane (OsteoBiol® Evolution, Tecnoss®) with a cross-mattress suture was left exposed to the oral cavity, seeking a secondary soft tissue healing. Patients treated by non-expert clinicians showed greater bone loss and soft tissue recession than those treated by experienced senior surgeons. Moreover, the esthetic self-evaluation of patients confirmed more positive results for the experienced group.

CONCLUSIONS

The findings of this study suggest that esthetic outcomes can be compromised by the inexperience of surgeons, especially when the implants are placed in esthetic areas. Consequently, the Authors conclude that “if clinicians plan immediate implant placement in the anterior area, it is recommended that this type of technique be carried out by experienced operators”.

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Single post-extractive ultra-wide 7 mm-diameter implants versus implants placed in molar healed sites after socket preservation for molar replacement: 6-month post-loading results from a randomised controlled trial

ABSTRACT

Immediate placement of implants into fresh extraction sockets is an option for replacing missing teeth, with the advantage of reducing the number of surgical interventions required for treatment and the time interval between dental extraction and the placement of implant-supported prostheses. However, this technique involves numerous challenges related to site-specific anatomic, occlusal and biomechanical factors. The present randomised controlled trial (RCT) was conducted with the aim of understanding which procedure would be preferable after having extracted a hopeless molar in both jaws, between immediate post-extractive ultra-wide 7 mm-diameter implants in combination with socket preservation procedures, and socket preservation procedures alone, with delayed implant placement. The aim was to test the hypothesis that there is no difference in clinical, radiographic and aesthetic outcomes positioning single post-extractive ultra-wide 7 mm-diameter implants or waiting 4 months to place the same diameter implant, after molar extraction and socket preservation procedure. Patients requiring one implant-supported single restoration to replace a failed tooth in the molar region of both maxilla and mandible were selected and randomised according to a parallel group design into two arms: implant installation in fresh extraction sockets augmented with cortico-cancellous heterologous bone and porcine derma (group A) or delayed implant installation 4 months after tooth extraction and socket preservation using the same materials (group B). After tooth extraction, the residual alveolar socket around the implant was grafted with cortico-cancellous heterologous bone, with a graft particle size between 250 and 1000 µm (OsteoBiol® Gen-Os®, Tecnoss®, Giaveno, Italy). Then, the bone graft was covered with a porcine derma (OsteoBiol® Derma, Tecnoss®), shaped according to the shape and dimension of the alveolar socket and stabilised with suture. Outcome measures were implant success and survival; complications; horizontal dimensional changes measured on cone beam computed tomography (CBCT) scans; peri-implant marginal bone level (MBL) changes; implant stability quotient (ISQ); and pink esthetic score (PES).

CONCLUSIONS

The results of this study revealed statistically significant differences both in MBL and horizontal marginal bone level changes between the two investigated approaches, with lower values for socket preservation procedure alone, with delayed implant placement. Both procedures achieved successful results, however, waiting 4 months after tooth extraction and socket preservation procedure was associated with less marginal bone loss. A possible explanation was that a wider diameter implant reduces the positive effect of the socket preservation.
Tissue changes after ridge preservation with two xenografts. Preliminary results from a multicenter randomized controlled clinical trial.

ABSTRACT

Ridge preservation procedures can counteract the tissue changes occurring after tooth loss. The aim of this randomized controlled trial was to compare and evaluate the clinical and histological outcomes of extraction sockets grafted with cortical porcine bone (OsteoBiol® Apatos, Tecnoss®, Giaveno, Italy) (cort-group) to those grafted with collagenated cortico-cancellous porcine bone (OsteoBiol® mp3®, Tecnoss®) (coll-group) both covered with a collagen membrane (OsteoBiol® Evolution, Tecnoss®) left exposed and fresh extraction sockets which healed naturally (nat-group).

The two different xenografts were also compared to each other to determine their respective efficacy in preserving the alveolar ridge dimensions following tooth extraction. The anatomical measurements were taken at baseline and at 3 months after tooth extraction. The following variables were registered to the nearest millimeter: vertical bone changes; buccal-lingual width; histomorphometric parameters such as newly formed bone (NFB), non-mineralized tissues (NMT) and residual graft particles percentages (RGP).

The grafted sites showed a significant (P<0.0001) lower vertical bone loss at buccal and lingual/palatal aspects than that registered at the no-grafting sites. Moreover, the grafted groups behaved significantly better than the non-grafted group in terms of horizontal bone resorption. The cort- and coll-groups had a horizontal bone loss of 1.33±0.71 mm and 0.93±1.25 mm, respectively, while the nat-group had a horizontal bone loss of 3.60±0.72 mm. No statistically significant differences were registered between the grafted groups for any of the variables, except for vertical bone loss at the lingual/palatal aspect (P=0.0039).

CONCLUSIONS

The present study showed that porcine bone, resorbable membrane and a flapless approach were more effective in controlling the bone changes after tooth extraction when compared to no grafting. The ridge preservation procedures had significantly better outcomes when compared to natural healing. The biomaterials did not differ for maintenance of bone width; even though, the bone height seemed to be better preserved with the cortical porcine bone.

Based on these findings, the Authors affirm: “Alveolar ridge preservation with cortical or collagenated cortico-cancellous porcine bone is an effective way to maintain the ridge dimensions after tooth extraction compared to spontaneous healing, though a complete prevention of remodeling is not achievable irrespective of the biomaterial employed. No significant differences were found between the two pertaining to the ridge width. Furthermore, no significant differences regarding the histomorphometric analysis were registered between the two grafted groups”.

Abstract author: Cristina Rodighiero, dental journalist, free publication, not for resale. Printed by Tecnoss® Dental s.r.l.
Molecular, cellular and pharmaceutical aspects of filling biomaterials during the management of extraction sockets

ABSTRACT

After a tooth extraction, both hard and soft tissues undergo dimensional changes and the aim of grafting and/or guided bone regeneration procedures is to counteract these changes by using different biomaterials and surgical techniques. In this article, the Authors reviewed the clinical, histological, volumetric and molecular results reported in different studies, so to evaluate which are the best surgical techniques and biomaterials for ridge preservation procedures.

Among the biomaterials tested for bone augmentation procedures, the one made of cortico-cancellous granules of porcine bone showed to be very similar to human mineral bone. Its natural micro-porous consistency is supposed to facilitate new bone tissue formation in defect sites and accelerate the regeneration process. Moreover, the studies evaluated in this review reported that this biomaterial is gradually resorbable and able to preserve the original graft shape and volume (osteocductive property).

Other important observations about porcine bone are related to the integration of collagenated porcine bone graft with the new bone and its capability to support the new bone formation when used in extraction sockets. Among the advantages of porcine bone, osteoconductivity and absence of adverse reaction and inflammatory response were mentioned. The histomorphometrical analysis of the reviewed studies showed that the percentage of new bone tissue was 22.5% of the total bone.

CONCLUSIONS

In their review, the Authors pointed out that cortico-cancellous porcine bone satisfied the characteristics of osteoconductivity and volume maintenance during the healing period, allowing new bone formation and reabsorption of the xenograft, without any signs of inflammatory cells.
Immediate, immediate-delayed (6 weeks) and delayed (4 months) post-extractive single implants: 1-year post-loading data from a randomised controlled trial

ABSTRACT

Nowadays there are different approaches with reference to timing of implant positioning, each one having its own advantages and limits. So, it would be useful to know whether a better clinical outcome could be achieved by placing delayed implants after bone healing, or by waiting for a few weeks to allow soft tissues to heal, or by placing implants immediately after tooth extraction. The aim of this RCT was to compare the clinical outcome of single implants placed immediately after tooth extraction with implants placed 6 weeks after tooth extraction (immediate-delayed placement), and with implants placed after 4 months of extraction and socket healing (delayed placement). In total, 210 patients were treated: 70 patients received immediate post-extractive implants, 70 patients received immediate-delayed implants at 6 weeks, and 70 patients received delayed implants after 4 months of healing, according to a parallel group design. In case of a large gap between the bony wall and the neck of the implant, patients of the immediate and immediate-delayed group had the socket grafted with a bone substitute made of a sticky paste made of 600-1000 µm pre-hydrated collagenated corticocancellous granules of porcine origin, properly mixed with collagen gel in sterile syringe (OsteoBiol® mp3®, Tecnoss®, Giaveno, Italy). The grafted area was then covered with a resorbable membrane derived from equine pericardium (OsteoBiol® Evolution (fine), Tecnoss®). The same grafting approach was used also for the sockets randomised to delayed implants if poorly preserved or in the aesthetic areas (from second upper to second upper premolars). Outcome measures were crown and implant failures, complications, peri-implant marginal bone level changes, aesthetics assessed using the pink aesthetic score (PES), and patient satisfaction recorded by blinded assessors. Patients were followed up to 1 year post-loading.

CONCLUSIONS

No statistically significant differences for failures, complications and patient satisfaction were observed when placing single implants immediately, 6 weeks or 4 months after tooth extraction. Failures were more frequent at immediate and immediate-delayed placed implants and bone level changes were similar between the different procedures, but aesthetics results were better at immediate and immediate-delayed implants. With reference to this last outcome, the Authors underline that “there are two plausible explanations for the present findings, which could work synergistically: delayed sites were not subjected to any bone preservation procedures unless in aesthetic areas or if severely damaged, as is often carried out in clinical practice. It is known that site preservation procedures are better able to preserve the site dimensions than not implementing any. The immediate or early placement of the implant in a post-extractive site might also contribute to partly preserve the width and height of the surrounding tissues. In order to better understand these mechanisms, more trials with large sample sizes are needed”.

Abstract author: Cristina Rodighiero, dental journalist, free publication, not for resale. Printed by Tecnoss® Dental s.r.l.
Traditional post-extractive implant site preparation compared with pre-extractive interradicular implant bed preparation in the mandibular molar region, using an ultrasonic device: a randomized pilot study

ABSTRACT
Immediate post-extraction implant placement for replacing multi-root teeth can be a clinical challenge, especially if insufficient bone tissue volume does not allow to reach the proper primary stability. As implant bed preparation is a critical procedure, the aim of this study was to compare two different approaches: implant bed preparation before and after root extraction. To do this, 22 patients, who needed an implant-prosthetic rehabilitation, were selected and randomly assigned to the test group (implant bed preparation before molar extractions) or control group (bed preparation after molar extractions). A guided bone regeneration (GBR) procedure was performed with bone porcine particles (OsteoBiol® Gen-Os®, Tecnoss®, Giaveno, Italy) applied around the implant into the alveolous and covered by a membrane (OsteoBiol® Evolution, Tecnoss®). The implant stability quotient (ISQ) and the position of the implant were evaluated and a statistical analysis was carried out.

CONCLUSIONS
In this study is shown how preparation of implant sites with an ultrasonic device before tooth extraction, allows implant placement in an ideal prosthetic position. This procedure is simple and allows to reach a higher stability in selective cases compared with traditional technique of extraction and placement.
**ABSTRACT**

In case of progressive tissue and volume loss with dimensional changes of the alveolar ridge contour, it has been demonstrated that incorporation of bone substitute material into the extraction socket can minimize the edentulous ridge volume loss or maximize the bone formation within the healing area. This technique, called socket grafting or “alveolar ridge preservation” (ARP), showed to be effective. The aim of this multi-center single-blind randomized control trial was to test the effectiveness of socket grafting with 2 biomaterials (cortical or pre-hydrated collagenated cortico-cancellous porcine bone) covered with a resorbable barrier in maintaining contour stability of the extraction area when compared to control extraction sockets that had a natural healing. The observation was performed by means of a laser scanner that provided the possibility of 3-dimensional evaluation to be performed on patients’ dental arches plaster cast models. Following tooth extraction, 55 patients were assigned to their treatment group using a random sequencing: 15 patients (cort) were grafted with cortical porcine bone (particle size 600-1000 µm, OsteoBiol® Apatos, Tecnoss®, Giaveno, Italy); 15 patients (coll) were grafted with collagenated cortico-cancellous porcine bone (particle size 600-1000 µm, OsteoBiol® mp3®, Tecnoss®); 25 patients (nat) had natural healing without grafting.

At the 4-month intergroup analysis, the test groups (cortical or pre-hydrated collagenated cortico-cancellous porcine material) seemed to behave significantly better than the naturally-healing group in terms of volume and contour conservation. No differences were seen, however, between the 2 test groups, although the volume loss and linear height reduction seemed to slightly favour the collagenated material.

**CONCLUSIONS**

Based on the results of the present randomized trial, Authors concluded that "the present investigation attested that post-extractive sockets grafted with either cortical or pre-hydrated collagenated cortico-cancellous porcine material covered with a resorbable collagen membrane showed reduced bone loss when compared to naturally-healing sockets. Moreover, the 2 grafting materials were not able to preserve the alveolar crest, and a reduction close to 30% in the estimates was registered after healing".
Regenerative properties of collagenated porcine bone grafts in human maxilla: demonstrative study of the kinetics by synchrotron radiation microtomography and light microscopy

ABSTRACT

As bone dimensional changes normally occur after tooth extraction, the management of extraction sockets needs a particularly careful attention by the clinician. After tooth extraction, in order to reduce the soft and hard tissue loss, preservation of the alveolar ridge volume is recommended and different types of biomaterial have been used to graft fresh extraction sockets and the majority of them showed favourable clinical outcomes. The aim of the present study was to analyze the regenerative potential of collagenated cortico-cancellous (OsteoBiol® mp3®, Tecnoss®, Giaveno, Italy) bone by synchrotron radiation X-ray micro-CT and histology in order to quantitatively investigate the kinetics of healing in post-extraction sockets. To the best of the authors’ knowledge, this is the first study on kinetics of bone regeneration using cortico-cancellous porcine bone substitutes, which are biomaterials developed with a structure similar to the human bone. Specifically, OsteoBiol® mp3® is a pre-hydrated collagenated heterologous cortico-cancellous bone mix made of 600 – 1000 µm thick granules (90 vol%) and collagen gel (10 vol%). Ridge preservation was performed on 21 patients using a flapless approach and a secondary soft tissue closure. Extraction sockets were filled and slightly condensed with cortico-cancellous porcine bone (mp3®), and a trimmed collagen membrane (OsteoBiol® Evolution, Tecnoss®) was used to completely cover the socket. At the time of implant surgery, the bone cores were harvested and evaluated by micro-CT and histology. Both micro-CT and histology confirmed the good performances of the collagenated cortico-cancellous porcine bone as substitute for the preservation of human maxillary post-extraction sockets.

CONCLUSIONS

As the Authors concluded: “the OsteoBiol® mp3® bone substitute, 12 months after grafting, was shown to offer better biomechanical performances than the spontaneously healed bone after the same period. Indeed, an increased density, due to a significant increase of the trabecular number, seems to guarantee an improved strength of the socket, starting point favorable to the success of the next implant”.
Wide diameter immediate post-extractive implants vs delayed placement of normal-diameter implants in preserved sockets in the molar region: 1-year post-loading outcome of a randomised controlled trial

ABSTRACT

In case of tooth loss, in order to minimise the risk of implant failures and complications, delayed implant placement after complete socket healing is generally preferred, usually associated with different ridge preservation procedures, ranging from soft tissue grafts to autogenous or bone substitutes grafts. As it would be useful to know if it is possible to have similar or better clinical outcomes by placing immediately wide diameters implants in post-extractive sites, the aim of this single-centre randomised controlled trial (RCT) was to compare the effectiveness of 6.0 to 8.0 mm-wide diameter implants placed immediately after tooth extraction, with conventional diameter implants placed in preserved sockets after 4 months of healing in molar sites. In the delayed group, the sockets were loosely packed with a mixture of cancellous and cortical porcine-derived bone granules with a granulometry of 250 to 1000 µm (OsteoBiol® Gen-Os®, Tecnoss®, Giaveno, Italy). In order to cover the socket, a resorbable collagen membrane derived from equine pericardium (OsteoBiol® Evolution, Tecnoss®) was trimmed and adapted on it. Included in the outcomes measures there were the peri-implant marginal bone level changes. Marginal bone levels at implant insertion (after bone grafting) were 0.04 mm for immediate implants and 0.11 mm for the delayed ones, and this was statistically significantly different. One year after loading, the loss was on average 1.06 mm in the immediate group and 0.63 in the delayed group, with a statistically significant difference. From an aesthetic point of view, the total PES score was statistically significantly better at delayed implants both at 4 months (9.65 ± 1.62 in the immediate group and 10.44 ± 1.47 in the delayed group) and at 1 year (9.71 ± 2.71 in the immediate group and 10.86 ± 1.37 in the delayed group). With reference to failures, 5 implants out of 47 failed in the immediate group (10.6%) and 2 out 44 in the delayed one (4.6%), with a difference not statistically significant. About complications, in the immediate group 10 patients reported complications vs 4 patients in the delayed group (difference not statistically significant). To be noted that 7 patients (14%) in the immediate group developed vestibular bone dehiscence from 3 months after implant placement to 9 months postloading.

CONCLUSIONS

The present study supports the notion that post-extractive immediately loaded implants could be at a higher risk of failure than delayed implants, as confirmed by other RCTs. The results show ridge preservation and delayed conventional implants placement yielded better aesthetic outcomes compared to immediate placement of larger diameter implants. At 1 year after loading, immediate implants lost 0.43 mm more bone than delayed implants and this difference was statistically significant.
Comparison of magnesium-enriched hydroxyapatite and porcine bone in human extraction socket healing: a histologic and histomorphometric evaluation.

ABSTRACT
After tooth extraction, the physiological reduction of alveolar height and width may cause problems with implants placement, especially in the anterior upper arch where bone volume preservation is essential for both biological and aesthetic reasons. In order to counteract bone resorption in fresh sockets and avoid invasive ridge augmentation procedures, the use of several biomaterials has been proposed. Thanks to its excellent biocompatibility and bioactivity, hydroxyapatite is widely used in bone grafting and it has a good potential as a scaffold for bone tissue engineering. The aim of this study was to compare the use of synthetic magnesium-enriched hydroxyapatite (MHA) with that of a xenogenic bone substitute consisting of cortico-cancellous porcine bone (PB) (OsteoBiol® Apatos, Tecnoss®, Giaveno, Italy), in fresh sockets by means of histological and histomorphometric analyses. Histological examinations revealed newly formed bone, biomaterial particles, connective tissue and an absence of inflammatory cells in all treated sites.

CONCLUSIONS
The histological findings from the present study showed that cortico-cancellous PB and MHA could be used successfully for ridge preservation. Moreover, they both resulted safe and biocompatible. The authors concluded that “within the limits of this study, the results showed similar biological behaviour with respect to bone formation and resorption for magnesium-enriched hydroxyapatite and porcine bone used for socket preservation”.
Histomorphometric results after postextraction socket healing with different biomaterials: a systematic review of the literature and meta-analysis

ABSTRACT

In this article, the authors present a systematic review of the literature with data about histomorphometric outcomes after alveolar socket healing following tooth extraction with or without the placement of a bone substitute material. The primary outcome was the percentage of new bone formation. Secondary outcomes were percentage of biomaterial, connective tissue and non-mineralized tissue still present as measured through histomorphometric analysis of samples.

A total of 802 papers were screened and after the application of the inclusion and exclusion criteria, 40 articles were included in the quantitative synthesis and 11 were included in the meta-analysis of comparative studies. In 16 studies, no bone substitute material was used. Bovine bone (BB) was used in 14 studied; allograft (AG) was used in 5 studies; porcine bone (PB) was used in 4 studies; hydroxyapatite (HA), was used in 6 studies and HA enriched with magnesium in 4 studies; freeze-dried bone allograft (FDBA) was used in 4 studies; calcium sulphate (CS) was used in 4 studies, beta-tricalcium phosphate (β-TCP) was used in 2 studies and other biomaterials were used in 7 studies.

The meta-analysis of the results showed that the use of BB is associated with a lower proportion of vital bone compared to ungrafted sockets, while PB and magnesium-enriched HA seemed to enhance bone formation. Sites grafted with AG showed a proportion of new bone comparable to that of sites that did not receive any bone substitute.

CONCLUSIONS

Within the limits of this review, from the results it is possible to conclude that there is no evidence for the superiority of a given biomaterial over the others in terms of new bone formation. With reference to new bone volume, comparative studies reported that BB caused a reduced proportion of new bone volume (NBV), while PB and magnesium-enriched HA induced a significantly higher amount of NBV, compared to sites healed without bone substitutes.
How effective is collagen resorbable membrane placement after partially impacted mandibular third molar surgery on postoperative morbidity? A prospective randomized comparative study

ABSTRACT
This was a prospective, randomized controlled study on the two methods (primary closure and secondary closure) proposed for wound closure in case of mandibular third molar (3 M) surgery. The study sample included patients with no history of medical illness or medication that could influence wound healing. They were randomly assigned to three groups: the secondary closure group (SC), with partial closure of the extraction site to allow secondary healing; the primary closure group (PC), involving total closure of the extraction site for primary healing; and the membrane based primary closure group (MBPC), involving total closure of the extraction site by sliding the flap and using a collagen membrane positioned to extend 3–4 mm beyond the margin of the bone defect. The aim of the study was to evaluate the incidence of postoperative complications and analyze swelling, mouth opening, and pain. With reference to pain, its scores were generally slightly better in the SC group than in the PC and MBPC groups, but with no statistically significant difference between the 3 groups (p > 0.05) except between SC and MBPC on the second day (p = 0.014). The swelling recorded on postoperative days 2 and 7 was lower in the SC group than in the PC (p= 0.046 and 0.000) and in MBPC (p = 0.005 and 0.002) groups, respectively, with no significant differences between the PC and MBPC groups (p > 0.05). Even if mouth opening showed a statistically significant difference between the three groups at day 2 (p 0.000), at day 7 there were no statistically significant differences between the three groups (p = 0.093) and the same was registered also for trismus scores.

CONCLUSIONS
According to the results of the present study, swelling and mouth opening seem to be better in case of a secondary closure. Primary closure and primary closure using the collagen membrane are relatively similar in terms of immediate postoperative discomfort. Anyway, the use of resorbable collagen membrane showed clinically satisfactory results and the absence of alveolitis and the minimal wound dehiscence in the primary closure using the collagen membrane suggests that membranes can support primary healing in terms of wound healing.
Combination of bone graft and resorbable membrane for alveolar ridge preservation: a systematic review, meta-analysis, and trial sequential analysis

ABSTRACT

It is well known that, after tooth extraction, the alveolar ridge undergoes remodelling and resorption, with the undesired result of a reduction of the height and width of the residual ridge. Consequently, alveolar ridge preservation (ARP) techniques are advocated in order to counteract these events and a variety of grafting materials has been tested in the postextractive socket. The aim of this systematic review was to analyze evidence regarding potential benefits of ARP procedures performed with allogenic/xenogenic grafts in combination with a resorbable membrane coverage in comparison with spontaneous healing. Consequently, in this paper seven studies comparing the use of a bone substitute combined with a resorbable membrane in the test group and spontaneous healing of the extraction socket in the control group were included. Materials used in the included studies were the following: six studies reported use of xenogenic grafting materials consisting of cortico-cancellous porcine bone, collagenated cortico-cancellous porcine bone, and bovine bone mineral associated with a collagen membrane, whereas one study reported the use of FDBA combined with a collagen membrane. In all studies, the control group was characterized by spontaneous healing. Horizontal ridge width reduction (HRWR) and vertical ridge height reduction (VRHR) were investigated as primary outcomes and volume changes (VC) as a secondary outcome. Meta-analysis revealed that the combination therapy resulted in a lower rate of resorption for both HRWR (−2.19 mm, 95% confidence interval [CI]: −2.67 to −1.71 mm) and VRHR (−1.72 mm, 95% CI: −2.14 to −1.30 mm).

CONCLUSIONS

According to the results of the meta-analysis, the evidence currently available in the literature is strong enough to conclude that filling postextraction sockets with a bone substitute covered by a resorbable membrane results in a lower rate of resorption, both in vertical and horizontal dimensions, compared with spontaneous healing. The Authors concluded that “further studies should be directed to compare use of different bone substitutes and membranes and investigate potential and significant variability related to them, as well as to flap design”.

Influence of the presence of alveolar mucosa at implants: a histological study in humans

ABSTRACT

In case of tooth loss, in order to minimise the risk of implant failures and complications, delayed implant placement after complete socket healing is generally preferred, usually associated with different ridge preservation procedures, ranging from soft tissue grafts to autogenous or bone substitutes grafts. As it would be useful to know if it is possible to have similar or better clinical outcomes by placing immediately wide diameters implants in post-extractive sites, the aim of this single-centre randomised controlled trial (RCT) was to compare the effectiveness of 6.0 to 8.0 mm-wide diameter implants placed immediately after tooth extraction, with conventional diameter implants placed in preserved sockets after 4 months of healing in molar sites. In the delayed group, the sockets were loosely packed with a mixture of cancellous and cortical porcine-derived bone granules with a granulometry of 250 to 1000 µm (OsteoBiol® Gen-Os® Tecnoss®, Giaveno, Italy). In order to cover the socket, a resorbable collagen membrane derived from equine pericardium (OsteoBiol® Evolution, Tecnoss®) was trimmed and adapted on it. Included in the outcomes measures there were the peri-implant marginal bone level changes. Marginal bone levels at implant insertion (after bone grafting) were 0.04 mm for immediate implants and 0.11 mm for the delayed ones, and this was statistically significantly different. One year after loading, the loss was on average 1.06 mm in the immediate group and 0.63 in the delayed group, with a statistically significant difference. From an aesthetic point of view, the total PES score was statistically significantly better at delayed implants both at 4 months (9.65 ± 1.62 in the immediate group and 10.44 ± 1.47 in the delayed group) and at 1 year (9.71 ± 2.71 in the immediate group and 10.86 ± 1.37 in the delayed group). With reference to failures, 5 implants out of 47 failed in the immediate group (10.6%) and 2 out 44 in the delayed one (4.6%), with a difference not statistically significant. About complications, in the immediate group 10 patients reported complications vs 4 patients in the delayed group (difference not statistically significant). To be noted that 7 patients (14%) in the immediate group developed vestibular bone dehiscence from 3 months after implant placement to 9 months post-loading.

CONCLUSIONS

The present study supports the notion that post-extractive immediately loaded implants could be at a higher risk of failure than delayed implants, as confirmed by other RCTs. The results show ridge preservation and delayed conventional implants placement yielded better aesthetic outcomes compared to immediate placement of larger diameter implants. At 1 year after loading, immediate implants lost 0.43 mm more bone than delayed implants and this difference was statistically significant.
Platelet-Rich Fibrin with bone grafts for regeneration of bony defect following extraction of supernumerary teeth: a case report

ABSTRACT

In case of abnormalities during tooth development, supernumerary teeth can occur as hyperdontic variants that exhibit diverse nature in terms of prevalence among races and location in human jaws. In this article, the Authors present a case report of partly erupted supernumerary teeth in regions 35 and 36 with its surgical management and regeneration of residual bony defect. In a 41-year-old male patient the presence of two supernumerary teeth was confirmed through occlusal and periapical radiographs. After a complete clinical examination, the surgical removal of supernumerary teeth was planned. The bone defect that ensued after removal was significantly large and, as a bony dehiscence was observed in relation to the lingual aspect of tooth 35 and the mesio lingual aspect of tooth 36, a combination of bone grafts (autograft, allograft (Puros, Zimmer Dental, CA, USA), xenograft (Osteobiol® Gen Os®, Tecnoss®, Giaveno, Italy) and platelet-rich fibrin (PRF) was placed to augment the bony defect. Over the 1-year period post operatively, gingival recession was seen on the grafted site; anyway, bone was present until two-thirds of the roots radiographically, suggesting adequate bone fill.

CONCLUSIONS

In this approach, the Authors used a combination of autograft with cortico-cancellous bone in the form of allograft and xenograft, ensuring not only sufficient bone fill, but also provided osteogenic, osteoinductive and osteoconductive effects to the surgical site. Hence, the Authors feel that this approach can be used as a viable option for management of such situations.
Extraction socket healing in humans after ridge preservation techniques: comparison between flapless and flapped procedures in a randomized clinical trial

ABSTRACT
Socket preservation procedures performed after tooth extraction allow maintaining soft and hard tissues architecture adequate for implant placement. The aim of this study is to investigate the effect of two surgical procedures, named flap and flapless, on the horizontal and vertical socket remodelling and the keratinized gingiva width. All sockets are treated with a xenograft and a collagen membrane.
Sixty-four patients, requiring at least one single premolar or molar tooth extraction and an implant-supported restoration, are included and randomly allocated to either test (flapless, with secondary soft tissue healing) or control (flap elevation and primary soft tissue closure) groups. In the test group, extraction sockets are augmented with cortico-cancellous porcine bone (OsteoBiol® mp3® Tecnoss®, Giaveno, Italy) and the graft is covered by a collagen membrane (OsteoBiol® Evolution). The collagen membrane is secured by sutures and left intentionally exposed to the oral cavity. Extraction sockets allocated to the control group receive a full-thickness mucoperiosteal flap procedure with two releasing incisions and augmentation with the same cortico-cancellous porcine bone covered by a collagen membrane; here the buccal flap is advanced coronally to guarantee soft tissue primary closure. After three months, the clinical outcomes of the two procedures are measured and analyzed using appropriate statistical tests. Comparing the two socket preservation techniques, statistically significant differences are registered for the output variables: changes in the width of keratinized gingiva, changes in the bucco-lingual width, and vertical bone changes at four sites, with P values of <0.001, <0.001, and 0.0105, respectively.

CONCLUSIONS
The results of this study might support the hypothesis that the flapless technique better preserves the hard tissue dimensions than the primary closure; moreover, the flapless procedure gives an increase in keratinized gingiva as an additional benefit. On the other hand, the flapped technique seems to result in smaller vertical bone resorption on the buccal aspect than the flapless technique.
Microarchitectural study of the augmented bone following ridge preservation with a porcine xenograft and a collagen membrane: preliminary report of a prospective clinical, histological, and micro-computed tomography analysis

ABSTRACT

It is universally known that the loss of teeth results in the alveolar ridge resorption and atrophy. When the atrophy is severe, it creates unfavourable conditions for implant positioning, needing a proper ridge augmentation. Therefore, following tooth extraction, it is advisable to adopt one of the several techniques and biomaterials described in the literature so to preserve the alveolus. In literature there are reports of the successful application of several bone graft materials in ridge preservation. One of these materials is a xenograft of porcine origin that has recently been studied. It is a particulated, high-porosity, cortico-cancellous xenograft, maintaining the structure and composition of the natural collagen and hydroxyapatite. The aim of this prospective study was to investigate the integration of porcine xenografts used in ridge preservation by histological and micro-CT analysis, focusing on whether socket grafting interferes with natural bone healing. The patients enrolled in the study were categorized into two study groups: in the test group (group 1; nine patients) patients underwent socket preservation, while the sockets in the control group (group 2; eight patients) were left to heal without the use of socket preservation techniques. In group 1, the cortico-cancellous porcine bone graft (OsteoBiol® Gen-Os®, Tecnoss®, Giaveno, Italy) was packed into the socket and a porcine collagen membrane (OsteoBiol® Evolution) was used as occlusive barrier. After a 6-month healing period, bone core biopsy samples were obtained and implants were placed in all sites. Histological analysis of the bone core biopsy samples obtained from the augmented sites of group 1 revealed that particles of the bone substitute material were surrounded by newly formed trabecular bone in 8 out of the 12 cases. Histological analysis of the 12 bone core biopsy samples obtained from the non-augmented sites in group 2 revealed healthy bone formation in the extraction sockets. The findings of the micro-CT analysis were consistent with those of the histological analysis.

CONCLUSIONS

After a 6-month healing period, the bone volume was sufficient for implant placement in all sites. The analyses performed revealed that the particles of the xenograft interfere with bone healing in the augmented sites. However, socket preservation using a combination of porcine xenografts and collagen membrane successfully maintained the vertical and horizontal dimensions of the ridge. Therefore, the Authors concluded that “in this study, socket preservation with the combination of a porcine xenograft and collagen membrane to maintain the bone volume of four-wall bone defects prior to implantation was utilized successfully”.
Clinical outcomes of implants placed in ridge-preserved versus nonpreserved sites: a 4-year randomized clinical trial

ABSTRACT

After tooth extraction, alveolar bone undergoes remodelling resulting in dimensional changes, which can complicate implant insertion. In order to limit dimensional changes, alveolar ridge preservation procedures using different grafting materials are commonly used. As the long-term effect of ridge preservation on implant success rate is still unclear, the aim of the present randomized clinical study was to evaluate the survival, success, and the aesthetic outcomes of implants placed in extraction sockets. In the study, 90 patients in need for a single premolar/molar tooth extraction and an implant treatment were randomly distributed among 3 groups: spontaneous healing (ctrl), ridge preservation with cortical porcine bone (OsteoBiol® Apatos, Tecnoss®, Giaveno, Italy) (cort) and ridge preservation with collagenated corticocancellous porcine bone (OsteoBiol® mp3®, Tecnoss®) (coll). In the two test groups, the sockets were grafted with the chosen biomaterial and a collagen membrane (OsteoBiol® Evolution, Tecnoss®) was placed under the interdental papillae. The collagen membrane was exposed to the oral cavity.

Three months after tooth extraction, at re-entry, implants were placed (BT Evo; Biotec, Vicenza, Italy). Marginal bone levels were recorded on digital intraoral periapical radiographs, the assessment of the Pink Esthetic Score (PES) was performed on digital photographs. Forty-two patients out of 90 (initial cohort study) completed the entire follow-up of 4 years. Cumulative survival and success rates for all implants were 100% at the 4-year evaluation. With reference to the marginal bone loss, there were no significant differences between the 2 grafting materials, but it was significantly greater in the nongrafted sites (P value < .001). At the 4-year evaluation, the PES resulted significantly better in the cort group than in the coll and ctrl ones.

CONCLUSIONS

From the results, it is evident that ridge preservation was more effective than natural healing in preserving marginal bone and better aesthetic outcomes were achieved. Although none of the grafting materials in this study could entirely preserve the pristine ridge contour of the post extractive socket, cortical porcine bone showed the best clinical outcomes in maintaining the vertical bone dimension. On the other hand, the collagenated corticocancellous porcine bone showed the best outcome in maintaining the horizontal dimension.
Dehiscences and fenestrations

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REGENERATION SCIENCE
INSPIRED BY NATURE
Clinical outcome of implants placed immediately after implant removal

ABSTRACT

The purpose of this study was to evaluate the clinical success of implants placed immediately after the explantation of failed implants due to fracture at 12 months. 9 patients (3 males and 6 females) aged 35 to 63 years were included in this study in a period ranging from 1999 to 2004. All of the patients selected for this study required the extraction of failed implants and were scheduled for immediate implant replacement.

As the placement of an immediate implant is often associated with a residual bone defect between the outer surface of the implants and the residual bone walls, the Authors considered to apply a GBR protocol only in case of a large bone defect. Consequently, 5 experimental implants which showed the absence of fenestrations or dehiscences of the bone walls and a residual gap between implant surface and surrounding bone walls <2mm, were not treated with any regenerative procedures. The remaining 4 experimental immediate implants, which exhibited bone fenestrations or dehiscences and/or peri-implant bone defects >2mm, were grafted with cortico-cancellous porcine bone particles (OsteoBiol® Gen-Os®, Tecnoss®, Giaveno, Italy) and covered with bioabsorbable membranes (OsteoBiol® Evolution, Tecnoss®). The membranes were used for the treatment of large bone defects and where a large portion of the bone recipient site around the implant was missing. A bioabsorbable barrier membrane was used in all instances when necessary. Due to insufficient stiffness of the membrane, cortico-cancellous porcine bone particles were grafted into the defect to prevent the collapse of the membrane and maintain a space beneath the membrane for bone regeneration.

All implants were then restored with fixed prostheses. After 12 months, all the implants were successful and no residual bone defects were observed or probed around any implant. Analogously, the follow-up x-rays showed no significant bone loss pattern.

CONCLUSIONS

Considering the findings of this study, the Authors suggest that it is possible to place implants immediately after a fractured implant explantation, with results that are similar to results obtained with implants placed immediately after tooth extraction.
Buccal bone augmentation around immediate implants with and without flap elevation: a modified approach

ABSTRACT

In literature, there is evidence of the fact that implants placed in fresh extraction sockets reduce not only morbidity rates in patients, but also the total time between tooth removal and the final prosthetic restoration. The aim of this study was to compare the clinical success and bone healing of implants placed in fresh extraction sockets using a flapless procedure compared to those placed with flap elevation. 20 patients (8 male and 12 female) aged 30 to 67 years were included in the study. All the patients selected for this study required the extraction of a natural tooth and were scheduled for immediate implant replacement. 10 implants were placed with flap elevation (control group), and 10 implants were placed without flap elevation (test group). All the sites selected showed a complete bone defect at the facial wall, which required bone augmentation. Bone augmentation was performed with a mixture of collagen gel and cortico-cancellable porcine bone (OsteoBiol® Gel 40, Tecnoss®, Giaveno, Italy). The surgical sites were protected at the level of gingival wound with a collagen membrane (OsteoBiol® Evolution, Tecnoss®). All grafting procedures were successfully carried out as planned without any complications. All the implants included in this study were 2-stage implants placed at the level of palatal/lingual bone in augmented bone. 6 months after placement, both control and test implants underwent a second-stage surgery and a clinical examination to determine the implant stability quotient (ISQ), the distance between the implant shoulder and the first bone-implant contact (DIB) and the distance between implant shoulder and the crestal bone at the midbuccal aspect (DIC). One implant failed in the test group. Only one implant (test group) showed bone growth over the implant neck at the re-entry procedure. ISQ and DIB did not show any significant differences between the control and test group; however, a higher DIC was found in the test sites compared to the control sites.

CONCLUSIONS

The present study showed that implants placed immediately after tooth extraction in presence of vertical bone defects can be successfully treated either with or without flap elevation, even in the presence of bone defects requiring augmentation procedures. It was also noted that the bone regenerated reached a higher coronal level in the group with flap elevation than in the group without flap elevation. These findings suggest more favorable outcomes in terms of regenerated bone for the flap elevation group.
Clinical outcome of implants placed immediately after implant removal

ABSTRACT
This article reports the clinical success of an implant placed immediately after the explantation of a fractured blade implant due to a fracture caused by biomechanical complications. A healthy 58-year-old male nonsmoker presented with a fractured blade implant that had been subjected to biomechanical overload. A gentle explantation was performed, and a new implant of the same shape was immediately placed. The peri-implant bone defect was grafted with a mixture of collagen gel and cortico-cancellous porcine bone (OsteoBiol® mp3®, Tecnoss®, Giaveno, Italy) and covered with a bioabsorbable membrane (OsteoBiol® Evolution, Tecnoss®).

Radiographic evaluation at 6 months after the treatment showed complete bone healing. No residual bone defect was observed or probed during the uncovering phase; moreover, no mobility, pain, suppuration, or presence of peri-implant radiolucency were observed at the second-stage surgery.

CONCLUSIONS
When an implant fails, it must be immediately removed. In case of a new implant placed in a fresh extraction socket, if the contact implant-bone is not ideal or portion of the implant wall is exposed because of a dehiscence in the bone, guided tissue regeneration techniques can be employed using barrier membranes with or without bone graft materials.

The present case report demonstrated the successful immediate replacement of a failed blade implant with a new implant of the same shape in the same location in combination with a graft material and a membrane.
Surgical reconstruction of peri-implant bone defects with prehydrated and collagenated porcine bone and collagen barriers: case presentations

ABSTRACT

One of the main concerns related to implant treatment is the peri-implant bone loss mainly due to infection. Over the years, various techniques have been proposed in order to solve this problem and barrier technique has been shown to reduce defect depth in case presentations. Some reports have shown enhanced outcome with a combination of barriers and autogenous bone grafts in animal experiments as well as in humans. In this case report, the aim of the Authors was to evaluate the healing capacity of PCPB material in the surgical reconstruction of long-standing chronically infected peri-implant defects. To do so, PCPB particles (OsteoBiol® mp3®, Tecnoss®, Giaveno, Italy - granulometry: 600-1000 µm) were used as defect-filling material, combined with a bioresorbable collagen barrier (Bio-Gide®, Geistlich AG, Wolhusen, Switzerland) to cover the defects and the implanted bone mineral. In this case study, three patients enrolled for treatment of advanced peri-implant infection and bone loss around one or more implants participated. After local anesthesia and the preparation of the target sites, OsteoBiol® mp3® was applied into the defects. The Bio-Gide® barriers were adjusted and placed to cover defects and implants. After 6 and 12 months of healing, clinical and radiographic examinations were done. All defects healed uneventfully. At 6 months, probing depths were reduced by 3-4 mm with no bleeding on probing or pus formation. At 12 months, healthy peri-implant conditions were found. Intra-oral radiographs showed gain of the marginal bone level by 2-4 mm.

CONCLUSIONS

The results of this study show that PCPB have favorable properties enhancing bone regeneration in peri-implant bone defects. In contrast to other xenogenic materials, PCPB seems to activate the Bone Metabolic Units (BMU) by triggering phagocytosis of the graft material and subsequently favor deposition of new matrix and subsequent mineralization. After discussing the results, the Authors concluded that “the encouraging treatment outcome of reconstructive surgery found here is based on three cases and must consequently be considered with caution. However, it can still serve as a promising topic for future short- and long-term studies”.
Resonance frequency analysis of implants inserted with a simultaneous grafting procedure: a 5-year follow-up study in man

ABSTRACT

It is well known that primary stability is a key factor for the long-term success of an implant-supported rehabilitation. Primary stability is determined by bone quality and quantity, implant geometry, and placement technique and it is strictly related to the level of primary bone contact. Different ways of measuring implant stability are available and in this study the Authors examined the resonance frequency analysis (RFA), representing a clinical, noninvasive quantitative assessment of the stability of an implant and its osseointegration level. In order to do this, 16 patients in need of maxillary and mandibular rehabilitation were selected. They received a total of 36 implants inserted using a single-stage procedure at the same time as reconstructive surgery and were distributed as follows: 19 implants were inserted in 10 patients treated with autologous bone (group A) and 17 implants were placed in 6 patients treated with a combination of 50% autologous bone (bone chips) and 50% deantigenated collagenated bone substitute of porcine origin (OsteoBiol® Gen-Os® and OsteoBiol® Putty, Tecnoss®, Giaveno, Italy) (group B). The implant stability quotient (ISQ) values were measured during 5 years of follow up. The RFA values were recorded with the ISQ scale by means of a transducer attached to the implant via a screw and a frequency response analyzer (Osstell device).

CONCLUSIONS

At surgical re-entry in the 22 sites augmented in the maxilla and 14 in the mandible it was observed that the space under the titanium grid was filled completely by newly formed bone. Consequently, the Authors affirm that “within the limitations of the present study, the results showed that implant stability increased over time and its changes were correlated with anatomical location and different types of grafts only in the early healing period. RFA measurements indicate predictable and stable long-term results for implants inserted in sites reconstructed with autogenous bone and with porcine bone substitute in addition to autologous bone”.

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ORIGINAL ARTICLE
International Journal of Periodontics and Restorative Dentistry
The clinical outcomes of immediate versus delayed restoration procedures on immediate implants: a comparative cohort study for single-tooth replacement

ABSTRACT

In recent years, the placement of implants into fresh extraction sockets has become a more and more used procedure because immediate implant placement reduces surgery and treatment time, morbidity, and costs for the patient. As it has been demonstrated that bone remodeling occurs after tooth extraction and simultaneous implant placement, augmentation procedures have been developed for treatment of the peri-implant bone defects linked to the placement of implants into fresh extraction sockets. Comparing the immediate and conventional restoration procedures for implants placed in fresh extraction sockets, the aim of this study was to evaluate the overall clinical outcomes and total costs and clinical treatment periods between the two above mentioned procedures. Implants were placed in fresh extraction sockets by means of a flapless technique and the peri-implant bone defect, between the implant surface and bone wall, was augmented with cortico-cancellous porcine bone particles (OsteoBiol® Apatos, Tecnoss®, Giaveno, Italy). Subsequently, a resorbable membrane (OsteoBiol® Evolution, Tecnoss®) was used to stabilize the graft. The study aimed to evaluate the changes of marginal bone level, facial soft tissue (∆FST), width of keratinized gingiva (∆WKG), and the papilla index. With reference to bone loss, the two procedures showed similar results, but in delayed restoration procedure a negative remodelling occurred from 4 to 12 months after implant placement. Moreover, for the delayed group a loss of the papillary soft tissues before restoration, followed by a reestablishment after restoration, was recorded.

CONCLUSIONS

As the results showed that the immediate restoration procedure seems to be more promising in terms of healing times and costs, the Authors concluded that “immediate restoration of implants installed in fresh extraction sockets was at least as effective and safe as delayed restoration”.

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Clinical outcomes of implants placed in extraction sockets and immediately restored: a 7-year single-cohort prospective study

ABSTRACT

It has been widely demonstrated that after tooth extraction an irreversible process of alveolar ridge volume loss takes place, with horizontal and vertical dimensional changes in both arches. Even if it has proven to be a predictable treatment strategy with a very high success rate, implant placement into fresh alveolar socket does not seem to alter the resorption changes that naturally occur after tooth extraction. Therefore, the aim of the present 7-year prospective single cohort study was to evaluate the success rate, marginal bone level (MBL), soft tissue stability of implants placed in fresh extraction sockets and immediately restored. A total of 32 patients (19 women and 13 men) with at least one tooth in need of extraction and of immediate implant restoration were enrolled in this study. The mean age of the present cohort group was 40.1 ± 13.3 with a range between 23 and 63 years.

Patients received immediate implants and immediate single restorations. The peri-implant bone defects between the implant surface and bone walls were grafted with cortico-cancellous porcine bone particles (OsteoBiol® mp3®, Tecnoss®, Giaveno, Italy) and the graft was stabilized by means of a resorbable membrane (OsteoBiol® Evolution, Tecnoss®). The parameters of the evaluation were: implant failures, complications, MBL, width of keratinized gingiva, facial soft tissue (FST) levels, modified Plaque Index and modified Bleeding Index.

CONCLUSIONS

The purpose of the present 7-year prospective single cohort study was to evaluate the success rate and the hard and soft tissues stability of implants placed immediately after tooth extraction and immediately restored. A total of 37 immediate implants were placed with a total cumulative survival rate of 94.6%. All clinical cases were treated with tooth extraction, flapless immediate implant placement, peri-implant gap filling with the use of a cortico-cancellous porcine bone and immediate restoration. Based on these results, the Authors concluded that “long-term data from the present study suggested that implants placed immediately after tooth extraction and immediately restored had favourable clinical outcomes and stable tissues conditions”.

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Implant stability in the posterior maxilla: a controlled clinical trial

ABSTRACT

Implant stability plays a fundamental role in the clinical success. Primary stability comes from the mechanical engagement of the fixture with cortical bone and is determined by the quantity and quality of the available bone at implant placement, the surgical procedure and the dimension and design of the fixture. Secondary stability comes from regeneration and remodelling of the bone and tissue around the implant after its insertion and is related to primary stability. The purpose of this controlled clinical trial was to investigate the evolution from primary to secondary stability of dental implants, placed in the human posterior maxilla, in three different groups: patients with native bone, patients with partially regenerated bone, and patients with nearly totally regenerated bone. In all procedures, the grafting heterologous materials used were particulate prehydrated bone (OsteoBiol® mp3®, Tecnoss®, Giaveno, Italy) and collagen membranes (OsteoBiol® Evolution, Tecnoss®). 133 (Anyridge®, Megagen) implants were installed in 59 patients in the posterior areas of the maxilla. The primary implant stability was measured at placement, by means of insertion torque (IT) and implant stability quotient (ISQ). The evolution from primary to secondary implant stability was studied, by means of ISQ, at different times (15, 30, 45, and 60 days). 52 implants had satisfactory high primary stability (IT ≥ 45 N/cm; ISQ ≥ 60). Significant differences were found for IT and ISQ between the groups (A, B, and C) but no differences between Groups B and C were found. However, no drops were reported in the median ISQ values during the healing period.

CONCLUSIONS

Further, long-term controlled studies are needed to confirm the outcomes emerging from the present work as it presents limitations, such as the limited number of patients treated and fixtures inserted; in particular, only a few implants were inserted in Group C (nearly totally regenerated bone), and this is a major limitation of the present work, since Group C was probably the most interesting to investigate, and it would have been appropriate to have inside it a higher number of fixtures. Anyway, the evaluation of the primary and secondary implant stability may contribute to higher implant survival/success rates in critical areas, such as the regenerated posterior maxilla.
Tissue stability of implants placed in fresh extraction sockets: a 5-year prospective single-cohort study

ABSTRACT
The aim of this 5-year prospective single-cohort study is to evaluate implants success rate, marginal bone level (MBL), soft tissue stability, and the patients’ satisfaction up to 5 years after tooth extraction and immediate implant placement. Implants were inserted in fresh extraction sockets, the gap between the residual bone walls and the implant surfaces were grafted with a xenograft (OsteoBiol® Apatos, Tecnoss®, Giaveno, Italy) and covered by a collagen membrane (OsteoBiol® Evolution, Tecnoss®) left exposed to the oral cavity (flapless technique). A total of forty-seven patients was evaluated. At the re-entry, 4 months after grafting, clinical parameters (width of keratinized gingiva [WKG], facial soft tissue level [FST], papilla index, plaque index, and bleeding on probing) were measured; periapical radiographs were taken at the time of implant placement (baseline) and after 1, 3, and 5 years. An image analysis software was used to measure changes in the marginal bone level (DMBL). Moreover, the clinicians evaluated patients’ satisfaction after 1, 3 and 5 years. After 5 years, the implant survival rate was 95.7%. DMBL showed statistically significant differences: mean values were -0.68 ± 0.39, -0.94 ± 0.44, and -1.08 ± 0.43 mm at the 1, 3, and 5-year follow-up, respectively. Changes in WKG (DWKG) and FST (DFST) decreased from the 1-year point of the survey (0.80 ± 0.79 and 0.71 ± 0.73 mm for DWKG and DFST, respectively) to the last follow-up check at 5 years (0.67 ± 0.74 and 0.56 ± 0.69 mm for DWKG and DFST, respectively), with no significant differences. Regarding patients’ satisfaction, 74% ± 11.8% of patients were satisfied by the overall implant treatment, 73.0% ± 11.1% were satisfied with the appearance of the peri-implant soft tissues, and 80.5% ± 11.3% gave their positive opinion on the aesthetic outcome of the definitive implant crown.

CONCLUSIONS
The outcomes of this study confirm that implants inserted immediately after tooth extraction and grafted with a cortico-cancellous porcine bone using a flapless procedure result in stable bone levels and soft tissue parameters. The aesthetic outcomes of the surgical procedure used in this study were considered satisfactory by the patients.
Postextractive implants in aesthetic areas: evaluation of perimplant bone remodeling over time

ABSTRACT
As some Authors have indicated that the immediate placement could offer many advantages, including time saving, the aim of this research was the evaluation of the peri-implant bone remodelling of post-extractive implants over two years. Thirty patients, requiring teeth extractions due to root fractures, destructive caries or endodontic failures, were enrolled for the study. All patients were treated with the same surgical technique, with atraumatic extraction, curettage of extraction socket and implant insertion. Implants (Sweden Martina, Due Carrare, Padova, Italy) were inserted placing the shoulder edge 1 mm deeper the cortical margin of palatal plate and the residual gaps were filled and slightly condensed with collagenated cortico-cancellous porcine bone (OsteoBiol® mp3®, Tecnoss®, Giaveno, Italy). A trimmed collagen membrane (OsteoBiol® Evolution, Tecnoss®) was used to completely cover the socket. A temporary adhesive bridge, with an adequate profile, was bonded to the adjacent teeth and three months after surgery the final prosthetic restoration was delivered. No complications were recorded during the healing period. Bone loss was measured using the radiographs taken at 0, 12 and 24 months after implant insertion and bone changes were measured at the mesial and distal peri-implant sites, and their average values were calculated using the distance between cortical edge and the fixture abutment junction. The values obtained at time 0 and at 2 years were compared by test t-student.

CONCLUSIONS
The results showed that after one year 73% of patient had 0 mm of bone reabsorption, 20% of patient had 0mm ≤ x ≤ 0.5mm, 7% of patient had 0.5mm ≤ x ≤ 2 mm of bone reabsorption. After two years 62% of patient had 0 mm of bone reabsorption, 24% had 0 mm ≤ x ≤ 0.5mm, 14% had 0.5mm ≤ x ≤ 2 mm. Within the limits of this study, the results showed no significant differences in bone reabsorption in most patients over 2 years.
Crestal access sinus lift

OsteoBiol®
by Tecnoss
Implant placement in fresh extraction sockets and simultaneous osteotome sinus floor elevation: a case series

ABSTRACT

In the posterior maxilla, implant placement immediately after tooth extraction is frequently complicated by the presence of the maxillary sinus and by a lack of adequate bone volume and quality, thus preventing a precise placement and stabilization of the implants. Therefore, in these situations, normally a maxillary sinus augmentation is performed, followed by implant placement in the reconstructed bone.

The purpose of this study was to evaluate the clinical success of implants placed in fresh extraction sockets with simultaneous maxillary sinus floor elevation using the osteotome technique.

12 patients (7 men and 5 women) aged 38 to 56 years were included in this study, requiring the extraction of a maxillary premolar and scheduled for immediate implant placement. The graft materials used in both sinus floor augmentation and peri-implant bone defects were a mixture of collagen gel and cortico-cancellous porcine bone particles (OsteoBiol® Gel 40, Tecnoss®, Giaveno, Italy), covered with bioabsorbable membranes (OsteoBiol® Evolution, Tecnoss®). The resulting graft material was extremely easy to handle because the collagen gel acted as a sealing material.

All implants were allowed to heal for 6 months prior to prosthetic rehabilitation. One of the 12 experimental implants failed because of an abscess during early healing. No implants failed after definitive prosthetic rehabilitation. No significant bone loss was detected at the final follow-up visit. 18 months after surgery, mean bone gain evaluated by radiographies was 4.2±1.4 mm.

CONCLUSIONS

The results of this study demonstrate that the use of the osteotome technique in order to obtain the sinus floor elevation and the implant placement in fresh extraction sockets can be considered a predictable procedure. Thanks to the lateral condensation of bone performed by this technique during the preparation of the implant site, the resulting bone quality seems to be improved.
Immediate loading of dental implant after sinus floor elevation with osteotome technique: a clinical report and preliminary radiographic results

ABSTRACT

One of the fundamental criteria for obtaining osseointegration is the possibility to obtain a good initial stability of the implant and to achieve this it is necessary to have a sufficient bone density and volume. As the osteotome technique is an alternative and conservative technique for sinus floor augmentation and immediate implant placement in the posterior region of the upper jaw, the aim of this clinical report was to analyze the possibility of sinus lift and immediate placement and loading of a dental oral implant in the premolar region of the maxilla using this technique. The authors describe the treatment of a 46-year-old male patient who needed to replace the maxillary premolar with an implant-supported crown restoration. The fixture and xenogenic bone substitute materials used were: BioHorizons Internal, diameter 4.0 mm and length 12 mm (BioHorizons, Birmingham, Ala), a collagen membrane (OsteoBiol® Duo-Teck, Tecnoss®, Giaveno, Italy), and prehydrated and collagenated cortico-cancellous porcine bone graft (OsteoBiol® Gel 40, Tecnoss®). The implant osteotomy site was prepared to full dimension by osteotomes of increasing diameter and the collagen membrane was introduced through the osteotomy and placed against the slightly elevated Schneiderian membrane. The graft material was prepared and injected through the osteotomy and into the elevated sinus cavity by means of its syringe. After this, it was possible to place the implant with a good primary stability, with no intraoperative complications.

CONCLUSIONS

At the follow up after 12 months, the implant was successful, showing that “this simplified treatment modality can make implant rehabilitation of the atrophic maxilla premolar region more accessible in a single stage with immediate loading to facilitate bone density improvement”.

Abstract author: Cristina Rodighiero, dental journalist, free publication, not for resale. Printed by Tecnoss® Dental s.r.l.
The use of various biomaterials in computer-guided crestal sinus lift procedures. A report on two case studies with volume comparison

ABSTRACT

When a sinus lift is necessary to rehabilitate the maxilla placing dental implants, the available techniques involve the use of biomaterials to fill the sinus cavity and reach an adequate bone volume for implant positioning. Among these techniques, the crestal approach is increasingly employed and in literature different maxillary sinus lift techniques using this kind of approach have been described. Moreover, thanks to computer-guided surgery, it is possible to perform minimally traumatic and invasive procedures for the filling of the maxillary sinus via a crestal approach. In this study, the Authors used the recently proposed transcrestal hydraulic lift technique, using two different biomaterials in two different clinical cases. The aim of this study is to compare the volumetric measurement and the behaviour of the two different biomaterials. In the first case, the detachment and lifting was achieved using hyaluronic acid gel and micronized heterologous bone in an 80% collagen matrix whose granulometry was less than 300 microns (OsteoBiol® Putty, Tecnoss®, Giaveno, Italy). While in the second case, a nano-crystallized hydroxyapatite in an aqueous solution (Nanogel, TEKNIMED, France) was used. Biomaterials like the ones here used, that have a pasty consistency and are smooth and free from lumps, are the most suitable to come into contact with the Schneiderian membrane. The surgical procedures were performed using computer-guided surgery and the filling volume obtained was measured with a comparative software program. In both cases, a ≥ 6 millimetres bone volume augmentation. Moreover, the distribution of biomaterials in the sinus was very regular, allowing the creation of a dome covering the implant and able to support the elevation of the membrane.

CONCLUSIONS

Based on the results, it seems that this technique is a viable alternative to conventional ones, featuring a reduced percussive trauma and a low invasiveness. The Authors concluded that “the two biomaterials used have the same pasty consistency, and seem to have the same clinical behaviour, however, the results must be monitored during the remodelling time. Further studies are necessary in order to investigate the higher or lower efficacy in comparison with statistically significant success and to check the filling volume of the sinus over time. Histologic studies will also be needed in order to confirm the quality of bone formed”.

Original Article
Oral Implantology
2016;Apr-Jun 9(2)
Lateral access sinus lift

OsteoBiol®
by Tecnoss

REGENERATION SCIENCE
INSPIRED BY NATURE
Maxillary sinus augmentation: histologic and histomorphometric analysis

ABSTRACT

A limited quantity of bone volume, related to an excessive resorption of the alveolar bone following a tooth extraction and enlargement of the maxillary sinus, can complicate the implant placement in the posterior maxilla. In order to allow a predictable implant placement, sinus floor lifting and grafting have been proposed. In this study, the Authors aimed to compare from a histological point of view the use of 100% autogenous bone versus a combination of autogenous bone and cortico-cancellous porcine bone for the sinus floor augmentation procedure. For this study, 18 patients were selected following these criteria: need for bilateral sinus lifting and grafting, presence of severe maxillary bone atrophy, presence of a residual maxillary sinus floor of less than 3 mm and presence of healthy systemic conditions. The surgery was performed under general anesthesia and the bone for grafting was harvested from the iliac crest. Each patient received 100% autogenous bone in one randomly selected sinus (control side) and a 1:1 mixture of autogenous bone and cortico-cancellous porcine bone particles (OsteoBiol® Gen-Os®, Tecnoss®, Giaveno, Italy) in the contralateral sinus (test side). The bony sinus windows were covered by a resorbable collagen membrane (OsteoBiol® Evolution, Tecnoss®). 5 months after surgery, all patients received at least 2 implants on each side of the maxilla and bone biopsy specimens (2 from each side) were taken at the time of implant placement. The histologic evaluation of the test sites at 5 months showed the presence of some residual cortico-cancellous bone particles and that the incompletely resorbed bone graft was well integrated and in complete continuity with the new bone tissue formation. No significant differences in bone percentages were observed in the bone biopsies from test and control sites.

CONCLUSIONS

In the present study, cortico-cancellous pig bone particles at 5 months became partially resorbed and surrounded by new woven bone. On the basis of the findings from this study, the Authors concluded that the cortico-cancellous pig bone particles have the capacity to support bone augmentation and can be successfully used in a 1:1 mixture with autogenous bone harvested from the iliac crest in case of severe maxillary atrophies (class V Cawood).
A clinical study of the outcomes and complications associated with maxillary sinus augmentation

ABSTRACT
The sinus lift procedure is performed in order to increase the bone volume in the lateral maxilla and allow the use of dental implants. The dental implants can either be placed simultaneously when there is sufficient bone height, or be placed in a second moment, after an augmentation procedure.

The aim of this study was to evaluate the rate of complications in maxillary sinus floor augmentation surgery and the impact of complications on subsequent implant treatment in a patient population with severe maxillary atrophy scheduled for treatment under general anaesthesia.

70 patients (124 sinuses) with severe maxillary atrophy were included in the study for the maxillary sinus augmentation treatment under general anaesthesia. In 93 sinuses, the treatment was performed with autogenous bone alone. The donor sites for bone harvesting included the mandibular symphysis or the antero-upper border of the iliac crest. The remaining 31 sinuses were augmented with a 1:1 mixture of autogenous bone and cortico-cancellous pig bone particles (OsteoBiol® Gen-Os, Tecnoss®, Giaveno, Italy). The particles had granulometry between 250 and 1000 µm. The bony sinus windows were covered with a resorbable collagen membrane. Finally, the mucoperiosteal flap was replaced and sutured using vertical interrupted mattress sutures.

CONCLUSIONS
In evaluating the intraoperative complications, the Authors found that the use of an onlay bone graft in conjunction with sinus augmentation appeared to significantly increase the rate of infective complications. Anyway, this study showed no significant correlations between the occurrence of complications and the type of filling material adopted in the maxillary sinus augmentation. Furthermore, it was observed that new bone formation took place within 6 months of the sinus lift operation.

In particular, the Authors concluded that “no radiographic discrepancies in the amount of bone regenerated were observed between sinuses where only autogenous bone was used and those where a 1:1 mixture of autogenous bone and cortico-cancellous pig bone particles was used”.

Original Article
The International Journal of Oral & Maxillofacial Implants
2006 Jan-Feb; 21(1):81-5
Histologic and ultrastructural analysis of regenerated bone in maxillary sinus augmentation using a porcine bone-derived biomaterial

ABSTRACT

In case of an insufficient bone volume in the posterior maxilla, maxillary sinus floor augmentation procedures are used. Even if several different materials have been proposed for sinus augmentation procedures, it is still not clear which graft materials are clinically most suitable for bone regeneration. Autogenous bone is considered to be the gold standard, but its main disadvantages, especially those related to the patient’s discomfort, produced a quest for a bone substitute that could be used in bone regeneration techniques and induce a predictable and rapid healing of the tissues at the interface with dental implants.

The aim of the present study was to report the results of light microscopy (LM) and transmission electron microscopy (TEM) in specimens retrieved 5 months after sinus floor augmentations using a porcine bone-derived biomaterial in the form of granules (OsteoBiol® Apatos, Tecnoss®, Giaveno, Italy). 10 patients were included in this study. After maxillary sinus augmentation using this biomaterial, 10 specimens were retrieved after 5 months and processed to be observed under light microscopy (LM) and transmission electron microscopy (TEM). At the same time, implants have been placed, planning second-stage surgery after 5 months.

After 5 months, the clinical observation revealed that all implants were stable and the x-rays showed the presence of bone around and above the implants placed in the augmented maxillary areas. The light microscopy observation showed that most of the particles were surrounded by newly formed bone and that mainly compact bone was present at the interface. Moreover, the bone biomaterial interface showed a close contact between the porcine bone particles and the surrounding bone that had mainly features of mature bone with numerous osteocytes. Newly formed bone area was 36±2.8%, marrow spaces were 38±1.6%, while residual graft material was 31±1.6%. Under TEM, all phases of bone formation (osteoid matrix, woven, and lamellar bone) were observed in proximity with the biomaterial particles.

CONCLUSIONS

The findings of this study show that this cortical porcine bone-derived biomaterial is biocompatible and can be used for maxillary sinus augmentation procedures, promoting bone formation without interfering with the normal reparative bone processes and implant osseointegration. Based on these results, the Authors concluded that “these findings could increase the scientific knowledge of the clinician for understanding the biologic interactions occurring in proximity of a porcine bone substitute, showing that bone in contact with it presents all the phases of bone formation and shows features similar to the pre-existing osseous tissue, thus indicating the biocompatible properties of this graft”.

Abstract author: Cristina Rodighiero, dental journalist, free publication, not for resale. Printed by Tecnoss® Dental s.r.l.
Osteotomy and membrane elevation during the maxillary sinus augmentation procedure. A comparative study: piezoelectric device vs. conventional rotative instruments

ABSTRACT

Sinus lift is generally considered to be a safe surgical procedure for the maxillary sinus floor augmentation with a low prevalence of complications. Anyway, in case of a sinus membrane perforation, it is no more possible to guarantee the graft stability and its vascularization, jeopardizing the maturation and mineralization of the bone graft. Moreover, the presence of a large sinus membrane perforation allows migration of the graft to the respiratory mucosa and its bacterial contamination.

The aim of this randomized-controlled clinical trial was to compare two treatment procedures for the surgical access (osteotomy and sinus membrane elevation) to the maxillary sinus by means of piezoelectric device and conventional instruments during the maxillary sinus floor augmentation procedures.

A total of 13 patients (10 females and 3 males) who required a bilateral maxillary sinus floor elevation for implant-prosthetic rehabilitation were selected. A within-patient control study was carried out. The osteotomy for sinus access was performed on one side of the maxilla using the piezosurgery (test sites) and on the other side using conventional rotary diamond burs (control sites).

Once the sinus membranes were elevated to obtain the requested volume for bone grafting, all the maxillary sinuses were grafted using 100% cortico-cancellous pig bone particles (OsteoBiol® mp3®, Tecnoss®, Giaveno, Italy). The bony sinus windows were covered with a reabsorbable collagen membrane (OsteoBiol® Evolution, Tecnoss®).

CONCLUSIONS

All patients had an uneventful healing and no signs or symptoms of maxillary sinus disease were observed after the augmentation surgical procedures.

With reference to the comparison between the two surgical procedures, none of the differences observed between the two groups reached a level of significance.

Within the limits of the present study, the Authors concluded that “piezosurgery and conventional instruments did not show any differences in the clinical parameters investigated for the maxillary sinus floor elevation”.

Abstract author: Cristina Rodighiero, dental journalist, free publication, not for resale. Printed by Tecnoss® Dental s.r.l.
LATERAL ACCESS SINUS LIFT

Porcine bone used in sinus augmentation procedures: a 5-year retrospective clinical evaluation

ABSTRACT
Inadequate bone height in the lateral part of the maxilla is a contraindication for implant surgery and the rehabilitation of the edentulous posterior maxilla with dental implants often represents a clinical challenge.

The aim of this study was to evaluate from a clinical point of view the maxillary sinus augmentation using porcine bone. This study included 121 healthy patients (71 women and 50 men), all candidates for augmentation in the posterior maxilla. After the elevation of the sinus membrane, the maxillary sinus was filled with sterilized porcine cortico-cancellous mixed bone particles (OsteoBiol® Apatos, Tecnoss®, Giaveno, Italy). In 20 cases a perforation of the sinus membrane occurred, but without clinical complications and all the membrane perforations were successfully repaired with a collagen membrane (OsteoBiol® Evolution, Tecnoss®) and showed uneventful healing. After a 4- to 6-month healing period, sandblasted and acid-etched implants were inserted. All grafted sinuses healed well without major complications and did not show occurrence of symptoms indicating possible maxillary sinusitis and the cumulative survival implant rate was 92% after a mean loading time of 5 years.

CONCLUSIONS
The results of this study show that porcine bone can be used with success in sinus floor augmentation procedures, and rougher-surfaced implants are probably preferable. These findings are in accordance with other studies that showed that porcine bone has good biocompatibility and osteoconductive properties, with osteoblastic seams forming bone directly on the biomaterial surface and with no histologic signs of adverse reactions.
A collagenated porcine bone substitute for augmentation at Neoss implant sites: a prospective 1-year multicenter case series study with histology

ABSTRACT

It is well known that the presence of localized defects and/or small amounts of bone below the maxillary sinus can compromise implant placement. In such situation, in order to achieve predictable results, it is necessary to perform specific bone augmentation techniques. Different bone substitutes and barrier membranes are commonly used for the augmentation of localized defects and of the maxillary sinus floor and the aim of this study was to evaluate from a clinical and histological point of view a porcine bone (PB) substitute used for augmentation of the alveolar crest or the maxillary sinus floor prior to or in conjunction with implant placement. The biomaterials used were two types of collagenated bone of porcine origin (OsteoBiol® Gen-Os® or OsteoBiol® mp3®, Tecnoss®, Giaveno, Italy), two types of collagen gel (OsteoBiol® Gel 40 or OsteoBiol® Gel 0, Tecnoss®), and two types of membranes (OsteoBiol® Evolution Fine or OsteoBiol® Lamina Soft X-fine, Tecnoss®). 19 patients were treated, with a total of 34 implants (Neoss Ltd., Harrogate, UK) placed. Implants were followed with implant stability measurements at placement and abutment connection, and with intraoral radiographs at abutment connection and after at least 1 year of loading. A biopsy for histology and morphometry was taken at the first re-entry operation. The results show that all but one procedure resulted in successful augmentation, with an overall procedure success rate of 94.7% and 90% for maxillary sinus floor augmentations. The histological examination showed the formation of new bone at the PB surface, forming bridges between particles and between particles and preexisting bone. The presence of scalloped resorption lacunae and new osteons inside the particles indicated ongoing resorption/remodeling of the particles.

CONCLUSIONS

The clinical cases presented in this study showed that collagenated PB could effectively be used for bone augmentation of various defects in all the 19 patients. The study included different defects and treatment strategies because the Authors decide to evaluate the use of the PB in consecutive patients with different needs as usually dealt with in everyday practice. This study showed good clinical results when using a PB substitute and barrier membranes for augmentation of the alveolar crest and maxillary sinus and the histology revealed osteoconductive properties of the material and also indicated osteoclastic resorption.
Maxillary sinus augmentation in humans using cortical porcine bone: a histological and histomorphometrical evaluation after 4 and 6 months

ABSTRACT

Bone substitutes, such as allografts, xenografts, and alloplasts, have been proposed in several augmentation procedures as an alternative to autogenous bone. Although autogenous bone is considered as the gold standard, its use has several disadvantages: a limited availability, a tendency to partially resorb, the need for an additional surgery, and the increased morbidity.

Among the bone substitutes available on the market, OsteoBiol® Apatos (Tecnoss®, Giaveno, Italy) is a xenogeneic bone substitute consisting of sterilized cortical porcine bone in form of particles with a high porosity and with a diameter ranging from 600 to 1000 µm. This biomaterial is similar to human bone, and it has been reported, in humans, to be osteoconductive, well integrated in the host site and incompletely resorbed after 5 months, and with no signs of adverse reactions in a rabbit study. All sinuses have been augmented with porcine cortical bone particles (Apatos) mixed with sterile saline solution and blood. A resorbable membrane (OsteoBiol® Evolution, Tecnoss®) was positioned while closing the packed sinus window. The aim of the present study was to perform histologic and histomorphometrical evaluation of 77 specimens retrieved 4 or 6 months after sinus augmentation using cortical porcine bone augmentation material. The specimens were processed to be observed under light microscopy. Histomorphometric measurements after 6 months showed: 31,4±2,6% newly formed bone, 34,3±3,1% marrow spaces, 37,6±2,2% residual graft.

The results of the evaluations confirmed the good biocompatibility and high osteoconductivity of this porcine biomaterial. Most of the grafted biomaterial particles were surrounded by newly formed bone, and no gaps or connective, fibrous tissues were found at the biomaterial-bone interface. There were no sign of inflammatory or other adverse reactions in the bone formed.

CONCLUSIONS

The present results show that cortical porcine bone is a biocompatible, osteoconductive biomaterial than can promote the formation of new bone, even in maxillary sinus augmentation procedures, without interfering with bone regeneration.

As this was a histological and histomorphometrical study only, in their conclusions the Authors anticipated that the long-term outcomes - that will be reported in a separate manuscript - were satisfactory in comparison to studies using other graft materials.
Zygomatic implant placement in conjunction with sinus bone grafting: the “extended sinus elevation technique.” A case-cohort study

ABSTRACT

In case of edentulous patients with an extremely atrophied maxilla, the implant-prosthetic rehabilitation represents a challenge for clinicians. As a matter of fact, the progressive bone resorption in the posterior region, the widening of the sinuses and the anterior alveolar bone resorption can dramatically reduce the possibility to perform a standard implant-prosthetic treatment. The introduction of the zygomatic implants made it possible for clinicians to perform immediate implant placement without bone augmentation for the treatment of such patients. However, although zygomatic implant insertion may have a number of advantages, existing clinical data have shown that the placement of zygomatic implants increases the risk of postoperative complications related to the sinus. The purpose of this cohort study was to introduce a modified surgical technique for the placement of zygomatic implants aiming to minimize the risk of biologic complications. The selected 10 patients, all with an extremely atrophied maxillae, were planned to be treated with one to four zygomatic implants in conjunction with sinus bone grafting. After the integrity of the sinus membrane was confirmed, the established sinus cavity was augmented with a bone graft material (OsteoBiol® mp3®, Tecnoss®, Giaveno, Italy) and the augmented area was covered with a resorbable barrier membrane (OsteoBiol® Soft Cortical Lamina, Tecnoss®) to prevent soft tissue ingrowth into the sinus and to enable guided bone regeneration. Fixation pins (TitanPin, Geistlich) were used when collapse of the barrier membrane was expected and a second barrier membrane (OsteoBiol® Evolution, Tecnoss®) was applied on top of the first membrane to allow optimal soft tissue integration. Implants were inserted after the bone grafting procedure. After 6 months after from the implant insertion, all patients received the definitive prostheses and underwent clinical and radiographic examinations. The overall 6-month implant survival rate was 90.9% for zygomatic implants and 100% for auxiliary implants placed in the anterior area and the clinical indicators, such as probing pocket depth, keratinized tissue and plaque and bleeding indices, were good in all patients. The radiographic examinations showed a substantial gain of radiographic bone around the zygomatic implants.

CONCLUSIONS

The findings of this cohort study demonstrate that the proposed “extended sinus elevation technique” to place zygomatic implants in conjunction with sinus bone grafting may decrease the risk of biologic complications, in contrast with traditional zygomatic implant placement, reducing sinus-related symptoms and complications, avoiding the exposure of implant threads in the maxillary antrum and improving biomechanical properties of the prosthesis.
Comparative histological results of different biomaterials used in sinus augmentation procedures: a human study at 6 months

ABSTRACT

As demonstrated by several studies, sinus augmentation is a predictable treatment for atrophy of the posterior maxilla and different bone substitutes have been used in sinus floor augmentation. However, only few studies compared the performances of the different kinds of grafts and so a current issue is the definition of the best filling material for the sinus cavity. Therefore, the aim of this study was to perform a histological and histomorphometric evaluation, in humans, of specimens retrieved from sinuses augmented with phycogene HA (Algipore®, DENTSPLY-Friadent, Mannheim, Germany), macroporous biphasic calcium phosphate (MBCP®) (Leone, Firenze, Italy), calcium carbonate (Biocoral®, Leader-Novaxa, Milan, Italy), collagenized porcine cortico-cancellous bone (OsteoBiol® Apatos Cortical, Tecnoss®, Giaveno, Italy) ABB (Bio-Oss®, Geistlich, Wohhusen, Switzerland). A total of 30 sinus augmentation procedures were performed and in every case, 100% biomaterial was used. 15 patients were scheduled for bone reconstruction procedures including sinus augmentation and implant insertion. For the examination, a total of 60 bone cores, 2 for each augmented sinus, 12 for every biomaterial, were retrieved. At low power magnification, it was possible to observe that many grafted particles were bridged by newly formed bone and in some portions of the specimens, graft particles appeared to be lined by newly formed bone, without gaps at the bone-particle interface and with no sign of inflammatory cells and multinucleated giant cells. In the porcine bone group, few peripheral osteocytic lacunae, present in the biomaterial, appeared to be filled with osteocytes; around some particles, osteoblasts could be seen, while actively depositing unmineralized osteoid matrix.

CONCLUSIONS

Based on the findings, the Authors concluded that "the results of the present study have shown that all these biomaterials can be used with success in maxillary sinus augmentation procedures showing good biocompatibility and osteoconductive properties, with osteoblastic seams forming bone directly on the biomaterial surface and with no histological signs of adverse reactions".
A 6-month histological analysis on maxillary sinus augmentation with and without use of collagen membranes over the osteotomy window: randomized clinical trial

ABSTRACT

When in the posterior edentulous maxilla the bone volume is insufficient for implant placement, it is necessary to perform a bone augmentation procedure, including the elevation of the sinus membrane from the floor of the maxillary sinus in order to allow the placement of a bone graft. As there are some doubts about the need for using a barrier concurrently with a graft in sinus augmentation procedures, in this randomized clinical trial histological and histomorphometrical analysis were used to assess the effectiveness of the use of a membrane in lateral sinus augmentation procedures, investigating the effect of a resorbable collagen membrane over the osteotomy window on maxillary sinus augmentation healing. After the informed consent was signed, all patients enrolled for this study underwent at least one session of oral hygiene before the sinus elevation procedure. Maxillary sinuses were allocated to either a control (membrane) or test (no membrane) group, using a computerized random allocation process. All the patients were treated with the same surgical technique consisting of sinus floor augmentation via a lateral approach. After the elevation of the sinus membrane, the sinuses were grafted with a mixture of autogenous bone harvested from the lateral bone wall and collagenated cortico-cancellous porcine bone (OsteoBiol® mp3®, Tecnoss®, Giaveno, Italy) and the sinuses in the control group were covered with a reabsorbable collagen membrane (OsteoBiol® Evolution, Tecnoss®) and the mucoperiosteal flaps were sutured with reabsorbable sutures. After 6 months and immediately prior to the implant placement, one bone biopsy was harvested from the lateral window and the bone samples were processed and forwarded to the Institute of Biomedicine, the Sahlgrenska Academy Gothenburg University, Sweden for histological examination.

CONCLUSIONS

On the basis of the results of the histological and histomorphometrical analysis, the Authors concluded that compared with sites which were not covered, the use of the membrane may slightly increase the amount of vital bone over a period of 6 months and the use of a membrane seems to reduce the proliferation of the connective tissue and the graft re-absorption rate. Anyway, further studies are needed to explore the advantages of the use of membranes for the sinus augmentation procedure and the influence on the amount and quality of regenerated bone.
Abstract

Adequate alveolar ridges are fundamental to successful rehabilitation with dental implants and different techniques for reconstructing atrophied ridges are available. Bone substitute grafts represent a relevant possibility, provided that the biomaterial for bone substitution is biologically safe and safety depends on the quality of its reproducibility, its biocompatibility, and an absence of toxicity. The aim of this study was to carry out a retrospective investigation of a bone substitute material (BSM) in retrieved bone biopsies from maxillary sinus augmentation in 15 human subjects. The Authors investigated OsteoBiol® mp3® (Tecnoss®, Giaveno, Italy), an antigen-free bone consisting 90% porcine granules of dimensions between 600-1000 µm mixed with 10% pure Type-I porcine collagen, used as a bone substitute for sinus augmentation. The investigation was performed by means of an ultrastructural study of the bone-to-biomaterial interface using scanning electron microscopy backscattered electron imaging (SEM-BSE), as well as analysis of the mineral degradation of residual bone substitute graft material using microanalytical system based on energy-dispersive X-ray spectrometry (EDX). In the 15 partially edentulous patients (6 women and 9 men), of ages ranging from 37 to 60 years, the sinus membrane was elevated with curettes of different shapes and after membrane elevation, all sinus cavities were grafted with a BSM. After BSM grafting, an absorbable collagen porcine membrane (OsteoBiol® Evolution, Tecnoss®) was placed over the window to minimize soft tissue invasion. 9 months after sinus lifting, bone cores were harvested from the maxillary sinus. The specimens were processed for observation under a SEM-BSE device, then chemical analysis and elemental mapping of the mineral composition were generated using EDX. Scanning electron microscopy revealed that newly formed bone had become closely attached to the xenograft. Elemental analysis (above all, a high Ca/P ratio) showed that there was a gradual diffusion of Ca⁺ ions from the biomaterial to the newly formed bone at the interface.

Conclusions

From a clinical point of view, after a 9-month follow-up period of these 15 patients the success rate was 100%. No perforation of the sinus membrane or other clinical complications such as sinusitis or pain resulted from surgery. The increased volumes produced by the grafting procedures were stable by the end of the healing period and all planned implants could be placed in the augmented sites. The analysis demonstrated that the biomaterial proved to be biocompatible, bioreabsorbable and osteoconductive when used as a bone substitute for maxillary sinus elevation.
Use of piezosurgery during maxillary sinus elevation: clinical results of 40 consecutive cases

ABSTRACT

Preservation of the sinus membrane is essential for a successful sinus grafting procedure and its integrity is crucial to stabilize grafting materials during the healing period. As perforation occurs most frequently during the rotary osteotomy stage when using a round diamond handpiece, the use of the piezoelectric technique was suggested in order to obtain a greater precision and safety in bone surgery. The aim of this study was to evaluate the performance of piezoelectric devices during sinus elevation to determine the percentage of sinus membrane perforation and the time required to perform the antrostomy and elevation of the membrane. A total of 40 sinuses were included and the elevation procedures were performed by means of a piezosurgery device. The space obtained with the sinus elevation was filled with graft material: either autologous bone or a mixture of 50% autologous bone and 50% deantigennated collagenated bone substitute of porcine origin (OsteoBiol® Gen-Os®, Tecnoss®, Giaveno, Italy) was used as a filling material. The total amount of graft material at each site varied according to the extent of maxillary bone resorption and the sinus anatomy. During the sinus elevation procedure, seven perforations occurred, and in those cases, the bony sinus windows were covered with a resorbable membrane (OsteoBiol® Evolution, Tecnoss®).

CONCLUSIONS

Postoperative healing was uneventful and free of complications in all patients. After 2 months, at radiographic analysis, an adequate amount of radiopaque material with greater density than the bone was present, and no signs of maxillary sinus infection were observed. Sinus membrane perforation occurred in 7 of 40 cases, representing 17.5% of procedures. These results are similar to those reported by several authors who also found very low perforation percentages using piezoelectric devices. The perforations were repaired using a collagen membrane in direct contact with the sinus membrane. Based on the results of this study, the Authors affirm that “sinus augmentation can be successfully performed by means of a piezoelectric device, which was demonstrated to be an attractive alternative to simplify sinus elevation procedures and offer promising results in terms of complications such as sinus membrane perforations”.

Abstract author: Cristina Rodighiero, dental journalist, free publication, not for resale. Printed by Tecnoss® Dental s.r.l.
Simultaneous sinus augmentation with implant placement: histomorphometric comparison of two different grafting materials. A multicenter double-blind prospective randomized controlled clinical trial

ABSTRACT

In many implant treatments, xenogenic biomaterials of different biologic origin are considered to be valid and predictable alternatives to autogenous bone, also for the sinus elevation via the lateral approach for implant rehabilitation of atrophic posterior maxillae. The aim of the present experimental randomized clinical trial was to evaluate the histologic behavior of two different xenogenic bone substitutes used in sinus floor augmentation procedures via the lateral approach. With a double-blind design, the two bone substitutes tested were a deproteinated particulated bovine bone (DPBB) (Bio-Oss® Geistlich) and a new grafting material consisting in a particulated cortical porcine bone (PCPB) (OsteoBiol® mp3®, Tecnoss®, Giaveno, Italy). In particular, this material has a granulometry ranging from 600 to 1000 µm and the prehydrated form is supplemented with collagen. All patients included in the study were treated with maxillary sinus floor elevation via a lateral approach and one of the two xenografts was used as the sole grafting material. Root-form implants were placed simultaneously. Stage-two surgery was performed at 6 months: all the implants were uncovered and the biopsy specimens harvested from each site, and histomorphometric analyses were performed.

CONCLUSIONS

42 specimen were analyzed histomorphometrically and the results showed no significant differences in total bone volume (PCPB 37.43%, DPBB 37.52%) or residual grafting material (PCPB 13.55%, DPBB 16.44%). As the histomorphometric data presented in the present experimental randomized clinical trial suggest that particulated cortical porcine bone has excellent osteoconductive properties, the Authors concluded that “in this study, PCPB compared well with DPBB as a grafting material for lateral sinus elevation”.

Abstract author: Cristina Rodighiero, dental journalist, free publication, not for resale. Printed by Tecnoss® Dental s.r.l.
Regeneration of human bone using different bone substitute biomaterials

ABSTRACT
In order to compensate for a lack or loss of bone tissue, it is possible to use bone substitute biomaterials (BSBs) available as inorganic or organic, natural or synthetic materials. Ideally, a BSB should have specific biological and clinical peculiarities.

The aim of this study was to evaluate and compare the in vivo behavior of different biomaterials, placed in humans, by means of two mathematical indexes, one used to examine bone regeneration processes and the other for the assessment of bone density structure obtained after regeneration.

13 different BSB were considered in the present analysis, and among them there was a collagenized porcine bone (OsteoBiol® Apatos Cortical, Tecnoss®, Giaveno, Italy) and a cortico-cancellous porcine bone (OsteoBiol® Apatos Mix). 295 patients were included in the study and almost all the cases were sinus augmentation procedures; one case was of alveolar socket regeneration and one case of an implant retrieved for fracture.

The data belonging to previously published studies have been analyzed using innovative mathematical models to evaluate the bone regenerative index (Br) and the structural density index (Ds).

The results showed that after 6 months the regenerated bone showed a D3 bone type. After several years, the regenerated bone type was D2, with an evident increase in the density of the regenerated bone over time. Moreover, the values of Br were higher for combined biomaterials indicating a fewer amount of residual particles and marrow spaces, while the values of Ds were higher for anorganic bovine bone indicating a greater new bone formation and a lesser amount of marrow spaces. After 20 years, the bone regenerated using hydroxyapatite still had a D4 bone quality.

CONCLUSIONS
Based on the results of the evaluations performed, the Authors concluded that “the clinical implications of the present observation appeared to be irrelevant in cases for which the BSBs were used with the aim to restore or augment bone for aesthetic/prosthetic reasons without implant placement. Instead, for those cases in which the use of BSBs was an essential pretreatment for implant prosthetic restorations, it was necessary to take into consideration that the augmented bone, after 6 months of healing, had on average a structure like poor D3 type bone and represented one-third of the space filled by BSBs. Finally, none of the evaluated biomaterials seemed to be an ideal BSB”. 

Abstract author: Cristina Rodighiero, dental journalist, free publication, not for resale. Printed by Tecnoss® Dental s.r.l.
Bone formation in sinus augmentation procedures using autologous bone, porcine bone, and a 50:50 mixture: a human clinical and histological evaluation at 2 months

ABSTRACT

In case of a severe resorption following teeth extraction and the pneumatization of the maxillary sinus, it is necessary to adopt maxillary sinus augmentation procedures with biomaterials in order to obtain a sufficient volume of bone tissue to allow a successful implant placement. With reference to bone substitute, the material used must be biologically safe and must satisfy the three fundamental mechanisms of osteogenesis, osteoinduction and osteoconduction.

The purpose of this human study was to compare from the histological, histomorphometrical and clinical point of view the outcomes of autologous bone, porcine bone, and a 50:50 mixture of the two in maxillary sinus augmentation procedures, after a 2-month healing period. In order to do this, 10 patients were included in this study, undergoing two-stage sinus augmentation procedures using 100% autologous bone (Group A), 100% porcine bone (OsteoBiol® Gen-Os®, Tecnoss®, Giaveno, Italy - Group B), and a 50:50 mixture of autologous and porcine bone (Group C) were included in this study.

After a 2-month healing period, in group A it was possible to observe trabecular bone with large marrow spaces. Histomorphometry showed that the percentage of newly formed bone was 23.2±3% (median: 23.4), of marrow spaces 60.4±2.3% (median: 60.45) and of residual grafted material 16.4±3.8% (median: 14.9).

In group B, trabecular bone with marrow spaces and residual biomaterial particles was observed. Histomorphometry showed that the percentage of newly formed bone was 21.6±3.4% (median: 21.6), of marrow spaces 56.1±3.2% (median: 56) and of residual grafted material 22.3±3.5% (median: 22.2).

In group C, trabecular bone with marrow spaces was observed. Histomorphometry showed that the percentage of newly formed bone was 24.5±3.4% (median: 24.5), of marrow spaces 55.1±3.7% (median: 55.1) and of residual grafted material 20.4±3.2% (median: 20.4).

CONCLUSIONS

Based on the results of the study, the Authors concluded that “the clinical and histological results of this study indicated that porcine bone alone or in combination with autologous bone are biocompatible and osteoconductive materials and can be successfully used in sinus augmentation procedures".
Spontaneous bone formation on the maxillary sinus floor in association with surgery to remove a migrated dental implant: a case report

ABSTRACT

In this case report, the Authors describe the clinical case of a 49-year-old man with a partially edentulous maxilla, who received a total of 5 implants, 2 in the left and 3 in the right posterior maxilla. As four months later the implant at the site of the maxillary left first molar was accidentally pushed in the sinus, a surgical removal of the implant from the maxillary sinus was needed.

The treatment proposed to the patient consisted in three main steps:
1) removal of the implant;
2) sinus augmentation procedure after 5 months;
3) implant insertion 5 months after bone graft.

So, the implant was removed and a bone OsteoBiol® Lamina (Tecnoss®, Giaveno, Italy) was used to close the lateral window of the sinus. After five months, a CAT scan examination revealed a normal mucosal thickness and no opacification of the left maxillary sinus; bone formation was evident. The surgery was undertaken with local anaesthesia and conscious sedation and at re-entry, the sinus wall was found to be totally healed, with evidence of newly formed bone.

CONCLUSIONS

Authors conclude that “the surgical trauma and the creation of a secluded space between the bone surfaces and the healed sinus mucosa resulted in a spontaneous bone formation in the maxillary sinus. The surgical approach described may be used to achieve bone formation to enable placement of dental implants without the addition of any grafting material”.

Abstract author: Cristina Rodighiero, dental journalist, free publication, not for resale. Printed by Tecnoss® Dental s.r.l.
Histomorphometric outcomes after lateral sinus floor elevation procedure: a systematic review of the literature and meta-analysis

**ABSTRACT**

Very often, the progressive resorption of the alveolar bone caused by tooth loss in the posterior maxilla needs a bone augmentation procedure in order to increase the available bone volume for the placement of dental implants needed to support a fixed prosthetic rehabilitation.

In literature it has been reported that the lateral approach sinus floor elevation (LASFE) can be safely applied in cases of posterior maxilla atrophy, leading to a high implant survival rate.

The aim of the present systematic review of the literature and meta-analysis was to investigate the histomorphometric outcomes of LASFE (Lateral approach sinus floor elevation) surgery in order to evaluate different bone substitute materials (AB, autogenous bone; BB, Bovine bone, AG, allograft; FDBA, freeze-dried bone allograft; HA, hydroxyapatite; PB, porcine bone; PRP, platelet-rich plasma) performances related to new bone formation.

After an electronic and manual search, 84 articles were included in the quantitative synthesis and 16 of them in the meta-analysis of comparative studies. Taking into consideration the articles selected, a total of 1846 subjects were treated, and a total of 2224 biopsies were taken and examined. Recorded data were statistically analyzed evaluating percentage of new bone volume, residual biomaterial, and connective/soft tissues in the biopsies. The results show that the use of autogenous bone (AB) alone led to a significantly higher new bone formation if compared with bovine bone (BB) alone (P = 0.04), while no significant difference was found when the latter was compared with a mixture of AB and BB (P = 0.52). Grafts composed of BB showed significantly greater new bone formation as compared to hydroxyapatite (HA) (P < 0.001) while a mixture of tricalcium phosphate (TCP) and HA achieved better outcomes than BB (P < 0.001).

PB alone showed at six months a new bone volume range between 31.4% and 43.9%.

**CONCLUSIONS**

None of the biomaterials used for LASFE procedures demonstrated a significant and predictable superiority regarding new bone formation. The observation that, in comparative studies, the amount of new bone volume was higher for AB than for BB could not be confirmed by clinical results and so it seems that when donor site morbidity is a concern, BB and a mixture of TCP and HA could be considered as predictable alternative with promising results. Anyway, the Authors concluded that “more randomized, controlled clinical trials providing individual data about the characteristics of the analyzed specimen (size and site of biopsy) and of the residual bone height before intervention may help to achieving a deeper knowledge of the histologic behavior of biomaterials in LASFE procedures”.
The use of resorbable heterologous cortical lamina as a new sinus lift floor: a technical note

ABSTRACT

In case of necessity of a pre-implant bone regeneration by mean of a grafted biomaterial, it is necessary that such biomaterial remains stable in situ, without micro movements, for about six months. Some of these biomaterials, such as pre-hydrated and collagenated cortico-cancellous porcine bone granules promote the formation of good-quality new bone. Unfortunately, they do not have the mechanical characteristics that would allow for stability in terms of shape and size. On the contrary, some grafting materials, such as heterologous porcine cortical lamina, have an excellent capacity in creating recipient sites that can be filled with cortico-spongious collagenated bone paste that reabsorbs, promoting new bone formation.

In this technical note, the Authors propose a technique for the reconstruction of a new rigid artificial sinus floor with the use of resorbable biomaterials of porcine origin: a cortical lamina in connection with pre-hydrated and collagenated cortico-cancellous porcine bone. The prerequisites necessary to carry out the technique are the stability of the lamina and the presence of a sufficient amount of graft granules in the site. For this technique, a rigid porcine cortical lamina was modelled and positioned in the sinus as a new sinus floor without hydration (OsteoBiol® Lamina, Tecnoss®, Giaveno, Italy). A pre-hydrated and collagenated cortico-cancellous porcine bone was used as filler in the new space created by OsteoBiol® Lamina, palatal wall, mesial and distal bone (OsteoBiol® mp3®, Tecnoss®). A porcine resorbable membrane was used to cover the graft in the vestibular side (OsteoBiol® Evolution, Tecnoss®).

CONCLUSIONS

The adequate vascularisation of the graft combined with the integration of the lamina, which does not need to be removed, makes possible to propose this technique as a potential alternative to those used so far. The Authors conclude: “In our experience, it is possible to propose this technique as an alternative to those previously and currently in use. Additional clinical and histological scientific studies are needed to evaluate the effectiveness of the technique and further develop its potential”.

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Journal of Biological Regulators and Homeostatic Agents
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Molecular, cellular and pharmaceutical aspects of bone grafting materials and membranes during maxillary sinus-lift procedures. Part 2: detailed characteristics of the materials

ABSTRACT

Bone substitute materials (BSBs) can be classified into four groups according to their origin: autogenic (bone originating from the same patient), allogenic (bone originating from another person), xenogenic (bone originating from another species) and synthetic (with no biological origin). Their use in bone tissue regeneration has been widely validated and various grafts or combination of bone substitute materials have been used in sinus lift procedures. Knowing the properties of each graft enables individual treatment concepts as the choice of the best BSB is crucial for success in maxillary sinus augmentation procedures. In this article, the aim of the Authors is to provide an overview of most of the materials currently available for sinus lift, with a specific focus on their histological, molecular, cellular and pharmaceutical aspects.

In their overview, the Authors examined collagenated BSB of porcine origin too (OsteoBiol®, Tecnoss®, Giaveno, Italy). In the literature review, porcine bone has been reported to have a microstructure similar to human bone. Most of the grafted porcine bone particles were surrounded by newly formed bone with large osteocyte lacunae and the newly formed bone was always in tight contact to the grafted particles, and no gaps were evident at the bone-particles interface. No inflammatory cells and multinucleated giant cells were detected around the particles or at the interface with bone. No osteoclasts were evident around the graft particles. Moreover, porcine bone has been demonstrated to be osteoconductive, with no adverse reactions, no inflammatory infiltrate and this material has been described as a resorbable graft material, with clear active resorption signs of its particles.

CONCLUSIONS

Following a detailed description of the different BSBs, the Authors concluded that: “the results of the present overview showed that all these BSBs can be used with success in maxillary sinus augmentation procedures presenting good biocompatibility and osteoconductive properties, with osteoblastic cells forming bone directly in contact with the material surface and without histological signs of adverse reactions. Most of these biomaterials seem to be gradually resorbed, and partially replaced by newly formed bone.”
LATERAL ACCESS SINUS LIFT

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M Esposito1
R Davò2
C Marti-Pages3
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DR Ippolito6
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ORIGINAL ARTICLE
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ABSTRACT

The presence of insufficient bone volume can limit dental implants placement and so several bone augmentation procedures with different grafting materials have been developed, in order to allow a correct implant anchorage. In case of severely atrophic maxillae, zygomatic implants can be an alternative to conventional bone augmentation and implant rehabilitation. The aim of this randomised controlled trial (RCT) of parallel group design was to compare the clinical outcome of immediately loaded cross-arch maxillary prostheses supported by zygomatic implants vs conventional implants placed in augmented bone. Patients with totally edentulous atrophic maxillae were randomly allocated to bone augmentation with a bone substitute and six to eight conventionally loaded dental implants (augmentation group) or four zygomatic implants, or two zygomatic and two conventional implants to be immediately loaded (zygomatic group). In the augmentation group, collagenated blocks (OsteoBiol® Sp-Block, Tecnoss®, Giaveno, Italy) of equine cancellous bone were used as onlays/veneers. The blocks were hydrated before use for 5 to 10 min with sterile, lukewarm physiological solution or with antibiotics. Afterwards, they were modelled to be adapted to the receiving site. To fill the gaps between the recipient bone and the bone blocks, OsteoBiol® mp3® bone substitute granules were used. Small defects could only be grafted with bone substitute granules according to clinical indications and the surgeon’s preference. Nasal sinus lift procedures using OsteoBiol® mp3® bone substitute granules could also be implemented. All the grafted areas and the maxillary windows were covered with OsteoBiol® Evolution resorbable barriers from equine pericardium. After implant insertion, the surgeon was allowed to cover exposed implant threads using a paste made of 600 micron to 1000 micron pre-hydrated collagenated cortico-cancellous granules of porcine origin, mixed with OsteoBiol® Gel 0 in sterile syringe (OsteoBiol® mp3®, 1 cc, Tecnoss®) and resorbable collagen barriers (OsteoBiol® Evolution, Tecnoss®). Patients were followed up to 4 months after loading, in order to measure outcomes related to prosthesis, implant and augmentation failures, any complications, quality of life (OHIP-14), the number of days that patients experienced total or partial impaired activity, time to function, and number of dental visits. No augmentation procedure failed. Preliminary 4-months post-loading data suggest that zygomatic implants were associated with statistically significantly less prosthetic and implant failures, as well as time needed to functional loading when compared with augmentation procedures and conventionally loaded dental implants. More complications were reported for zygomatic implants, which were solved spontaneously or could be handled.

CONCLUSIONS

Keeping in mind that placement of zygomatic implants is a complex procedure requiring skilled and experienced operators, zygomatic implants proved to be a better rehabilitation modality for severely atrophic maxillae. Anyway, long-term data are essential to confirm or dispute these preliminary results.

Abstract author: Cristina Rodighiero, dental journalist, free publication, not for resale. Printed by Tecnoss® Dental s.r.l.
Immediately loaded zygomatic implants vs conventional dental implants in augmented atrophic maxillae: 1-year post-loading results from a multicentre randomised controlled trial

ABSTRACT

The presence of insufficient bone volume can limit dental implants placement and so several bone augmentation procedures with different grafting materials have been developed in order to allow a correct implant anchorage. In case of severely atrophic maxillae, zygomatic implants can be an alternative to conventional bone augmentation and implant rehabilitation. The aim of this randomised controlled trial (RCT) of parallel group design was to compare the clinical outcome of immediately loaded cross-arch maxillary prostheses supported by zygomatic implants vs conventional implants placed in augmented bone. Patients with totally edentulous atrophic maxillae were randomly allocated to bone augmentation with a bone substitute and six to eight conventionally loaded dental implants (augmentation group), or to receive four zygomatic implants, or two zygomatic and two conventional implants to be immediately loaded (zygomatic group). In the augmentation group, collagenated blocks (OsteoBiol® Sp-Block, Tecnoss®, Giaveno, Italy) of equine cancellous bone were used as onlays. To fill the gaps between the recipient bone and the bone blocks, OsteoBiol® mp3® bone substitute granules were used. All the grafted areas and the maxillary windows were covered with OsteoBiol® Evolution resorbable barriers from equine pericardium. After implant insertion, the surgeon was allowed to cover exposed implant threads using (OsteoBiol® mp3®, Tecnoss®) and resorbable collagen barriers (OsteoBiol® Evolution, Tecnoss®). Patients were followed up to 1 year after loading. No augmentation procedure failed. Five patients dropped out from the augmentation group. Six prostheses could not be delivered or failed in the augmentation group vs one prosthesis in the zygomatic group, with a statistically significant difference. Eight patients lost 35 implants in the augmentation group vs two patients who lost four zygomatic implants, with a statistically significant difference. A total of 14 augmented patients were affected by 22 complications vs 28 zygomatic patients (40 complications), the difference being statistically significant. Both groups had significantly improved quality of life (OHIP-14) scores.

CONCLUSIONS

Based on the results, Authors concluded that “preliminary 1-year post-loading data suggest that immediately loaded zygomatic implants were associated with statistically significantly fewer prosthetic failures (one vs six patients), implant failures (two vs eight patients) and time needed to functional loading (1.3 days vs 444.3 days) when compared to augmentation procedures and conventionally loaded dental implants. Even if more complications were reported for zygomatic implants, they proved to be a better rehabilitation modality for severely atrophic maxillae. Long-term data are absolutely needed to confirm or dispute these preliminary results”.  

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BONE SUBSTITUTES
OsteoBiol® mp3®
OsteoBiol® Sp-Block
MEMBRANE
OsteoBiol® Evolution
Short (6-mm) dental implants versus sinus floor elevation and placement of longer (≥10-mm) dental implants: randomized controlled trial with a 3-year follow-up

ABSTRACT
Edentulous posterior maxilla is often characterized by reduced bone volume, especially due to severe post-extraction alveolar crest resorption, and this anatomic limitation can jeopardize osseointegration and therefore the possibility to have a functional and aesthetic implant-supported restoration. In order to obtain a sufficient bone height for implant insertion, a reconstructive bone surgery is often needed and maxillary sinus floor elevation has become the more reliable and commonly used procedure. As the use of short implant (6-mm) can be an alternative to sinus floor elevation, the aim of this 3-year follow-up randomized clinical trial was to investigate this alternative to sinus floor elevation (SFE) and placement of longer (≥10-mm) implants in the posterior maxilla. Thirty-three patients were included in the study and randomly assigned either to receive one to four short (6-mm) implants (test group) or to undergo augmentation procedures and simultaneous placement of one to four standard-length (≥10-mm) implants (control group). In both groups, tapered implants (AnyRidge, MegaGen, Gyeongbuk, South Korea) were placed. In the control group, the augmentation procedures consisted in the insertion of collagenated porcine particulate bone graft (OsteoBiol® Gen-Os®, Tecnoss®, Giaveno, Italy) in a lateral window below the lifted membrane, with simultaneous implant placement. The primary outcomes of the study were implant survival, stability, marginal bone loss, and complications associated with the two treatment options; secondary outcomes included treatment time and cost and patient satisfaction. At 3 years, implant survival rates were 100% and 95.0% for test group and control group, respectively, with a difference that was not statistically significant. The mean ISQ values of both groups did not differ at placement (68.2 vs. 67.8, P = 0.1), at delivery of the final restoration (69.5 vs. 69.4, P = 0.9), and after 1 year (71.0 vs. 71.5, P = 0.1). At the 3 years follow-up, the mean ISQ in the control group was significantly higher than that of the test group (72.4 vs. 71.6, P = 0.004). Mean MBL was significantly higher in the control group both at 1 year (0.14 mm vs. 0.21 mm, P = 0.006) and at 3 years (0.20 mm vs. 0.27 mm, P = 0.01). Surgical time and cost were significantly higher in the control group than in the test one and patient satisfaction was high in both groups.

CONCLUSIONS
In the present randomized clinical trial, both short (6-mm) implants and long (≥10-mm) implants in combination with sinus floor elevation provided good results up to 3 years after loading; however, with 6-mm short implants, the treatment was faster and less expensive. Anyway, in order to confirm these results, long-term randomized controlled trials on larger samples of patients are needed.
Management of acute maxillary sinusitis after sinus bone grafting procedures with simultaneous dental implants placement – a retrospective study

ABSTRACT

The complications of sinus lift procedure are considered to be low and are represented by acute maxillary sinusitis, wound dehiscence, and Schneiderian membrane perforations with consecutive spilling of the grafting material in the sinus cavity. In this study, the Authors aimed to evaluate the incidence of acute maxillary sinusitis in case of lateral window sinus lift with simultaneous implant insertion. Between 2013 and 2015, 116 patients received 245 dental implants with concomitant bone augmentation of the maxillary sinus floor. The sinus lifting procedure was bilateral in 35 patients and unilateral in 81 patients (a total of 151 sinuses). Depending on the volume that was required to be augmented, the grafting material used was a mix of xenograft (Cerabone®, Botiss biomaterials GmbH, Gerlingen, Germany or OsteoBiol® Gen-Os®, Tecnoss®, Giaveno, Italy) and autologous bone chips, human allograft (Maxgraft®, Botiss biomaterials GmbH) with autologous bone chips, a mix of xenograft and allograft or alloplastic grafting material (Maxresorb®, Botiss biomaterials GmbH). Based on the patients’ preferences, dental implants used were either MIS (Medical Implant System, MIS Implant Technologies Ltd, Shlomi, Israel) or Megagen (MegaGen, Gyeongsan, Daegu, South Korea), with diameters varying from 3.75 to 5.5 mm and length varying from 10 to 13 mm. Maxillary sinusitis occurred in 5 patients (4.3 %), with headache, locoregional pain, cacosmia, inflammation of the oral buccal mucosa and rhinorrhea or unilateral nasal discharge. To solve the sinusitis, in 3 patients the grafting material was removed, in 1 patient the grafting material was removed together with all the implants, and in 1 patient only 2 implants and the grafting material were removed, leaving 1 implant in place. The sinus cavity was irrigated with metronidazole solution and antibiotic therapy with clindamycin and metronidazole was prescribed for 10 days. Following this treatment, all signs of infection disappeared within 5 to 7 days and normal sinus function and drainage were restored.

CONCLUSIONS

In case of acute sinusitis, this complication has to be managed immediately to avoid further complications like pansinusitis, osteomyelitis of the maxillary bone, or the spreading of the infection in the infratemporal space or orbital cavity. During all the steps of the procedure, it is mandatory to pay attention not to obliterate the ostium, impairing maxillary sinus clearance.
Influence of the position of the antrostomy in sinus floor elevation assessed with cone-beam computed tomography: a randomized clinical trial

ABSTRACT

Augmentation procedures in the distal regions of the edentulous maxilla are necessary in order to allow implant rehabilitation. The aim of the present study was to evaluate dimensional variations of augmented sinus volumes after sinus floor elevation using a lateral approach placing the antrostomy close to the sinus floor or more cranially to it. For the purpose of the study, 24 healthy volunteers, presenting an edentulous atrophic zone in the posterior segment of the maxilla requiring sinus floor elevation and a fixed oral rehabilitation, were recruited. The lateral approach was adopted placing the antrostomy randomly either close to the level of the sinus floor (group A) or approximately 3-4 mm cranially (group B). After the window preparation and the sinus mucosa elevation, the elevated space was filled with a resorbable collagenated cortico-cancellous porcine bone (250–1000 µm; OsteoBiol® Gen-Os®, Tecnoss®, Giaveno, Italy). A collagen membrane (0,3 mm; OsteoBiol® Evolution, Tecnoss®) was placed to cover the access window, and silk sutures were provided to secure the flaps. Cone-beam computed tomography (CBCT) was done before surgery (T0) and after 1 week (T1) and 9 months (T2) in order to analyse the dimensional variations. At T1, the sinus floor was found to be elevated by 9.8 ± 2.1 mm in group A and 10.9 ± 1.9 mm in group B. At T2, shrinkage of 2.0 ± 1.7 mm in group A and 1.4 ± 2.5 mm in group B was observed. The area was reduced approximately 18-24% between T1 and T2. The sinus mucosa width increased by 4.3-5 mm between T0 and T1, and regained the original dimensions at T2.

CONCLUSIONS

As demonstrated in the present study, following the lateral approach for maxillary sinus floor elevation, the volume of the augmentation seems to be dependent on the location of the access antrostomy. After 9 months, it was evident that the more cranial the antrostomy, the greater the augmentation height.
Sinus membrane elevation with heterologous cortical lamina: a randomized study of a new surgical technique for maxillary sinus floor augmentation without bone graft

ABSTRACT

In case of edentulism in atrophic posterior maxilla, different surgical techniques have been proposed in order to have a sufficient bone volume for implant supported rehabilitation. Together with the surgical techniques, the use of allografts, xenografts and alloplasts has been reported in the literature to help bone formation, thanks to their osteoinductive, osteoconductive and osteogenic properties. The aim of this randomized controlled clinical trial was to compare the efficacy of two different techniques for maxillary sinus augmentation using a lateral window approach: heterologous cortical lamina without any grafting material versus 100% collagenated granular collagenated porcine bone. Twenty-three patients, requiring maxillary sinus augmentation, were divided in two groups. In Group I, the sinus was filled with collagen porcine bone (OsteoBiol® Gen-Os®, Tecnoss®, Giaveno, Italy) and a collagen membrane (OsteoBiol® Evolution, Tecnoss®) was used to close the lateral window of the sinus. In Group II, the sinus was treated with heterologous cortical lamina only (OsteoBiol® Lamina, Tecnoss®) of 1 mm thickness, modelled and positioned in the sinus as a new sinus roof. Radiographically, in Group I bone grafts showed increased hyperdensity between immediate postoperative and after six months healing, with higher density than native bone. In the second surgical phase, the sinus wall was found to be totally healed in all cases. No gaps were present at the bone–porcine bone interface that was always in close contact with the graft particles. In the cortical lamina group, newly formed bone was present histologically, newly formed vessels and new bone trabeculae were seen throughout the large marrow spaces. The histological results showed new bone formation in both groups. There was a statistically significant difference in the surgical time required to complete the augmentation procedures: 18.3 ± 2.1 min for lamina treated sites versus 12.5 ± 3.1 min for porcine bone treated sites.

CONCLUSIONS

This study has reported good results of sinus membrane elevation, with or without bone graft. Even if sinus treated with bone lamina showed a greater volumetric contraction, the overall results led the Authors to conclude that “the use of heterologous cortical lamina is a valid technique for the mechanical support of sinus membranes resulting in only bone tissue formation and not mixed with the graft. The graft material was biocompatible and not completely resorbed after six months, although the remains were integrated into the bone”.

Grafted with
BONE SUBSTITUTES
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MEMBRANE
OsteoBiol® Evolution
OsteoBiol® Lamina
Periodontal regeneration

OsteoBiol®
by Tecnoss
Healing of gingival recessions using a collagen membrane with a demineralized xenograft: a randomized controlled clinical trial

ABSTRACT

Gingival recessions commonly associated with compromised esthetics, root hypersensitivity, higher incidence of root caries, and compromised plaque control and their treatment is performed via so-called mucogingival therapy. In order to promote the root coverage, it is possible to adopt the principles of guided tissue regeneration (GTR). As a variety of non-resorbable and absorbable barrier membranes has been used with clinical outcomes similar to those achieved by traditional procedures, the aim of this study was to compare the efficacy of two surgical techniques: coronally advanced flap (CAF) alone or in combination with the use of an absorbable membrane plus a demineralized xenograft (GTRF) for the treatment of gingival recession in a prospective randomized controlled clinical trial.

16 nonsmokers with 20 Miller Class I or Class Il buccal gingival recessions at canines or premolars were included in the study. 10 defects were randomly assigned by coin toss to be treated by a CAF only (control sites), and the remaining 10 defects were treated by the GTRF method (test sites). The barrier device used was a collagen membrane (OsteoBiol® Evolution, Tecnoss®, Giaveno, Italy) and the bone substitute used was a demineralized xenograft (OsteoBiol® Gel 40, Tecnoss®).

The results following both procedures appeared equivalent, providing good root coverage, gain in clinical attachment levels, healthy nonbleeding sulcus and increase of keratinized tissue.

CONCLUSIONS

Even if both treatments resulted in a significant reduction of recession and gain in clinical attachment level, the Authors found that the increase in keratinized tissue from baseline to 6 months was slightly greater for the GTRF group than for the CAF group and the test group experienced a statistically significant increase in gingival thickness (+0.71±0.21 mm) from baseline to the 6-month evaluation. Consequently, the Authors concluded that “both procedures offer a predictable, simple, and convenient means of root coverage in Miller Class I and II recession defects, but the GTRF-supported procedure resulted in more keratinized tissue and a significant increase in gingival thickness than the CAF-only approach”. 
Porcine dermal matrix for covering of recession type defects: a case series

ABSTRACT

The aim of the Authors was to study the clinical applicability of porcine dermal matrix for treatment of recession type defects. In order to do this, twenty-eight gingival recessions in six patients were selected for root coverage procedures using a modified tunneling technique and porcine dermal matrix (PDM). In this observational trial, one specialized clinician performed recession coverage using modified tunneling techniques: the buccal gingiva was undermined in a split-thickness fashion, the interproximal buccal soft tissues were elevated, and PDM (OsteoBiol® Derma, Tecnoss®, Giaveno, Italy) was trimmed to size, hydrated in sterile saline for 3 to 5 minutes, pulled into the tunnel and fixed in position by anchoring sutures. Healing was uneventful for all 28 covered defects, without any PDM exposure at any time. Depth and width of gingival recession were assessed at baseline and at 6 and 12 months postoperatively and the mean root coverage was 65.52% and 56.82% respectively and the complete root coverage was achieved in 42.86% of the treated defects.

CONCLUSIONS

The results of this study demonstrate that porcine dermal matrix can potentially be used as a replacement material for autologous tissue in case of recession defects. The Authors underline that a randomized controlled clinical study is needed to prove its potential and the long-term reaction following root coverage.
The effectiveness of a resorbable bone substitute with a resorbable membrane in the treatment of periodontal infrabony defect - a multicenter randomised controlled trial

ABSTRACT

In order to regenerate the function and aesthetics of lost periodontal tissues following a periodontal disease, the use of guided tissue regeneration (GTR), bone grafting and enamel matrix derivatives (Emdogain) has been suggested. However, in the literature it has been reported that GTR and Emdogain alone for the treatment of infrabony defects seem to be not so effective; on the contrary, it has been suggested that the use of bone grafts seems to be more promising. Based on the consideration that there is a need of a deeper evaluation of the use of bone grafts in such clinical situations, the Authors conducted a multicenter RCT with the aim to evaluate the efficacy of a bone substitute represented by a mix of cancellous and cortical porcine-derived bone, with a granulometry of 250 to 1000 µm (OsteoBiol® Gen-Os®, Tecnoss®, Giaveno, Italy) with a resorbable collagen barrier derived from equine pericardium (Fine 30 x 30 mm; OsteoBiol® Evolution, Tecnoss®) versus an identical open flap debridement intervention for the treatment of deep infrabony defects.

Of the 97 patients with infrabony defects included in this trial, 49 patients were randomly allocated to the BG group (grafting with a bone substitute covered with a resorbable barrier) and 48 to the OFD group (open flap debridement), according to a parallel group design in five European centres. Infrabony defects of the patients allocated to the BG group were overfilled with loosely packed granules of OsteoBiol® Gen-Os® (Tecnoss®) and the grafted area was completely covered with a resorbable collagen membrane derived from equine pericardium (OsteoBiol® Evolution, Tecnoss®).

Both bone grafting and open flap debridement lead to improvements in periodontal conditions but the use of a bone substitute in conjunction with a collagen resorbable membrane yielded significantly better statistical results. The BG group obtained significantly greater statistical PAL gain (mean difference = -0.8 mm, 95% CI [-1.51; -0.03], P = 0.0428), PPD reduction (mean difference = -1.1 mm, 95% CI [-1.84; -0.19], P = 0.0165) and RAD gain (mean difference = -1.2 mm, 95% CI [-2.0; -0.4], P = 0.0058) compared to the OFD group.

CONCLUSIONS

Based on the results, the Authors concluded that “the use of a bone substitute covered with a resorbable membrane yielded significantly better statistical clinical outcomes than open flap debridement in the treatment of periodontal infrabony defects deeper than 3 mm, with regard to PAL gain, PPD reduction and RAD gain”. With reference to conflict of interest, the Authors stated that this trial was partially funded by Tecnoss®, however “data belonged to the authors and by no means did the manufacturer interfere with the conduct of the trial or the publication of the results”.

Abstract author: Cristina Rodighiero, dental journalist, free publication, not for resale. Printed by Tecnoss® Dental s.r.l.
Horizontal augmentation

OsteoBiol®
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REGENERATION SCIENCE
INSPIRED BY NATURE
Maxillary alveolar ridge reconstruction with nonvascularized autogenous block bone: clinical results

ABSTRACT

Implant treatment of severely resorbed maxillas is considered a demanding procedure, characterized by a higher failure rate compared with the implant treatment of patients with adequate bone volume. In this study, 56 patients (18 men, 38 women) aged 27 to 63 years, requiring a treatment for maxillary atrophy, were selected and scheduled for onlay bone graft and titanium implants in a 2-stage procedure, with the purpose to evaluate the clinical success of bone reconstruction of the severely atrophic maxilla using autogenous bone harvested from the antero-superior edge of iliac wing. Moreover, the Authors analyzed the clinical success and the marginal bone level of dental implants placed 4 to 5 months after bone grafting and before prosthetic rehabilitation. A total of 129 onlay bone grafts were used to augment the 56 severely resorbed maxillas. The cortico-cancellous blocks harvested from the iliac wing were adapted to the atrophic maxilla and attached to the residual ridge with self-tapping screws (Cizeta, Milano, Italy). An additional mixture of cortico-cancellous porcine bone particle and collagen (OsteoBiol® mp3®, Tecnoss®, Giaveno, Italy) was placed at the periphery of the block grafts. The augmentation procedure allowed the insertion of implants in the grafted area 4 to 5 months after surgery. The clinical and radiographic observations showed a satisfactory success rate rate (96,8%) of the block and a very low rate of resorption after bone graft and implant placement.

CONCLUSIONS

The use of iliac bone grafts, harvested from the antero-superior edge of iliac wing, for the reconstruction of severely atrophic maxillas, combined with the supplementary use of a mixture of cortico-cancellous porcine bone particle and collagen, showed to be a reliable treatment procedure.
A modified edentulous ridge expansion (MERE) technique for immediate placement of implants. A case report

ABSTRACT

In this article the Authors present a case report of a 43-year-old female patient affected by edentulism associated to horizontal resorption of the ridge, in order to describe a new technique, called MERE Technique, which gives to the clinician the possibility of treating atrophic ridge with a reduced number of surgical procedures and a reduced healing time. Recently, this technique has been modified by Coatoam and Mariotti with a segmental ridge-split procedure that includes an orthodontic ligature wire for stability of the bony plates.

In treating this case, the Authors applied a further modification of the segmental ridge-split procedure, including the use of connective tissue graft as a biologic barrier to cover an immediate implant for improved hard and soft tissue regeneration.

The MERE technique was performed in different steps. After the flap design, the sagittal osteotomy and the osteotomes technique, the Authors proceeded with the implant placement, followed by the grafting of a mix of cancellous and cortical porcine bone (OsteoBiol® Putty, Tecnoss®, Giaveno, Italy) in order to close the gap between the bone plates. Before suturing, an autogenous connective tissue graft was layered over the bony wound in order to achieve augmentation of the keratinized mucosa and avoid bone graft infection. Postoperative recovery was uneventful.

CONCLUSIONS

The MERE technique allows to achieve regeneration of soft and hard tissues in the treated site. This approach lies in restoring proper placement and continuity to the mucogingival junction, increasing the quantity of keratinized tissue, and deepening the fornix. The Authors concluded that “within the limits of this case report, this technique appeared to be reliable and simple, reduced morbidity as compared with other techniques such as autogenous bone grafts and guided bone regeneration”.

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The Bone Lamina Technique: a novel approach for lateral ridge augmentation - a case series

ABSTRACT

Even if nowadays dental implants are considered a successful option for the treatment of edentulousness, resorption of the alveolar ridge is still a concern as it may interfere with optimal three dimensional implant placement. In order to overcome this problem, different guided bone regeneration (GBR) technique have been suggested. As collagen membranes and nonresorbable membranes reinforced with titanium both present some drawbacks, in this case series the Authors present a different treatment approach for lateral ridge augmentation, called “Bone Lamina Technique”. This technique uses a xenogenic cortical bone shield in combination with particulated bone substitutes and a thin collagen barrier, resulting in a biocompatible and mechanically stable concept for space maintenance and blood clot protection.

Four systemically healthy patients (aged 48 to 59 years) with inadequate dental alveolar ridge widths were selected for inclusion. All ridge defects were augmented using a xenogenic cortical bone shield (OsteoBiol® Lamina, Tecnoss®, Giaveno, Italy) in combination with a particulated bone substitute (OsteoBiol® mp3®, Tecnoss®) and a thin collagen barrier (OsteoBiol® Evolution, Tecnoss®) positioned on top of the bone Lamina. At re-entry surgery, biopsy specimens were harvested for histologic analysis and the results revealed a sufficient amount of bone structure for implant placement without additional augmentation procedures.

CONCLUSIONS

After the GBR, in all cases it was possible to place one or two implants without the need for additional augmentation procedures. Postoperative healing was uneventful, and clinically healthy mucosa without signs of infection covered the defect after 5 to 6 days. The Authors affirmed in their conclusions “this case series inaugurated a novel clinical approach for lateral ridge augmentation, the Bone Lamina Technique. Re-entry surgery revealed that sufficient amount of bone was achieved in all treated cases and implants could be placed without an additional augmentation procedure. Histology revealed osteoconductive properties of the material and also indicated that resorption of the cortical Lamina had taken place. Therefore, this approach may have the potential to act as a biologic and stable barrier technique for augmentation procedures”.

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Vertical splitting of the mandibular body as an alternative to inferior alveolar nerve lateralization

ABSTRACT

The inferior alveolar nerve lateralization (IANL) technique allows placement of longer implants, gives better initial stabilization and reduces the treatment time, but nerve repositioning is a complex procedure, with a high risk of complications. This is why, in this article, the Authors present the vertical ridge-splitting technique as an alternative to IANL in order to allow the placement of longer implants for the rehabilitation of severely atrophic posterior mandibles. The ridge-splitting/expansion technique consists in the creation of a new implant bed by longitudinal osteotomy of the alveolar bone. The buccal cortex is repositioned laterally by green stick fracture and the technique is usually performed simultaneously with implant placement and significantly shortens the treatment time.

In this study, 143 patients, who had between 1.8 and 8 mm residual crestal height above the mandibular canal, were treated with the vertical splitting of the mandibular body, performed by piezoelectric surgery, followed by bone expansion and insertion of conical implants of 10 and/or 12 mm in length. The survival rate of the 636 implants inserted was of 99% at the end of 12 months, with minor complications.

As in one osteotomy the buccal cortical bone was fractured while screwing the implant, this was treated by creating perforations in the cortical bone for mechanical retention of the cortico-cancellous bone block (OsteoBiol® Dual-Block, Tecnoss®, Giaveno, Italy). Then, the site was covered by a collagen membrane (OsteoBiol® Evolution), with an uneventful healing.

CONCLUSIONS

The vertical ridge-splitting technique is a relatively simple procedure for the prosthetic rehabilitation of severely resorbed posterior mandibles. It can be performed in case of minimal bone height, allowing for greater implant stability, and minimizing the risk of neurological disturbance.

In one case treated in this study, it has been necessary to insert a cortico-cancellous bone block, covered by a collagen membrane which proved to support the proper healing.
Expansion of the alveolar bone crest with ultrasonic surgery device: clinical study in mandible

ABSTRACT

It is well known that after a tooth extraction the consequent horizontal bone resorption makes difficult to perform an ideal implant placement. In particular, the presence of atrophic alveolar crests measuring less than 3 mm in width puts much more limitations to the placement of implants, making the complementary use of bone grafts necessary.

In this study, the Authors show the application of the split-crest mandibular procedure in two stage in order to avoid the cortical bone resorption of the alveolar crest.

Twenty-two healthy patients were included in this study and subjected to a sagittal corticotomy in the coronal area of the alveolar crest and a second sagittal corticotomy, but in a lower (basal) position and two vertical corticotomies in the buccal wall, using an ultrasonic surgery device (Surgisonic, Esacrom, Imola, Italy). After a proper crest expansion by means of a combination of scalpel, thin chisels and threaded osteotomes (Bone System, Milano, Italy), two submerged implants (Bone System, Milano, Italy) were placed in the premolar and molar area. The gap within the sockets was filled by particles of cortico-cancellous porcine bone (Gen-Os®, OsteoBiol®, Tecnoss®, Giaveno, Italy). Postoperative results were assessed by panoramic and periapical radiographs.

CONCLUSIONS

The postoperative course was uneventful in twenty-one of the twenty-two patients. Three months after implants insertion, ossification of the osteotomy lines was evident, with a mean horizontal bone increase in coronal area of 5±3 mm. No dehiscence of the mucosa was observed and the mucosa on the lingual and buccal side over the augmentation sites appeared unaffected in all patients.

The conclusion of the Authors is that “mandibular ridge expansion using a split-crest technique that included grafting the implant sites with a ultrasonic surgery device is a viable therapeutic alternative for implant placement in this patient population”.

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Delayed expansion of the atrophic mandible by ultrasonic surgery: a clinical and histologic case series

ABSTRACT

In this paper the Authors present a human case series with clinical and histologic results about delayed expansion of mandibles by ultrasonic surgery. 32 patients with residual alveolar ridge width between 2.3 and 4.1 mm in the coronal area of the posterior mandible were included in the study in order to be subjected to the intended ridge expansion treatment. After achieving a proper bone expansion, two submerged implants (Bone System) per ridge were inserted in the premolar and molar areas, meanwhile the gaps were filled with cortico-cancellous porcine biomaterial (OsteoBiol® Gen-Os®, Tecnoss®, Giaveno, Italy). Three months after implant placement, bone cores were harvested from the regenerated areas for histologic analysis and a histomorphometric analysis was performed in order to determine the percentages of newly formed bone, grafted material and marrow spaces.

At three months, the implant success rate was 96.88% and the mean increase in ridge width was 5.17 ± 0.86 mm. Clinically, the intercortical bony gap seemed to be filled with newly formed bone. The histologic specimens showed a mixture of new bone and particles of biomaterial and the histomorphometric analysis showed 64 ± 3.1% of the specimen was composed of newly formed bone, 8 ± 0.8% was made up of marrow spaces, and 27 ± 2.6% comprised the residual grafted biomaterial.

CONCLUSIONS

Even if further long-term studies are needed to evaluate the findings of this study, it is possible to conclude that mandibular ridge expansion using a delayed split-crest technique by means of ultrasonic surgery and association with a biomaterial can be helpful in setting the adequate environment for implant placement.
Regeneration of atrophic crestal ridges with resorbable lamina: technical note

ABSTRACT

Block grafts, both autologous and heterologous, and titanium grids are frequently used in surgical procedure aiming to increase the mandibular bone base, both horizontally and vertically, for implant purposes in atrophic distal ridges. In case of autologous block grafts, it is necessary to perform one operation in a donor site and a second one in the recipient size, with a considerable discomfort for the patient. Heterologous block grafts do not need two operations, but they do need the use of synthetic screws and pins for their fixation. Titanium grids are manageable with difficulties in the event of exposure and are removed with difficulty. In this work, a technique is proposed for the reconstruction of vertical and horizontal atrophic ridges with the use of a resorbable biomaterial of porcine origin, the cortical lamina, together with the collagenated and pre-hydrated granules and resorbable membranes of mesenchymal tissue (OsteoBiol® Lamina, OsteoBiol® mp3®, OsteoBiol® Evolution, Tecnoss®, Giaveno, Italy). Ten patients, 3 males and 7 females, aged between 30 and 58 years, received a procedure of mandibular bone regeneration of atrophic ridges, with the insertion of a total of 16 implants. The implants were stabilized on the basal bone, leaving a gap between the lamina and the surface of the implant itself so that it could be filled with osteoconductive biomaterial. A collagen membrane was used to slow resorption (OsteoBiol® Evolution, Tecnoss®) and to occlusally cover the defect. After 6 months, it was possible to see newly formed bone around the implants, and the complete integration of the previously inserted lamina.

CONCLUSIONS

The results demonstrated that the use of porcine cortical laminae with a thickness of 0.9 mm allows for the creation of a rigid moldable box, in which it is possible to use collagenated and granulated fillers that can be easily reached by blood vessels and transformed into bone in order to act as a support for the implant load. It has been demonstrated the good vascularization of the graft combined with the integration of the lamina, which does not need to be removed. Consequently, the Authors concluded “our results allow us to propose this technique as a potential alternative to those used to date”.

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The use of a collagenated porcine cortical lamina in the reconstruction of alveolar ridge defects. A clinical and histological study

ABSTRACT

In case of hard tissue volume lack, the use of resorbable and non-resorbable membranes has been proposed in order to allow a proper alveolar ridge reconstruction. After the evaluation of the clinical advantages and disadvantages of different biomaterials normally used for this purpose, the Authors suggest that the use of a collagenated porcine cortical barrier seems to have relevant clinical advantages, including: the long-term stability of the membrane; its plastic consistency, well suited for the vertical reconstruction; the absence of a second re-entry surgery for its removal; the quality of integration with the native bone and the appositional graft; the second intention healing with keratinized mucosa in case of exposure and the poor presence of connective tissue over the regenerated bone.

The present pilot study included 8 partially edentulous patients (6 females and 2 males, mean age: 45 years) requiring bone regeneration procedures to achieve a prosthetically driven implant placement, with the aim to clinically and histologically evaluate the use of a collagenated porcine bone lamina in case of lateral and vertical bone augmentation procedures, in conjunction with porcine-derived bone particles. The bone graft consisted of a porcine-derived collagenated bone (OsteoBiol® mp3®, Tecnoss®, Giaveno, Italy) whereas the membrane consisted of a porcine-derived collagenated cortico-cancellous shield (OsteoBiol® Curved Lamina, Tecnoss®). The membrane is a soft cortical lamina derived from cortical porcine bone, with a plastic consistency, and can be shaped with sterile scissors to reach the desired size, and adapted to completely cover the grafting site.

The histological examination showed porcine bone to have osteoconductive properties, with the presence of new bone on the surface of the porcine bone particles. The Authors also found evidences of osteoclastic resorption, with no signs of foreign body reaction. Further, at the coronal part of the defect, a well vascularized connective tissue was found and this might suggest a certain porosity of the membrane, which allows vascular cells ingrowth and new vessels formation, attesting the biocompatibility of the shield.

CONCLUSIONS

The present study showed good clinical results when using a porcine bone substitute and a collagenated cortical lamina for the augmentation of the alveolar crest. A curved bone lamina was employed, with the clinical advantage of its adaptation to the alveolar crest, guaranteeing an optimal contour of the regenerated bone.

As the Authors stated in their conclusion: “It may be assumed that the combination of a slowly resorbing cortical bone shield facing the inside of the defect and a biocompatible and tissue friendly collagenated membrane facing the outside could have the potential to simplify the achievement of the desired results without depending from operator skills”.

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The use of resorbable heterologous Cortical Lamina and micrized collagenated bone in the regeneration of atrophic crestal ridges: a surgical technique. Case series

ABSTRACT

In case of dental implants placement for prosthetic purposes in areas with severe atrophy, it is necessary to regenerate the ridges in order to have a good-quality bone to support the implants. To obtain the necessary pre-implant bone regeneration, several grafting techniques are available. An indispensable prerequisite is the stability of the biomaterial in situ, to be reabsorbed and substituted by new bone. Some graft materials, such as micrized and collagenated porcine bone, have an excellent capacity to be reabsorbed, but do not have the mechanical characteristics that would allow for stability in terms of shape and size. Consequently, it is necessary to adopt a proper technique, able to maintain such biomaterial stable in situ, without micromovements, for about six months. In this article, the Authors propose a technique for the reconstruction of vertical and horizontal atrophic ridges with the use of resorbable biomaterials of porcine origin: cortical lamina in connection with micrized collagenated bone paste and a resorbable membrane of mesenchymal tissue (OsteoBiol® Lamina and OsteoBiol® Putty, Tecnoss®, Giaveno, Italy). In this technique, the use of porcine cortical Lamina with a thickness of 1 mm allows the creation of a semi-rigid moldable “container” in which a collagenated micrized heterologous bone paste can be put as a filler. This kind of biomaterial is easily accessible by blood vessels and is transformed into bone, to provide a stable support for the implant placement.

CONCLUSIONS

As during the post-operative check-up newly formed bone around the implants was observed, as well as the complete integration of the inserted Lamina, in their conclusions the Authors affirm: “In our experience, it is possible to propose this technique as an alternative to those previously and currently in use. Additional clinical and histological scientific studies are needed to evaluate the effectiveness of the technique and further develop its potential”.

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Vertical augmentation

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REGENERATION SCIENCE

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Vertical ridge augmentation of atrophic posterior mandible using an inlay technique with a xenograft without miniscrews and miniplates: case series

ABSTRACT

Even if the rehabilitation of partially or totally edentulous posterior mandible with implant supported prosthesis has become a common practice, local conditions of the edentulous ridges may be unfavorable for implant placement and a vertical and horizontal augmentation may be necessary. In case of an horizontal osteotomy with the interposition of bone in the form of a “sandwich” to augment the alveolar ridge, it has been reported that the use of miniscrews and miniplates increases the risk of fracture of the osteotomy segments. The purpose of this study was to use an inlay technique, without the use of miniscrews and miniplates for stabilization of the transported bone fragments. 9 consecutive patients (6 men and 3 women) aged between 26 and 51 years were enrolled in this study. A horizontal osteotomy was performed 2-3 mm above the mandibular canal, and two oblique cuts were made using a piezosurgery device. As the patients refused the harvesting of autogenous bone, an inlay procedure was proposed using blocks of collagenated cancellous equine bone (OsteoBiol® Sp-Block, Tecnoss®, Giaveno, Italy) without miniscrews and miniplates. The blocks were inserted mesially and distally between the cranial osteotomized segment and the mandibular basal bone. The residual space was filled with particles of cortico-cancellous porcine bone (OsteoBiol® Gen-Os®, Tecnoss®). A resorbable collagen membrane (OsteoBiol® Evolution, Tecnoss®) was applied above the buccal surface of the surgical site.

4 months after surgery, the Authors proceeded with the implants insertion. The postoperative course was uneventful in 7 of the 9 patients. No dehiscence of the mucosa was observed at the marginal ridge of the mobilized fragment. Newly formed bone was present near the osteotomized segments, and was observed to be in close contact with the particles of biomaterials. No gaps or connective tissue were present at the bone-biomaterial interface. Histomorphometrical results showed: 44±2.1% newly formed bone, 18±0.8% marrow spaces, 33±2.4% residual grafted material.

CONCLUSIONS

From the results of this study, it is possible to suggest that the equine collagenated block can be considered as a good material for bone regeneration in inlay grafting procedures in atrophic posterior mandibles. As noted by the Authors, “the rigidity of the equine collagenated block allowed to eliminate the use of miniscrews and miniplates and simplified the technique. Besides, the rigidity of the block allowed maintenance of the space”.

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Vertical ridge augmentation of the atrophic posterior mandible with a 2-stage inlay technique: a case report

ABSTRACT

In case of atrophic posterior mandible, the application of the inlay technique showed to be able to achieve good augmentation results. Instead of using autogenous bone, some authors have suggested to use inorganic bovine bone blocks for inlay bone grafting in atrophic posterior mandibles, obtaining histological and clinical outcomes comparable to those achieved using autogenous bone.

In this article, the use of a 2-stage inlay technique in atrophic posterior mandible with more than 10-mm thickness and less than 5-mm height above the inferior alveolar nerve is described. The Authors performed an inlay procedure using a cancellous equine bone block (OsteoBiol® Sp-Block, Tecnoss®, Giaveno, Italy) in order to allow the subsequent implant placement for prosthetic rehabilitation of the affected region. The first surgical procedure was a basic corticotomy of the buccal and lingual bone. One month later, a complete inlay procedure was performed. The cancellous equine bone block graft material was shaped and placed between the cranial osteotomized segment and the mandibular basal bone and a resorbable collagen membrane (OsteoBiol® Evolution, Tecnoss®) was applied to the buccal surface of the surgical site.

CONCLUSIONS

After the inlay technique application, computed tomography and conventional radiography showed a mean vertical bone gain of 11,5 mm. This 2-stage inlay technique avoids the use of chisels to complete bone osteotomy and reduces postsurgical nerve disturbances in atrophic posterior mandibles.

The Authors concluded that “a randomized controlled clinical trial is necessary to compare outcomes using this modification of the inlay technique with those obtained using the original procedure.”
Vertical ridge augmentation of an atrophic posterior mandible with an inlay technique and cancellous equine bone block: a case report

ABSTRACT

In the augmentation of atrophic posterior mandible, the inlay technique proved to be reliable and successful. For this technique, both autogenous bone and xenografts are used with similar results. Nevertheless, the use of xenografts has been associated with some disadvantages, such as persistence of residual material due to their slow rate of resorption and the need of their stabilization by means of titanium bone plates and miniscrews. In order to overcome the postsurgical patient morbidity, researchers have examined new graft materials, for examples a cancellous equine bone graft that does not require miniplates or miniscrews, thereby avoiding the need for subsequent surgery to remove these components.

In this article, the Authors describe a successful implant prosthetic rehabilitation in an atrophic left posterior mandible in a 62 year old man using a cancellous equine bone block as grafting material. In order to allow subsequent implant placement for the prosthetic rehabilitation, an inlay procedure using a cancellous equine bone block (OsteoBiol® Sp-Block, Tecnoss®, Giaveno, Italy) was proposed. After the cancellous equine bone block graft material have been shaped and placed between the cranial osteotomized segment and the mandibular basal bone, a resorbable collagen membrane (OsteoBiol® Evolution, Tecnoss®) was applied to the buccal surface of the surgical site. As underlined by the Authors, “the block used in the present study was produced following a method that avoids a ceramic coating of hydroxyapatite crystals, thereby enhancing the speed of physiologic resorption. The presence of collagen makes these blocks more compact and less fragile than other commercial blocks, allowing them to be shaped and fixed without a high risk of breakage and placed without bone plate fixing. Furthermore, the presence of collagen promotes blood clotting and invasion of regenerative and reparative blood cells”.

CONCLUSIONS

The histological evaluation showed new bone formation within the cancellous portion of the blocks and no foreign body reaction and the computed tomography and conventional radiography showed a 5 mm mean vertical bone gain. The new bone was in intimate contact with the biomaterial at all sites; no empty space was observed between the bone and the biomaterial at high magnification. The vertical bone gain obtained allowed the surgeon to insert an implant of adequate length for a reliable fixed prosthetic rehabilitation.

Based on these results, the Authors concluded that “Cancellous equine bone grafts may be an effective alternative to autogenous bone and inorganic bovine bone grafting for reconstruction of the posterior mandible using the inlay technique”.

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Early volumetric changes after vertical augmentation of the atrophic posterior mandible with interpositional block graft versus onlay bone graft: a retrospective radiological study

ABSTRACT

When the residual height of the edentulous ridge in the posterior mandibles is not adequate to place implants, it is necessary to perform surgical augmentation treatments in order to gain a sufficient bone height for an implant placement in bone over the inferior alveolar nerve. Autologous bone grafting is considered the “gold standard” for bone augmentation techniques. However, the donor site morbidity, the increased operative time, the soft-tissue injuries and deficiencies in the quality and quantity of augmented available bone represent the disadvantages of this technique. The aim of the present study was to evaluate volumetric and clinical outcomes of atrophic posterior mandibles treated with xenogeneic bone material inlay and autologous bone onlay grafting techniques. 20 patients were retrospectively sorted into two groups: the inlay group, in which the atrophic posterior mandible was grafted with equine xenogeneic interpositional cancellous bone block (OsteoBiol® Sp-Block, Tecnoss®, Giaveno, Italy); the onlay group, in which the atrophic posterior mandible was onlay-grafted with autogenous bone block from the iliac crest. Bone volumes at baseline and at 4 months after surgery were measured by computed tomography scans. Peri-implant marginal bone loss at 1 year was also recorded. After surgery, the height index showed a mean vertical augmentation height of 6.0 mm in the inlay-group and of 7.4 mm in the onlay-group. With reference to loss of vertical bone height during the graft healing, it was registered in both groups, but with no significant differences between the two groups.

CONCLUSIONS

The success rate of the autogenous onlay blocks (82.4%) seemed to be lower than that recorded in patients who had undergone vertical augmentation with interpositional blocks of cancellous equine bone (93.8%); moreover, implants placed in onlay autogenous grafts showed greater bone loss than those inserted in inlay-augmented areas. Based on the results of this study, the Authors affirm that there is a significant role for the interpositional technique in cases of atrophic posterior mandible. In their opinion, “xenogeneic cancellous bone blocks grafted in a posterior mandible presenting vertical defects from 3 to 7 mm, performed with an interpositional technique, appeared to be an effective surgical procedure, showing a volumetric bone remodeling similar to that recorded for autogenous bone grafted with an onlay block procedure.”
Interpositional augmentation technique in the treatment of posterior mandibular atrophies: a retrospective study comparing 129 autogenous and heterologous bone blocks with 2-7 years follow-up

ABSTRACT

In case of insufficient bone height following tooth loss, the implant rehabilitation of atrophic posterior mandible is challenging. The ideal approach seems to be the vertical bone augmentation performed with different techniques, as guided bone regeneration, alveolar distraction osteogenesis and onlay bone grafting. The aim of this retrospective study was to evaluate the clinical and radiological results of inlay augmentation procedure with three different types of block bone graft: autogenous bone block harvested from iliac crest (ABB), deproteinized bovine bone mineral block (BBB) and collagenated equine bone block (EBB). Following ostectomy, the different types of blocks were shaped and placed between the cranial osteotomized segment and the mandibular basal bone. Residual gaps were filled with particulated ABB, BBB or EBB taken from the respective blocks. The grafted areas were then covered with a resorbable collagen membrane (Bio-Gide®, Geistlich, Wolhusen, Switzerland; OsteoBiol® Evolution, Tecnoss®, Giaveno, Italy). A total of 115 patients were treated and 129 inlay surgeries were performed (10 surgeries with ABB, 61 with BBB and 58 with EBB). The results showed a mean postoperative vertical bone gain of 5.55 mm, with the greatest augmentation obtained in the EBB group, followed by BBB and ABB. Anyway, these differences were not statistically significant. The Authors underline that EBB probably allows for a greater augmentation for its rigidity, due to the presence of a collagen matrix. At 7 years after loading, ABB and BBB showed 1.34 and 1.37 mm of peri-implant marginal bone loss respectively, while EBB lost 0.61 mm 3 years after loading. The result on implant survival rates with a 4.2-year mean follow-up were comparable (94.4% for ABB, 91.1% for BBB and 96.0% for EBB).

CONCLUSIONS

Within the limitations of this study, the Authors concluded that: “the use of collagenated blocks should be considered with this technique involving a lower adjustment of the coronal segment on the block itself. As a consequence, heterologous biomaterials might be considered ideal in the inlay technique for the posterior mandible”.
Short vs longer implants in mandibular alveolar ridge augmented using osteogenic distraction: one year follow-up of a randomized split-mouth trial

ABSTRACT

In case of tooth loss, the consequent atrophy of the alveolar bone can hinder the success of a fixed rehabilitation, as the implant placement in a jaw with a low bone level is not predictable. In these cases, the clinician can choose between essentially three options: bone augmentation procedures, use of zygomatic implants in case of maxillary jaws and use of so-called short implants. The aim of this randomized split-mouth trial was to compare the implant survival rate of short implants, with an intrabony length of 6 mm, with the implant survival rate of longer implant, with an intrabony length of 10 mm, placed in posterior atrophic mandibles. Thirty-six patients with bilateral posterior edentulous mandible and presenting a bone availability height less than 9 mm from the mandibular canal were enrolled in this study and their hemiarches were randomized to receive both 6-mm-long and normal-length implants (10 mm). The technique used for the vertical bone augmentation was the “sandwich” technique, using a bone substitute block graft. The graft material used was the bone block graft OsteoBiol® Sp-Block (Tecnoss®, Giaveno, Italy) of dimensions 10x10x20 mm. At the 1-year post-loading follow-up, loss of implants and complications were assessed. The total loss around long implants was low, but the morbidity and complication rate was higher compared with the short implant outcomes.

CONCLUSIONS

The results from this trial lead the Authors to the conclusion that “both assessed techniques provided good and similar outcomes up to 1 year after loading. In addition, the short implant type can represent a preferable therapeutic choice to vertical bone augmentation for the placement of longer implants, because of the offered advantages in time, morbidity, and economics”.

Abstract author: Cristina Rodighiero, dental journalist, free publication, not for resale. Printed by Tecnoss® Dental s.r.l.
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ABSTRACT

The aim of this study was to evaluate whether 6 mm-long by 4 mm-wide dental implants could be an alternative to longer implants placed in bone augmented with bone substitutes in posterior atrophic jaws. In order to do this, 20 patients with bilateral atrophic mandibles and 20 patients with bilateral atrophic maxillae, having 5 to 7 mm of bone height above the mandibular canal or below the maxillary sinus, were randomised according to a split-mouth design to receive one to three 6 mm-long and 4 mm-wide implants or at least 10-mm long implants in augmented bone. The augmentation procedure consisted of an interpositional block of collagenated cancellous equine bone (OsteoBiol® Sp-Block, Tecnoss®, Giaveno, Italy) in mandibles or a mix of 100% cancellous and cortical porcine-derived collagenated bone having a particle size of 250 to 1000 µm (OsteoBiol® Gen-Os®, Tecnoss®) in maxillary sinuses. Both sides were to be treated during the same surgical session (one side to be augmented and the other to receive short implants). Outcome measures were prosthesis and implant failures, any complication, time needed to fully recover mental nerve function (only for mandibular implants) and patient preference. There were no statistically significant differences in graft, implant or prosthesis failures, though significantly more intra- and postoperative complications occurred at grafted sites. All 20 patients treated with mandibular implants and 15 patients treated with maxillary implants preferred short implants, whereas 5 patients treated with maxillary implants described both procedures as equally acceptable. These differences were statistically significant.

CONCLUSIONS

Based on the short-term data (5 months after loading) it is possible to suggest that short implants may be as effective, if not more effective, than longer implants placed in augmented posterior jaws. It should be noted that the long-term prognosis is yet unknown and the sample size of the present and other published RCTs are still relatively small to be drawing definitive conclusions. In the Authors’ opinion, “5- to 10-year post-loading data are necessary before making reliable recommendations”.

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Abstract author: Cristina Rodighiero, dental journalist, free publication, not for resale. Printed by Tecnoss® Dental s.r.l.
Posterior atrophic jaws rehabilitated with prostheses supported by 5x5 mm implants with a novel nanostructured calcium-incorporated titanium surface or by longer implants in augmented bone. Preliminary results from a randomised controlled trial

ABSTRACT

The use of short implants, with an intrabony length of 8 mm or less, may be considered as a simpler, cheaper and faster alternative to bone augmentation procedures for the subsequent placement of longer implants. Consequently, the aim of this study was to compare the outcome of partial fixed prostheses supported by 5x5 mm implants with prostheses supported by implants at least 10 mm long placed in augmented posterior jaws. For this trial, 40 patients with atrophic posterior mandibles with 5 to 7 mm of bone height above the mandibular canal and 40 patients with atrophic maxillae with 4 to 6 mm below the maxillary sinus, were enrolled and divided in two groups in order to receive one to three 5x5 mm implants or one to three at least 5x10 mm-long implants in augmented bone. Bone vertical augmentation of the mandibles was performed by the interposition of bovine bone blocks (OsteoBiol® Sp-Block, Tecnoss®, Giaveno, Italy) and resorbable barriers (OsteoBiol® Evolution) and implants were placed after 4 months. Maxillary sinuses were augmented with particulated porcine bone (OsteoBiol® mp3® pre-hydrated collagenated porcine bone), the lateral window was covered with a resorbable collagen barrier (OsteoBiol® Evolution) and implants were placed simultaneously. 4 months after loading, the Authors evaluated prosthesis and implant failures and the presence of complications. The results showed that there were no statistically significant differences in prosthesis and implant failures.

CONCLUSIONS

Within the limitation of this study (small sample size and short duration of the follow-up), short-term data (4 months after loading) indicate that 5x5 mm implants achieved similar results compared to longer implants placed in augmented bone. So, in the Authors’ opinion, “short implants might be a preferable choice to bone augmentation especially in posterior mandibles since the treatment is faster, cheaper and associated with less morbidity. However, 5 to 10 years of post-loading data are necessary before making reliable recommendations”.
Posterior atrophic jaws rehabilitated with prostheses supported by 5 x 5 mm implants with a novel nanostructured calcium-incorporated titanium surface or by longer implants in augmented bone. One-year results from a randomised controlled trial

ABSTRACT

In this study, the Authors aimed to verify if short implants can be a simpler, cheaper and faster alternative with less associated morbidity compared to longer implants placed in bone augmented with bone substitutes in posterior atrophic jaws and if they could provide similar success rates. A total of 40 patients with atrophic posterior arches were randomised according to a parallel group design to receive one to three 5 mm implants or one to three at least 10 mm-long implants in augmented bone. In mandibles, the augmentation procedure consisted of interpositional blocks of collagenated cancellous bovine bone (OsteoBiol® Sp-Block, Tecnoss®, Giaveno, Italy) and maxillary sinuses were augmented with a sticky paste made of 600 to 1000 µm pre-hydrated collagenated cortico-cancellous bone granules of porcine origin (OsteoBiol® mp3®, Tecnoss®). The same bone substitute was also used to fill gaps between bone blocks and the surrounding bone in mandibles. The grafted area was covered with a collagen resorbable barrier (OsteoBiol® Evolution, Tecnoss®) from equine pericardium. All implants were submerged and loaded after 4 months with provisional prostheses.

CONCLUSIONS

One year after loading, 5 × 5 mm implants achieved similar results compared to longer implants placed in augmented bone and so it is possible to presume that short implants might be a preferable choice to bone augmentation especially in posterior mandibles.

With reference to the blocks used, the Authors declared: “in this trial, we decided to use blocks of collagenated bovine bone instead of the blocks of sintered bovine bone we used in previous studies because sintered bone blocks were too brittle and sometimes fragmented into small pieces during shaping and insertion procedures. We therefore used a more solid bone block of animal origin”.
ABSTRACT

In the absence of bone of adequate height, clinicians are faced with the dilemma of whether to attempt an augmentation procedure or to place shorter implants with an intra-bony length of 8 mm or less. The aim of this pilot study was to compare the outcome of single implant-supported crowns and partial fixed prostheses supported by 4 mm-long implants (test procedure), with prostheses supported by at least 10 mm-long implants (control procedure), placed in posterior jaws augmented. Augmentation consisted of interpositional blocks of collagenated cancellous equine bone (OsteoBiol® Sp-Block, Tecnoss®, Giaveno, Italy) in mandibles or the insertion of a mix of cancellous and cortical collagenated porcine-derived granular bone having a granulometry of 250 to 1000 µm (OsteoBiol® Gen-Os®, Tecnoss®) in a lateral window below the lifted maxillary sinus membrane. The same bone substitute was also used to fill gaps between bone blocks and the surrounding mandibular bone. The grafted areas were covered with resorbable collagen membranes derived from equine pericardium (OsteoBiol® Evolution, Tecnoss®).

CONCLUSIONS

Four months after loading, 4 mm-long implants achieved similar results to longer implants in augmented jaws but were affected by fewer complications. The present findings suggest that short implants may be an alternative to augmentation procedures of posterior jaws at least up to 5 years after loading. Anyway, it must be underlined that the long-term prognosis of short implants is not sufficiently known and 5- to 10-year post-loading data from larger trials are necessary before being able to offer reliable recommendations.
4 mm long vs longer implants in augmented bone in posterior atrophic jaws: 1-year post-loading results from a multicentre randomised controlled trial

ABSTRACT

In case of a residual vertical bone height less than 8.0 mm, when it is necessary to use dental implants in order to replace missing teeth, clinicians must decide if it is better to perform an augmentation produce or to place short implants. The aim of this trial was to evaluate whether 4.0 mm short dental implants could be an alternative to augmentation with xenografts in the maxilla and placement of at least 10.0 mm long implants in posterior atrophic jaws. In the augmentation procedures, the atrophic jaws were augmented either with mandibular interpositional collagenated block of cancellous equine bone (OsteoBiol® Sp-Block, Tecnoss®, Giaveno, Italy) or with a mixture of cancellous and cortical collagenated porcine-derived granular bone (OsteoBiol®, Gen-Os®, Tecnoss), placed through a lateral window below the lifted maxillary sinus epithelium. The grafted areas were covered with resorbable collagen membranes derived from equine pericardium (fine 30 mm × 30 mm, OsteoBiol® Evolution, Tecnoss®). This study tested the null hypothesis that there were no differences in the clinical outcomes between the two procedures against the alternative hypothesis of a difference. Outcome measures were prosthesis failure, implant failure, any biological or prosthetic complications, peri-implant marginal bone levels changes. The follow-up was 1 year after initial loading. There were no statistically significant differences in implant failures or prostheses failures. Significantly more complications occurred at augmented sites: six patients in the short implant group were affected by six complications vs 18 patients from the augmented group with 24 complications.

CONCLUSIONS

One year after loading, 4.0mm long implants achieved results similar to longer implants in augmented jaws, but were affected by fewer complications. Based on the results, Authors concluded that “short implants might be a preferable choice to bone augmentation, especially in mandibles, since the treatment is less invasive, faster, cheaper and associated with less morbidity. However, 5 to 10 years post-loading data from larger trials are necessary before being able to produce reliable recommendations".
Posterior atrophic jaws rehabilitated with prostheses supported by 5 × 5 mm implants with a nanostructured calcium-incorporated titanium surface or by longer implants in augmented bone. 3-year results from a randomised controlled trial

ABSTRACT
As short implants could be a simple, cheap and fast alternative with less morbidity when compared to longer implants placed in augmented bone, it is indispensable to verify if they can provide similar success rates, especially in the long-term. The aim of this RCT was to compare the results of partial fixed prostheses supported by 5.0 mm × 5.0 mm implants with prostheses supported by implants at least 10.0 mm long placed in augmented posterior jaws, up to 3 years post-loading. This was a randomised controlled trial of parallel group design with two arms. One arm consisted of patients having one to three 5.0 mm × 5.0 mm implants either in the mandible or in the maxilla. Patients of the other arm had their jaw augmented to allow placement of one to three at least 10.0 mm × 5.0 mm implants either in the mandible or in the maxilla. The augmentation procedures consisted of interpositional blocks of collagenated cancellous bovine bone (OsteoBiol® Sp-Block, Tecnoss®, Giaveno, Italy) in mandibles, or the insertion, using a sterile syringe, of a sticky paste made of 600 µm to 1000 µm pre-hydrated collagenated cortico-cancellous bone granules of porcine origin (OsteoBiol® mp3®, Tecnoss®, 1 cc) in a lateral window below the lifted maxillary sinus membrane. All implants had a diameter of 5.0 mm and were submerged and loaded after 4 months with provisional prostheses. Four months later, definitive screw-retained or provisionally cement metal-ceramic or zirconia prostheses were delivered. The follow-up of all patients was 3 years post-loading and the outcome measures were: prosthesis and implant failures, biological or prosthetic complications, and peri-implant marginal bone level changes. Three years after loading, 5.0 mm × 5.0 mm implants achieved similar results than longer implants placed in augmented bone. There were no statistically significant differences in prostheses and implant failures up to 3 years after loading. Significantly more complications occurred at mandibular grafted sites. Longer implants showed a greater bone loss up to 3 years after loading than short implants, both in maxillae and in mandibles.

CONCLUSIONS
As bone augmentation procedures are more technically demanding than the placement of short implants and based on the results of this trial, it is possible to suggest that implants as short as 5.0 mm may be as effective as longer implants placed in augmented posterior jaws at least up to 3 years after loading. Anyway, the Authors recommended to keep in mind that the long-term prognosis is yet unknown and the sample size of the present and other published RCTs is still relatively small to be able to draw definitive conclusions.

Grafted with
- BONE SUBSTITUTE OsteoBiol® Sp-Block
- OsteoBiol® mp3®
- MEMBRANE OsteoBiol® Evolution

Abstract author: Cristina Rodighiero, dental journalist, free publication, not for resale. Printed by Tecnoss® Dental s.r.l.
Posterior atrophic jaws rehabilitated with prostheses supported by 6 mm long 4 mm wide implants or by longer implants in augmented bone. One-year post-loading results from a pilot randomised controlled trial

ABSTRACT

Insufficient bone height is a problem for an adequate implant placement in atrophic jaws. In these cases, the alternatives are to use short implants or to place longer implants after bone augmentation. As there are few short-term randomised controlled trials comparing the effectiveness of prostheses supported by short implants with those supported by longer implants placed in augmented bone, the aim of this trial was to evaluate whether 6 mm long by 4 mm wide dental implants could be an alternative to implants at least 10 mm long placed in bone augmented with bone substitutes in posterior atrophic jaws. A total of 20 patients with bilateral atrophic mandibles and 20 patients with bilateral atrophic maxillae, were randomly allocated according to a split-mouth design to receive one to three 6 mm long and 4 mm wide implants, or implants at least 10 mm long in augmented bone. The augmentation procedure consisted in the insertion of an interpositional block of collagenated cancellous equine bone (OsteoBiol® Sp-Block, Tecnoss®, Giaveno, Italy) in mandibles or a mix of cancellous and cortical porcine-derived collagenated bone having a granulometry of 250 to 1000 µm (Osteo-Biol® Gen-Os®, Tecnoss®) in maxillary sinuses. The grafted areas were covered with a collagen resorbable barrier (Fine 30 × 30 mm, OsteoBiol® Evolution, Tecnoss®) derived from equine pericardium. At mandibular grafted sides, implants were placed 3 months after augmentation, whereas implants were inserted in maxillae simultaneously to sinus lift procedures. Outcome measures were prosthesis and implant failures, any complication and radiographic peri-implant marginal bone level changes. All maxillary implants and prostheses were successful, whereas 2 mandibular prostheses could not be placed on implants at least 10 mm long due to graft failures. There were no statistically significant differences in implant and prosthesis failures, though significantly more complications occurred at grafted sites in mandibles, but not in maxillae. Patients with mandibular 6 mm-long implants lost an average of 1.05 mm of peri-implant bone at 1 year and patients with mandibular implants at least 10 mm long lost 1.07 mm, with a statistically significant difference. Patients with maxillary 6 mm-long implants lost an average of 1.02 mm of peri-implant bone at 1 year and patients with maxillary implants at least 10 mm long lost 1.09 mm, with a statistically significant difference. There were no statistically significant differences in bone level changes up to 1 year between 6 mm and at least 10 mm-long implants in both jaws.

CONCLUSIONS

Based on the results, the Authors concluded that “Short implants might be a preferable choice to bone augmentation, especially in posterior mandibles since the treatment is faster, cheaper and associated with less morbidity. However, 5 to 10 years post-loading data from larger trials are necessary before being able to produce reliable recommendations”. 

Abstract author: Cristina Rodighiero, dental journalist, free publication, not for resale. Printed by Tecnoss® Dental s.r.l.
ABSTRACT

The aim of this trial was to evaluate whether 6 mm long by 4 mm wide dental implants could be an alternative to implants at least 10 mm long placed in bone augmented with bone substitutes in posterior atrophic jaws. A total of 20 patients with bilateral atrophic mandibles and 20 patients with bilateral atrophic maxillae, were randomly allocated according to a split-mouth design to receive one to three 6 mm long and 4 mm wide implants, or implants at least 10 mm long in augmented bone. The augmentation procedure consisted in the insertion of an interpositional block of collagenated cancellous equine bone (OsteoBiol® Sp-Block, Tecnoss®, Giaveno, Italy) in mandibles or a mix of cancellous and cortical porcine-derived collagenated bone having a granulometry of 250 to 1000 μm (OsteoBiol® Gen-Os®, Tecnoss®) in maxillary sinuses. The grafted areas were covered with a collagen resorbable barrier (Fine 30 × 30 mm, OsteoBiol® Evolution, Tecnoss®) derived from equine pericardium. At mandibular grafted sides, implants were placed 3 months after augmentation, whereas implants were inserted in maxillae simultaneously to sinus lift procedures. Outcome measures were prosthesis and implant failures, any complication and radiographic peri-implant marginal bone level changes. At the 3-year post-loading follow-up two short maxillary implants affected by peri-implantitis failed together with their prosthesis vs three mandibular prostheses that could not be placed on implants at least 10 mm long due to graft failures. There were no statistically significant differences in implant and prosthesis failures. In total, 18 complications occurred in 13 patients at augmented sites vs four complications in three patients with 6 mm long implants. Significantly more complications occurred at grafted sites in mandibles, but not in maxillae. In mandibles, patients with 6 mm long implants lost an average of 1.25 mm of peri-implant bone at 3 years vs 1.54 mm in patients with implants of at least 10 mm long, with a statistically significant difference. In maxillae, patients with 6 mm-long implants lost an average of 1.28 mm of peri-implant bone at 3 years vs 1.50 mm in patients with implants of at least 10 mm long, with a statistically significant difference.

CONCLUSIONS

Three-year post-loading data indicate that 6 mm long implants achieved similar (in the maxilla) if not better (in the mandible) results than longer implants placed in augmented bone and, consequently, short implants might be a preferable choice to bone augmentation, especially in posterior mandibles. Anyway, in the Authors’ opinion, “5 to 10 years’ post-loading data from larger trials are necessary before being able to produce reliable recommendations”.

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Soft tissue augmentation

OsteoBiol®
by Tecnoss

REGENERATION SCIENCE
INSPIRED BY NATURE
Stage-two surgery using collagen soft tissue grafts: clinical cases and ultrastructural analysis

ABSTRACT

In the case reports presented in this study the Authors show the application of two different products that could be used as alternatives to autologous tissues usually harvested from the palate like free gingival grafts (FGG) or subepithelial connective tissue grafts (SCTG) during stage-two implant surgery.

Different soft tissue grafts are available on the market, including acellular dermal matrices (ADM) (derived from human or porcine skin), and bilayer collagen matrices (CMs) with a dense and a porous part (porcine origin). The grafts selected for the study were OsteoBiol® Derma (Tecnoss®, Giaveno, Italy) and Mucograft® (Geistlich Pharma). Derma is a xenogenic ADM obtained from dermis of porcine origin and it is not cross-linked. It is available in different thicknesses and sizes and is resorbed within 3 to 5 months. It is normally used for recession coverage or for keratinized attached gingiva augmentation. Mucograft® is a bilayer CM of porcine origins, it is composed of collagen type I and III and it is intended to be used for keratinized attached gingiva/mucosa augmentation or for root coverage procedures.

So, the aim of this study was to present the clinical application of the two above-mentioned soft tissue grafts during stage-two surgery in order to increase mucosal thickness and keratinized attached mucosa around implants.

CONCLUSIONS

The application of a porous CM and a xenogenic ADM has been successful in terms of keratinized attached mucosa augmentation and ridge volume increase, respectively. Porous CM was used to primarily gain keratinized tissue and ADM was used to enhance ridge volume.

Based on the positive results obtained, the Authors affirm that “ADM is recommended primarily for ridge volume augmentation and needs to be completely covered to achieve an uneventful healing because of its dense structure. Contrary, the bilayered CM can be left exposed with the aim to gain keratinized tissue around teeth and implants. However, shrinkage of the materials, especially when left exposed, seems to be a major drawback. Further studies are needed to compare and to better understand the clinical indications and behaviour of different soft tissue substitutes”.

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Abstract author: Cristina Rodighiero, dental journalist, free publication, not for resale. Printed by Tecnoss® Dental s.r.l.
Maxillofacial

OsteoBiol®
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REGENERATION SCIENCE
INSPIRED BY NATURE
Grafted with BARRIER - BONE SUBSTITUTE OsteoBiol® Lamina

Orbital floor restoration

ABSTRACT

In case of traumas involving the middle-third of the face, the fractures of the orbital floor must be solved by means of a reconstructive surgery, in order to restore the continuity of the orbital floor, to provide support of orbital contents and prevent soft tissues’ fibrosis. In this kind of reconstructive surgery, the material for reconstruction plays an important role.

Over the years, different materials have been tested and autogenous grafts have been used as the material of choice. Recently, alloplastic materials have gained popularity because of their availability and ease of use. The purpose of this study was to review materials used in orbital floor reconstructive surgery at the Department of Maxillo-Facial Surgery of University of Rome “La Sapienza”, with emphasis on their biocompatibility, their shaping features, and mechanical properties. From January 1995 to December 2003 379 patients with a diagnosis of orbital floor fracture, either pure or combined with other facial fractures were treated with these products.

CONCLUSIONS

In order to reconstruct the fractured orbital floor, autologous, allogenic and alloplastic materials are used and an argument of controversy among the surgeons is the choice of the most suitable material.

Based on the scientific evidence, the Authors suggest that the ideal implant should have the following features: it must be biocompatible and easily applicable; it should provide a good structural support; it should be stable and slightly resorbable. Surgical timing, material’s availability and, obviously, costs are critical elements of choice.

Taking all these properties into consideration, alloplastic materials present several advantages due to their wide availability, the opportunity to use them in fractures of any dimension, their molding feature, the reduced surgical timing and the reasonable costs. In their study, among others materials, the Authors used swine bone cortex (OsteoBiol® Lamina, Tecnoss®, Giaveno, Italy), which proved to be a good material. Cortical swine bone allowed the restoration of the bone continuity in a satisfactory way. The main advantage of the swine bone cortex use is the possibility to restore even wide fractures that normally must be treated using a metal mesh support. Actually, the use of a metal mesh implies higher costs, a greater risk of infection and more serious lesions to the eyeball if further orbital trauma occurs. In the cases treated with swine bone cortex, the biocompatibility of the product proved to be good and no intolerance reaction neither any foreign-body reaction were observed.

The Authors concluded: “At present, swine bone cortex (OsteoBiol® Lamina) implanted in 11 patients proved excellent results. Its main advantages, despite the modeling properties are not as good as other materials, are an optimal integration to the surrounding tissues and its use in rather wide fractures, thus allowing floor reconstruction without placement of metal mesh support”.

Abstract author: Cristina Rodighiero, dental journalist, free publication, not for resale. Printed by Tecnoss® Dental s.r.l.
Hess area ratio and diplopia: evaluation of 30 patients undergoing surgical repair for orbital blow-out fracture

ABSTRACT

As diplopia is common occurrence after orbital blow-out fractures, the aim of this study was to determine if the Hess area ratio is effective in predicting postoperative diplopia in patients undergoing surgery for orbital blow-out fracture. In the study were included 30 consecutive cases affected by orbital fractures and diplopia undergoing surgical correction within 7 days after injury. Surgical approaches performed included transpalpebral, Lynch incision, combination of transpalpebral, Lynch incision, subciliary and transconjunctival. Two fractures of the medial wall were treated with endoscopy and in one case the reduction was performed through a previous cutaneous lesion. Orbital wall defects were repaired using bovine pericardium (Tutopatch), titanium mesh covered with bovine pericardium, and decalcified swine bone cortex (OsteoBiol® Soft Cortical Lamina, Tecnoss®, Giaveno, Italy).

To evaluate ocular motility disturbance, the involved ocular motility range was measured by use of a manual Hess screen test before and 4 months after surgery. The percentage of Hess area ratio was used to express the range of ocular motility in a numerical value.

CONCLUSIONS

The clinical cases of this study suggest that Hess area ratio is a useful procedure to convert Hess graphic representation in a numerical value so that Hess chart data can be compared among clinicians and used to predict surgical outcomes in patients undergoing surgery for orbital blow-out fractures.
Orbital wall reconstruction with swine bone cortex

ABSTRACT

Orbital fractures are common facial injuries and they can be isolated or associated with other orbital defects arising from maxillofacial fractures. The decision regarding surgical intervention in the management of medial orbital wall fractures is influenced by a variety of factors, including the presence and severity of restricted ocular motility, the degree of enophthalmos, the estimated fracture size, and the clinical judgment of the surgeon; however, untreated medial orbital wall fractures can result in secondary enophthalmos. Several kinds of materials have been proposed for the reconstruction of medial orbital wall defects: bone grafts harvested either from calvaria or the mandible, titanium meshes, and resorbable sheets. The use of these materials, alone as well as a combination of autologous bone grafts and alloplastic materials, has been widely reported. The aim of this study was to describe the Authors’ experience with collagenated swine bone cortex (OsteoBiol® Soft Cortical Lamina, Tecnoss®, Giaveno, Italy) for the reconstruction of the fractured medial orbital wall. In the cases reported, it is underlined the handling advantages of the OsteoBiol® sheet, which can be easily shaped with scissors by the surgeon, before a tepid saline solution bath, assuring the necessary plasticity to adapt the material both to bone and soft tissues. Postoperative clinical evaluation of the patient, Hess test, ophthalmologic examination and CT have been performed to assess the correct position of the Lamina with satisfactory results.

CONCLUSIONS

Based on their experience, the Authors believe that collagenated swine bone cortex is an excellent option to restore medial wall defects, thanks to its biocompatibility and adaptability. The Lamina does not provide injuries to the orbital soft tissues during its application, and it can be used to restore wide defects.

With reference to its handling properties, they affirm that “this heterologous implant, thanks to collagen and to superficial decalcification, takes on elastic texture, keeping the density of the bone tissue. In this way, the edges remain soft to prevent microtraumas to the soft tissue, and it can be safely inserted in the orbit, granting a very high resilience. In our department, the use of this material was initially reserved to reconstruct orbital floor fractures; however, the considerable advantages that this material offers made it possible to be used in other situations, such as for the restoration of medial orbital wall fractures”.
A new option for the reconstruction of orbital floor defects with heterologous cortical bone

ABSTRACT

The orbital floor is one of the most frequently injured areas of the maxillofacial skeleton during facial trauma and blow-out fractures are the most frequent consequences of maxillofacial trauma. The aim of the management of orbital fractures is to stabilize and reconstruct the orbital wall, while repairing orbital soft tissues. Autogenous, allogenic or alloplastic materials have been used to replace the damaged bone sites, each with its own advantages and disadvantages. In this study, the Authors present their experience with heterologous cortical bone for the treatment of orbital floor fractures and discuss the potential advantages and disadvantages of this alloplastic material. Twenty-one patients (16 men and 5 women; mean age 33 years; range 9-57) with a traumatic orbital floor underwent reconstruction with heterologous cortical bone. A laminar, cortical, equine bone graft (OsteoBiol® Lamina, Tecnoss®, Giaveno, Italy) with dimensions of 35 x 35 x 1 mm was used. The lamina was hydrated in sterile physiological solution and was later shaped according to the template with sterile scissors until the desired size and shape. As highlighted by the Authors, the main advantages of this material are the optimal integration to surrounding tissues and its use in rather wide fractures. Moreover, it is slightly radiopaque, which means that it can be visualized radiographically. All patients underwent clinical and radiological follow-up examinations at 1, 3, 6 and 12 months. Computed tomographic scans were taken at the postoperative 6th month, and at the first postoperative year if needed. None of the patients showed impaired visual acuity preoperatively or post-operatively and all patients had a negative intraoperative forced duction test demonstrating free globe movement. There was no graft extrusion, resorption or displacement during the follow-up period.

CONCLUSIONS

According to the results, equine-derived heterologous laminar cortical bone grafts can be easily used and are also safe and efficient. As stated by the Authors “equine-derived heterologous laminar cortical bone grafts are a good alternative for the reconstruction of blowout fractures due to their plasticity and biocompatible structure. Without donor area morbidity, it is a safe and appropriate heterologous bone graft material for maxillofacial applications such as orbital floor reconstruction. Its use in near-total and total orbital floor defects should be avoided as it is not indicated for use in load-bearing circumstances”. The Authors declare that they have no conflicts of interest.

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ORIGINAL ARTICLE
Reconstruction of the adult hemifacial microsomia patient with temporomandibular joint total joint prosthesis and orthognathic surgery

ABSTRACT

The clinical presentation of hemifacial microsomia (HFM) is variable, and many classification systems have been developed, depending on temporomandibular joint, ramus and glenoid fossa conditions. As the management of hemifacial microsomia is controversial, numerous reconstructive techniques have been described. Its surgical treatment depends on the patient’s age and contemplates two primary methods to reconstruct the TMJs involving the use of autogenous tissues (i.e., rib or sternoclavicular grafts (SCGs)) versus alloplastic total joint prosthetic devices. The increasing use of temporomandibular prosthesis for temporomandibular problems has led the Authors to use them even in HFM, and in this article a case of female nongrowing patients with HFM type IIb treated with temporomandibular prosthesis in an all-in-one protocol is presented. A 22-year-old female patient with left side hemifacial microsomia (type IIb), following completion of clinical, cephalometric, dental model, and radiographic imaging analyses, was subjected to a treatment including presurgical orthodontics to align and level the maxillary and mandibular arches and surgery treatment consisting in right mandibular ramus sagittal split osteotomy, left TMJ reconstruction to advance the mandible in a counterclockwise direction with custom-fitted total joint prostheses (TMJ Concepts, Ventura, California, USA), maxillary osteotomies to advance the maxilla in a counterclockwise direction and level the occlusal plane transversely with rigid fixation and bone grafting. A laminar, cortical, heterologous bone graft (OsteoBiol® Lamina, Tecnoss®, Giaveno, Italy) was used to fill the osteotomy’s gap. Postsurgical orthodontics was performed to refine and retain the occlusion.

CONCLUSIONS

In the Authors’ experience, TMJ Concepts patient-fitted TJP in conjunction with orthognathic surgery for TMJ and jaw reconstruction is a valid option for patients with HFM because this kind of treatment doesn’t need a graft donor site and its results are predictable and stable.
Tecnoss s.r.l. is an innovative, globally active company that develops, produces and documents premium-quality xenogenic biomaterials by the brands Tecnoss® and OsteoBiol®.

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