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1. Pre-clinical (*in vitro* & *in vivo*) studies (p. 2 – p. 8)
 2. Clinical studies and case series (p. 9 – p. 19)

Pre-clinical (*in vitro* & *in vivo*) studies

1. Ultrastructural and Physicochemical Characterization of a Non-Crosslinked Type 1 Bovine Derived Collagen Membrane

da Silva Brum I, Elias CN, Nascimento ALR, de Andrade CBV, de Biasi RS, de Carvalho JJ. *Polymers (Basel)*. 2021 Nov 26;13(23):4135. doi: 10.3390/polym13234135.

<https://pubmed.ncbi.nlm.nih.gov/34883638/>

In this work, *in vitro* testing was used to study the properties of non-crosslinked type 1 bovine derived collagen membranes used in bone regeneration surgery. Collagen membranes were prepared, their surface roughness was quantified by interferometry, their morphology was observed by scanning electron microscopy (SEM) and transmission electron microscopy (TEM), their wettability was measured by the contact angle technique, their mechanical properties were investigated by tensile testing, their phase transformation temperatures were measured by Differential Scanning Calorimetry (DSC), and their biocompatibility was evaluated by immunological testing. The calorimetry tests showed that the membrane is formed only by type 1 collagen. The SEM observations showed that the morphology consists of layers of highly organized collagen fibers and patterns of striated fibrils typical of type 1 collagen. The small contact angle showed that the membrane is hydrophilic, with the possibility of rapid absorption of body fluids. The tensile tests showed that the membrane has enough elasticity, ductility, and mechanical strength for use in tissue regeneration. With the immunostaining technique, it was possible to confirm the membrane biocompatibility.

2. Cytocompatibility of Bone Substitute Materials and Membranes

Schafer S, Al-Qaddo H, Gosau M, Smeets R, Hartjen P, Friedrich RE, Nada OA, Vollkommer T, Rashad A. *In Vivo*. 2021 Jul-Aug;35(4):2035-2040. doi: 10.21873/invivo.12472.

<https://pubmed.ncbi.nlm.nih.gov/34182478/>

Background/aim: With the demographic change and associated chronic bone loss, the need for cytocompatible bone replacement materials arise in modern medicine. *The aim of this *in vitro* study was to investigate the cytocompatibility of eleven different bone substitute materials and membranes.*

Materials and methods: Seven bone substitute materials and four membranes were assessed *in vitro*. The specimens were tested based on their interaction with MC3T3 pre-osteoblasts, through the utilization of viability, proliferation, and cytotoxicity assays. Cell vitality was evaluated using live-dead staining. **Results:** Although we found minor differences in cytocompatibility among the assessed materials, all tested materials can be considered as cytocompatible with a viability of more than 70% of the negative control, which indicates the non-toxic range as defined in current, international standards (DIN EN ISO 10993-5:2009, German Institute for Standardization, Berlin, Germany). Direct live-dead staining assays confirmed satisfactory cytocompatibility of all tested membranes. **Conclusion:** All examined bone substitute materials and membranes were found to be cytocompatible. In order to assess whether the observed minor differences can impact regenerative processes, further *in vivo* studies need to be conducted.

3. Collagen membranes of dermal and pericardial origin-*In vivo* evolvement of vascularization over time

Dau M, Volprich L, Grambow E, Vollmar B, Frerich B, Al-Nawas B, Kämmerer PW. *J Biomed Mater Res A*. 2020 Dec;108(12):2368-2378. doi: 10.1002/jbm.a.36989.

<https://pubmed.ncbi.nlm.nih.gov/32363796/>

Aim of the study was to compare the evolvement of vascularization over time of collagen membranes (CMs) of dermal and pericardial origin in an *in vivo* animal study. Twenty-eight mice underwent implantation of three commercially available CM derived from porcine dermis (homogenous structure: CM1 (Control 1) and bilayer structure: CM2 [Control 2]), from porcine pericardium (CM3; Test 1) as well as CM3 sprayed with silica-enhanced nanostructured hydroxyapatite (CM4, Test 2). After 3, 6, 9, and 12 days, intravital fluorescence microscopy was conducted for determination of capillary diameter, density, flow, and length. At Day 12, samples were examined immunohistologically for expression of fibroblast growth factor receptor 4 (FGFR4), CD11b, CD68, α SMA, and CD34. In all CM, intravital fluorescence microscopy over time showed increasing values for all parameters with the highest levels in CM4 and the lowest values in CM1. Significant lower amounts of FGFR4, CD11b, and CD68 were detected in CM4 when compared to CM2 ($p < .05$). In contrast to CM3, lower values of α SMA and higher numbers of CD34 positive-marked vessels were observed in CM4 ($p < .05$). In conclusion, dermal bilayer as well as pericardial CM seem to have a higher vascularization rate than dermal homogenous CM. Additional coating of pericardial CM with a silica-enhanced hydroxyapatite increases the speed of vascularization as well as biological remodeling processes.

4. Biofunctionalization of porcine-derived collagen matrices with platelet rich fibrin: influence on angiogenesis *in vitro* and *in vivo*

Blatt S, Burkhardt V, Kämmerer PW, Pabst AM, Sagheb K, Heller M, Al-Nawas B, Schiegnitz E. *Clin Oral Investig*. 2020 Oct;24(10):3425-3436. doi: 10.1007/s00784-020-03213-8.

<https://pubmed.ncbi.nlm.nih.gov/32030513/>

Objectives: Porcine-derived collagen matrices (CM) can be used for oral tissue regeneration, but sufficient revascularization is crucial. **The aim of this study was to analyze the influence of platelet-rich fibrin (PRF) on angiogenesis of different CM *in vitro* and *in vivo*.** **Materials and methods:** Three different CM (mucoderm®, jason®, collprotect®) were combined with PRF in a plotting process. Growth factor release (VEGF, TGF- β) was measured *in vitro* via ELISA quantification after 1,4 and 7 days in comparison to PRF alone. In ovo yolk sac (YSM) and chorion allantois membrane (CAM) model, angiogenic potential were analyzed *in vivo* with light- and intravital fluorescence microscopy after 24 h, then verified with immunohistochemical staining for CD105 and α SMA. **Results:** Highest growth factor release was seen after 24 h for all three activated membranes in comparison to the native CM (VEGF 24 h: each $p < 0.05$; TGF- β : each $p < 0.001$) and the PRF (no significant difference). All activated membranes revealed a significantly increased angiogenic potential *in vivo* after 24 h (vessels per mm²: each $p < 0.05$; branching points per mm²: each $p < 0.01$; vessel density: each $p < 0.05$) and with immunohistochemical staining for CD105 (each $p < 0.01$) and α SMA (each $p < 0.05$). **Conclusions:** PRF improved the angiogenesis of CM *in vitro* and *in vivo*.

5. The Biomaterial-Induced Cellular Reaction Allows a Novel Classification System Regardless of the Biomaterials Origin

Al-Maawi S, Rutkowski JL, Sader R, Kirkpatrick CJ, Ghanaati S. *J Oral Implantol.* 2020 Jun 1;46(3):190-207. doi: 10.1563/aaid-joi-D-19-00201.

<https://pubmed.ncbi.nlm.nih.gov/32068853/>

Several different biomaterials are being introduced for clinical applications. However, no current material-specific systematic studies define parameters for evaluating these materials. **The aim of this retrospective animal study is to classify biomaterials according to the *in vivo* induced cellular reaction and outline the clinical consequence of the biomaterial-specific cellular reaction for the regeneration process.** A retrospective histologic analysis was performed for 13 polymeric biomaterials and 19 bone substitute materials (BSMs) (of various compositions and origins) that were previously implanted in a standardized subcutaneous model. Semiquantitative analyses were performed at days 3, 15, and 30 after implantation according to a standardized score for the induction of multinucleated giant cells (MNGCs) and vascularization rate. The induced cellular reaction in response to different polymeric materials allowed their classification according to the MNGC score in the following groups: class I induced no MNGCs at any time point, class II induced and maintained a constant number of MNGCs over 30 days, and class III induced MNGCs and provided an increasing number over 30 days. All BSMs induced MNGCs to varying extents. Therefore, the resultant BSM classifications are as follows: class I induced MNGCs with a decreasing number, class II induced and maintained constant MNGCs over 30 days, and class III induced MNGCs with increasing number over 30 days. These observations were mostly related to the biomaterial physicochemical properties and were independent of the biomaterial origin. Consequently, the induction of MNGCs and their increase over 30 days resulted in disintegration of the biomaterial. By contrast, the absence of MNGCs resulted in an integration of the biomaterial within the host tissue. This novel classification provides clinicians a tool to assess the capacity and suitability of biomaterials in the intended clinical indication for bone and soft tissue implantations.

6. Investigation of the effects of albumin-glutaraldehyde tissue adhesive on human gingival fibroblast cells

Doğanay Ö, Atasoy S, Diker N, Alkan A. *Yeditepe Dent J.* 2020 Jan;16:213-219. 10.5505/yeditepe.2020.71501. doi: 10.5505/yeditepe.2020.71501.

<https://www.researchgate.net/publication/346460491> Investigation of the effects of albumin-glutaraldehyde tissue adhesive on human gingival fibroblast cells

Aim: Albumin-glutaraldehyde tissue adhesive has been firstly used for cardiovascular surgery. After that, it has been applied to spleen, cardiac tissues and abdominal tissues to strengthen parenchyma and to provide hemostasis when damaged in severe trauma. **In order to diagnose possible complications of albumin-glutaraldehyde tissue adhesive which has been previously used in guided bone regeneration technique in dentistry, we compared *in vitro* cytotoxic**

effects of albumin-glutaraldehyde tissue adhesive that is experimentally used in oral surgery with collagen membrane which is frequently used in clinical practice on human gingival fibroblast (HGF-1) cell line. **Material and Methods:** Two groups were constituted to investigate cytotoxic effects of supernatants separately collected from albumin-glutaraldehyde tissue adhesive and collagen membrane on 1st, 3rd, 7th, 10th, 14th and 21st days. Supernatants were added to human gingival fibroblast cells for 24, 48 and 72 hours and then, the cytotoxicity was evaluated by MTT analysis. **Results:** In all periods, cell viability was statistically significantly lower in the group of albumin-glutaraldehyde tissue adhesive than the group of collagen membrane ($p < 0.05$). It was observed that as the exposure time of supernatants increases, cell viabilities decrease. **Conclusion:** It was obviously seen that human gingival fibroblast cells showed cytotoxic behavior against supernatants gathered from the group of albumin-glutaraldehyde tissue adhesive.

7. Biofunctionalization of porcine-derived collagen matrices with platelet rich fibrin: influence on angiogenesis *in vitro* and *in vivo*.

Blatt S, Burkhardt V, Kämmerer PW, Pabst AM, Sagheb K, Heller M, Al-Nawas B, Schiegnitz E. Clin Oral Investig. 2020. [Epub ahead of print].

<https://www.ncbi.nlm.nih.gov/pubmed/32030513>

AIM: The aim of this study was to analyze the influence of platelet-rich fibrin (PRF) on angiogenesis of different CM (CM; collprotect® membrane, Jason® membrane, mucoderm®) *in vitro* and *in vivo*.

MATERIALS AND METHODS: Three different CM (mucoderm®, jason®, collprotect®) were combined with PRF in a plotting process. Growth factor release (VEGF, TGF- β) was measured *in vitro* via ELISA quantification after 1, 4 and 7 days in comparison to PRF alone. In ovo yolk sac (YSM) and chorion allantois membrane (CAM) model, angiogenic potential were analyzed *in vivo* with light- and intravital fluorescence microscopy after 24 h, then verified with immunohistochemical staining for CD105 and α SMA. **RESULTS:** Highest growth factor release was seen after 24 h for all three activated membranes in comparison to the native CM (VEGF 24 h: each $p < 0.05$; TGF- β : each $p < 0.001$) and the PRF (no significant difference). All activated membranes revealed a significantly increased angiogenic potential *in vivo* after 24 h (vessels per mm²: each $p < 0.05$; branching points per mm²: each $p < 0.01$; vessel density: each $p < 0.05$) and with immunohistochemical staining for CD105 (each $p < 0.01$) and α SMA (each $p < 0.05$). **CONCLUSIONS:** PRF improved the angiogenesis of CM *in vitro* and *in vivo*. **CLINICAL RELEVANCE:** Bio-functionalization of CM with PRF could easily implemented in the clinical pathway and may lead to advanced soft tissue healing.

8. EMD-liquid as adjunct to natural bovine bone grafting at buccal bone dehiscence defects at implant sites: an experimental study in beagle dogs

Ikawa T, Akizuki T, Shujaa Addin A, Fukuba S, Stavropoulos A, Izumi Y. Clin Oral Implants Res. 2019; 30(10):989-996.

<https://www.ncbi.nlm.nih.gov/pubmed/31319440>

AIM: Evaluation of the effect of enamel matrix derivative in liquid form (EMD-liquid) as adjunct to grafting with natural bovine bone (NBB), on new bone formation and osseointegration in buccal dehiscence defects at dental implants. **MATERIAL AND METHODS:** In six beagles, 3 months after extraction of the mandibular premolars and first molars. Three titanium implants (3.3 \varnothing × 8.0 mm) were inserted, and dehiscence-type defects (mesiodistal width 3 mm × 5 mm depth) were created on their buccal aspect. The defects were randomly assigned to one of the following three treatment groups: Group 1: NBB, Group 2: NBB/EMD-L, Group 3: Control. All sites were covered with a collagen membrane. Histomorphometric measurements were performed after 3 months of healing. **RESULTS:** New bone area, bone-to-implant contact, and first bone-to-implant in the NBB and NBB/EMD-L groups were significantly greater than in the control group. Further, first bone-to-implant was at a significantly more coronal position in the NBB + EMD-liquid group compared with the NBB group. **CONCLUSIONS:** Natural bovine bone grafting enhances bone regeneration and osseointegration at implants with buccal bone dehiscences compared with no grafting, and adjunct use of EMD-liquid appears to further enhance bone formation and osseointegration.

9. Use of Collagen, PTFE and PRF Membranes in Bone Reconstruction an Experimental and Histomorphometric Study.

Neculae II, Anghelescu VM, Zurac SA, Dinca OM, Vladan CG, Bucur A. 2017. J Transl Med Res; 22(1): 42-47.

<https://www.sgo-iasgo.com/pdfs/2017-1-42.pdf>

This study presents a comparison between outcomes of bone regeneration, after producing standardized bone defects followed by covering them with membranes (such as collprotect® membrane) in an experimental animal model. The study was conducted on 18 New Zealand rabbits, by creating two defects in the left tibial bone of each rabbit: one standardized defect with a diameter of 4 mm, and the second by creating 5 monocortical holes with a small round bur. The defects were augmented with bovine bone, beta-tricalcium phosphate and perioglass and they were covered with 3 types of membrane: collprotect® collagen membrane (12 defects - group A), PTFE membrane (12 defects - group B) and PRF membrane, made from the blood of the same rabbit (12 defects – group C). The animals were sacrificed after 6 months and analysed histomorphometrically. The new bone around graft particles has a thickness of 98.26 μ m for collagen membrane, 49.19 μ m for PTFE membrane and 63.98 μ m for PRF membrane. The density of osteoblasts and osteocytes has an average of 0.0012 for collagen membrane, 0.0009 for PTFE membrane and 0.0010 for PRF membrane. Regarding the collagen

membrane, it is observed that when used the bone. Regeneration appears to have a higher density of osteoforming cells and a higher quantity of new bone.

10. Collagen Membranes Adsorb the Transforming Growth Factor- β Receptor I Kinase-dependent Activity of Enamel Matrix Derivative.

Stähli A, Miron RJ, Bosshardt DD, Sculean A, Gruber R. 2016. *J Periodontol*; 87(5):583-90.

<https://www.ncbi.nlm.nih.gov/pubmed/26777762>

The aim of this study is to evaluate the ability of two CMs and a collagen matrix to adsorb the activity intrinsic to EMD that provokes transforming growth factor (TGF)- β signaling in oral fibroblasts.

METHODS: Three commercially available collagen products were exposed to EMD or recombinant TGF- β 1, followed by vigorous washing. Oral fibroblasts were either seeded directly onto collagen products or were incubated with the respective supernatant. Expression of TGF- β target genes interleukin (IL)-11 and proteoglycan 4 (PRG4) was evaluated by real time polymerase chain reaction. Proteomic analysis was used to study the fraction of EMD proteins binding to collagen. **RESULTS:** EMD or TGF- β 1 provoked a significant increase of IL-11 and PRG4 expression of oral fibroblasts when seeded onto collagen products and when incubated with the respective supernatant. Gene expression was blocked by the TGF- β receptor I kinase inhibitor SB431542. Amelogenin bound most abundantly to gelatin-coated culture dishes. However, incubation of palatal fibroblasts with recombinant amelogenin did not alter expression of IL-11 and PRG4. **CONCLUSION:** These *in vitro* findings suggest that collagen products (collprotect® membrane, Jason® membrane, and mucoderm) adsorb a TGF- β receptor I kinase-dependent activity of EMD and make it available for potential target cells.

11. Porcine dermis-derived collagen membranes induce implantation bed vascularization via multinucleated giant cells: a physiological reaction?

Barbeck M, Lorenz J, Grosse Holthaus M, Raetscho N, Kubesch A, Booms P, Sader R, Kirkpatrick CJ, Ghanaati S. 2015. *J Oral Implantol*; 41(6):e238-51.

<https://www.ncbi.nlm.nih.gov/pubmed/25546240>

In this study, the tissue reactions to two new porcine dermis-derived collagen membranes of different thickness were analyzed. The thicker material (mucoderm®) contained sporadically preexisting vessel skeletons and fatty islands. The thinner membrane (collprotect® membrane) had a bilayered structure (porous and occlusive side) without any preexisting structures. These materials were implanted subcutaneously in mice to analyze the tissue reactions and potential transmembranous vascularization. Histological and histomorphometrical methodologies were performed at 4 time points (3, 10, 15, and 30 days). Both materials permitted stepwise connective tissue ingrowth into their central regions. In the mucoderm® matrix, newly built microvessels were found within the preexisting vessel and fatty island skeletons after 30 days. This vascularization was independent of the inflammation-related

vascularization on both material surfaces. The collprotect® membrane underwent material disintegration by connective tissue strands in combination with vessels and multinucleated giant cells. The histomorphometric analyses revealed that the thickness of mucoderm® did not decrease significantly, while an initial significant decrease of membrane thickness in the case of collprotect® membrane was found at day 15. The present results demonstrate that the 2 analyzed collagen membranes underwent a multinucleated giant cell-associated vascularization. Neither of the materials underwent transmembraneous vascularization. The microvessels were found within the preexisting vessel and fatty island skeletons. Additional long-term studies and clinical studies are necessary to determine how the observed foreign body giant cells affect tissue regeneration.

12. Enhanced periodontal regeneration using collagen, stem cells or growth factors.

Basan T, Welly D, Kriebel K, Scholz M, Brosemann A, Liese J, Vollmar B, Frerich B, Lang H. 2017. *Front Biosci (Schol Ed)*; 9:180-193.

<https://www.ncbi.nlm.nih.gov/pubmed/27814584>

The aim of the present study was to examine the regenerative potential of a) different collagen support versus blank, b) different collagen support +/- a growth factor cocktail (GF) and c) a collagen powder versus collagen powder + periodontal ligament stem cells (PDLSCs) comparatively in a large animal model. The stem cells (SC) were isolated from extracted teeth of 15 adult miniature pigs. A total of 60 class II furcation defects were treated with the materials named above. Concluding, a histological evaluation followed. A significant increase in regeneration was observed in all treatment groups. The new attachment formation reached a maximum of 77 percent. In the control group a new attachment formation of 13 percent was observed. The study shows that all implanted materials improved periodontal regeneration, though there were no significant differences between the experimental groups. Within the limitations of this study, it can be assumed that the lack of significant differences is due to the complexity of the clinical setting.

*Study refers to Angiopore (Bredent medical), which was a former private label of collprotect® membrane.

Clinical studies and case series

13. Alveolar ridge augmentation by open healing with high-density polytetrafluoroethylene membrane

Cvetanovska Stojcheva D, Aleksandrovska A, Petrevska M, Micevski B. *Int J. Dent. Biomater. Res.* 2022 Mar;1(1).

<https://jdbr.net/index.php/ijdbr/article/view/6>

Non resorbable polytetrafluoroethylene membranes find great use in everyday oral surgery treatments. We aimed to verify the performance of high-density polytetrafluoroethylene (hdPTFE) membrane in open healing after alveolar ridge augmentation at two patients. For that reason, we raised full thickness flap and grafted with different xenograft granules that were covered with resorbable collagen membrane. Then the grafted area was covered with high-density polytetrafluoroethylene membrane (permamem®) and stabilized with sutures by leaving it partially exposed. Six weeks after open healing, the permamem® was removed and successful post-operative healing with no complications were observed. The newly formed soft tissue grew under the membrane and completely covered the new alveolar ridge volume. There were no signs of dehiscence or infection, and the patients had no pain or discomfort, neither after suture nor the membrane removal. Also, there were no visible signs of bacterial plaque on the membrane after its placement and during removal. After eight months implants were successfully installed, and full mouth prosthetic reconstruction was following the osseointegration. In conclusion, the high-density polytetrafluoroethylene membrane efficiently supported open healing and led to successful alveolar ridge augmentation.

14. Osseointegration at Implants Installed in Composite Bone: A Randomized Clinical Trial on Sinus Floor Elevation

Kotsu M, Apaza Alccayhuaman KA, Ferri M, Iezzi G, Piattelli A, Fortich Mesa N, Botticelli D. *J Funct Biomater.* 2022 Feb 28;13(1):22. doi: 10.3390/jfb13010022.

<https://pubmed.ncbi.nlm.nih.gov/35323222/>

Osseointegration of implants installed in conjunction with sinus floor elevation might be affected by the presence of residual graft. The implant surface characteristics and the protection of the access window using a collagen membrane might influence the osseointegration. To evaluate these factors, sinus floor elevation was performed in patients using a natural bovine bone grafting material. The access windows were either covered with a collagen membrane made of porcine corium (Mb group) or left uncovered (No-Mb group) and, after six months, two mini-implants with either a moderate rough or turned surfaces were installed. After 3 months, biopsies containing the mini-implants were retrieved,

processed histologically, and analyzed. Twenty patients, ten in each group, were included in the study. The two mini-implants were retrieved from fourteen patients, six belonging to the Mb group, and eight to the No-Mb group. No statistically significant differences were found in osseointegration between groups. However, statistically significant differences were found between the two surfaces. It was concluded that implants with a moderately rough surface installed in a composite bone presented much higher osseointegration compared to those with a turned surface. The present study failed to show an effect of the use of a collagen membrane on the access window.

15. Comparison of Injectable Biphasic Calcium Phosphate and a Bovine Xenograft in Socket Preservation: Qualitative and Quantitative Histologic Study in Humans

Čandrić M, Tomas M, Karl M, Malešić L, Včev A, Perić Kačarević Ž, Matijević M. *Int J Mol Sci.* 2022 Feb 25;23(5):2539. doi: 10.3390/ijms23052539.

<https://pubmed.ncbi.nlm.nih.gov/35269686/>

This study is the first histologic evaluation of an injectable biphasic calcium phosphate (IBCP) in humans six months after socket preservation according to the principles of guided bone regeneration. After tooth extraction, the alveolar ridge of 21 patients was augmented with IBCP (maxresorb® inject) in the test group, while 20 patients in the control group received a bovine xenograft (BX) (cerabone®). Six months after augmentation, a reentry procedure was performed to collect biopsies of regenerated bone for qualitative and quantitative histologic analysis. A total of 20 biopsies were taken for analysis. Qualitative histologic analysis showed complete integration of the biomaterial and no inflammatory tissue reaction, indicating the biocompatibility of the bone grafts and the surrounding tissue in both groups. Histomorphometric analysis showed comparable results in terms of newly formed bone (IBCP: $26.47 \pm 14.71\%$, BX: $30.47 \pm 16.39\%$) and residual biomaterial (IBCP: $13.1 \pm 14.07\%$, BX: $17.89 \pm 11.81\%$), with no significant difference found across groups ($p > 0.05$, Mann-Whitney U test). Statistical significance between groups was found in the result of soft tissue percentage (IBCP: $60.43 \pm 12.73\%$, BX: $51.64 \pm 14.63\%$, $p = 0.046$, Mann-Whitney U test). To conclude, IBCP and BX showed good osteoconductivity and biocompatibility with comparable new bone formation six months after alveolar ridge preservation.

16. Preliminary Study with the Use of a Titanium Mesh as Space Maker and Implant Primary Stabilization for One-Stage Sinus Lift in Cases with Less Than 1.5 mm Residual Bone

Filipov I, Bolognesi F, Chirila L, Cristache CM, Corinaldesi G, Park KB. *J Clin Med.* 2021 Oct 22;10(21):4853. doi: 10.3390/jcm10214853.

<https://pubmed.ncbi.nlm.nih.gov/34768375/>

Background: In the lateral area of the maxilla, the alveolar bone can lose significant volume due to maxillary sinus pneumatization following teeth extractions. This preliminary study evaluated the effectiveness of a novel technique for one-stage sinus lifting and simultaneous implant placement in cases with less than 1.5 mm residual alveolar bone. The subsequent survival rate at 1-year post-occlusal

loading was assessed. **Methods:** 15 patients were selected, the main inclusion criteria were the partially edentulous area in the posterior maxilla with alveolar bone height of less than 1.5 mm below the sinus. All of the patients underwent one-stage sinus lifting, along with simultaneous implant placement using a "butterfly" anchorage device to optimize the primary stability and xenograft bone as graft material. At 6 to 9 months after surgery, the anchorage device was removed and implants were loaded. Panoramic x-ray images were used to assess the new bone formation, while the biological stability was measured using resonance frequency analysis. **Results:** 15 implants were inserted. The mean implant stability quotient (ISQ) value was 71.3 (SD = ± 2.51) and the mean healing period was 7.3 (SD = ± 1.23) months. The mean bone height after the healing period was 14.4 (SD = ± 2.05). A statistically significant correlation was found between the healing period and the ISQ value (Spearman rho = 0.684, sig. = 0.005). No statistically significant correlation was found between the ISQ value and the new regenerated bone height (Person r = 0.389, sig. = 0.152). Smoking was identified as a risk factor involved in postoperative complications. **Conclusions:** The results of the present preliminary study demonstrated that the proposed "butterfly" technique was effective when performing one-stage sinus lifting and simultaneous implant placement in cases with less than 1.5 mm of residual alveolar bone. The survival rate was 100% at 1-year post occlusal loading.

17. Sinus Mucosa Thickness Changes and Ostium Involvement after Maxillary Sinus Floor Elevation in Sinus with Septa. A Cone Beam Computed Tomography Study

Kato S, Omori Y, Kanayama M, Hirota A, Ferri M, Apaza Alccayhuaman KA, Botticelli D. *Dent J (Basel)*. 2021 Jul 21;9(8):82. doi: 10.3390/dj9080082.

<https://pubmed.ncbi.nlm.nih.gov/34435994/>

Background: A thickening of the sinus mucosa is observed after sinus floor augmentation. **The objective of this retrospective study was to evaluate the influence of the presence of septa in the dimensional variation and ostium involvement over time of the Schneiderian mucosa after sinus floor augmentation.** **Materials and methods:** Fifteen sinuses with septa (septa group) and 15 without (control group) were selected. CBCTs taken before surgery, and were analyzed after 1 week and after 9 months. Schneiderian membrane thickness changes over time and involvement of the ostium were evaluated. **Results:** Four perforations occurred in the septa group and none in the control group. After 1 week of healing, the sinus mucosa thickness increased in height by 5.7 mm and 7.1 mm in the septa and control groups, respectively. In this period, the patency of the ostium decreased in both groups, and three infundibula were obstructed in the septa group, and five in the control group. The mucosa was thicker and the edema was closer to the ostium in the control compared to in the septa group. After 9 months of healing, the dimensions regressed to normal pattern and no obstruction of the infundibula were observed. No statistically significant differences were found between septa and control groups. **Conclusions:** after one week of healing, the sinus mucosa increased in dimensions in both septa and control groups. However, the sinus mucosa presented a tendency of being thicker and closer to the ostium, resulting in a higher number of infundibula obstructions, in the control group compared to in the septa group. After 9 months, the sinus mucosa regressed to normal dimensions and no obstructions of the infundibula were observed in any group.

18. Influence of Anatomical Parameters on the Dimensions of the Subantral Space and Sinus Mucosa Thickening after Sinus Floor Elevation. A Retrospective Cone Beam Computed Tomography Study

Omori Y, Nakajima Y, Imai H, Yonezawa D, Ferri M, Apaza Alccayhuaman KA, Botticelli D. Dent J (Basel). 2021 Jun 24;9(7):76. doi: 10.3390/dj9070076.

<https://pubmed.ncbi.nlm.nih.gov/34202457/>

Background: Various anatomical parameters might influence the surgical approach for maxillary sinus floor elevation. The objective of the present study was to retrospectively evaluate the influence of anatomical parameters on the dimensions of the subantral space and of the sinus mucosa thickening after sinus floor elevation. **Material and methods:** Seventy-eight maxillary sinuses in sixty-five patients were evaluated on cone beam computed tomographies taken before surgery and after one week (t1w) and nine months (t9m). Several parameters such as the distance XF between an axis parallel to the base of the nose (X-axis) and the sinus floor (F) were correlated with the height gain (IF) at t1w and t9m and the post-surgical edema. **Results:** A weak significant positive correlation was observed between height gain vs. sinus height of interest (XF), the balcony, and the sinus floor angle. The post-surgical edema was influenced by the initial mucosa thickness and the xenograft used. **Conclusions:** Various parameters might affect height gain and sinus mucosa thickening after sinus floor elevation. The height of interest, the balcony, and the sinus floor angle showed significant correlations with height gain. The initial thickness of the mucosa and the biomaterial used influenced the post-surgical edema.

19. Effect of systemic antibiotics on the outcomes of regenerative periodontal surgery in intrabony defects: a randomized, controlled, clinical study

Pietruska M, Dolińska E, Milewski R, Sculean A. Clin Oral Investig. 2021 May;25(5):2959-2968. doi: 10.1007/s00784-020-03616-7.

<https://pubmed.ncbi.nlm.nih.gov/33048260/>

Objectives: To assess the potential influence of systemic antibiotic administration on the healing of periodontal intrabony defects treated with deproteinized bovine bone mineral (DBBM) and collagen membrane. **Materials and methods:** Forty-one intrabony defects were treated by means of DBBM and collagen membrane (GTR). Postoperatively, the patients received either systemic antibiotics (i.e., 1 g of amoxicillin, twice daily for 7 days) (test) or no antibiotics (control). Clinical attachment level (CAL), probing depth (PD), and gingival recession (GR) were measured at baseline and at 1 year following regenerative surgery. The depth of the intrabony component (INTRA DD) and its width (INTRA DW) were measured during surgery and after 1 year at reentry. The depth (RxD) and width (RxW) of the intrabony defects were evaluated radiographically at baseline and at 1 year. **Results:** No adverse events were observed in any of the two groups throughout the entire study period. In the test group, mean CAL changed from 8.7 ± 1.4 mm at baseline to 5.0 ± 1.7 mm at 1 year ($p < 0.0001$), while PD decreased from 7.8 ± 1.5 mm at baseline to 4.0 ± 0.9 mm at 1 year ($p < 0.0001$). In the control group, mean CAL changed from 8.6 ± 1.9 mm to 5.9 ± 1.6 mm ($p < 0.001$) and mean PD improved from 7.4 ± 1.3 mm to 4.1 ± 1.3 mm ($p < 0.001$). Mean CAL gain measured 3.6 ± 1.6 mm in the test and 2.7 ± 1.6 mm in the control group, respectively. Defect fill (i.e., INTRA DD gain) at re-entry measured 3.7 ± 1.8 mm in the test and 2.7 ± 2.1 mm in the control group. A CAL gain of ≥ 3 mm was measured in 76% of the defects

in the test group and in 40% of the defects in the control group, respectively. In both groups, all evaluated clinical and radiographic parameters improved statistically significantly compared with baseline, but no statistically significant differences were found between the two groups. Conclusions: Within their limits, the present study has failed to show any substantial added clinical benefits following the postoperative administration of amoxicillin in conjunction with regenerative periodontal surgery using DBBM and GTR.

20. Two-Year Follow-Up of 4-mm-Long Implants Used as Distal Support of Full-Arch FDPs Compared to 10-mm Implants Installed after Sinus Floor Elevation. A Randomized Clinical Trial

Rossi F, Tuci L, Ferraioli L, Ricci E, Suerica A, Botticelli D, Pellegrino G, Felice P. *Int J Environ Res Public Health*. 2021 Apr 6;18(7):3846. doi: 10.3390/ijerph18073846.

<https://pubmed.ncbi.nlm.nih.gov/33917587/>

Background: In edentulous patients, bone resorption cannot allow the installation of standard implants and it is demanded to use short implants in the residual alveolar bone or longer implants in grafted bone. **Aim:** To compare the survival and bone level changes of standard plus short 4-mm implants used as distal support of a maxillary full-arch fixed dental prostheses (FDPs) with standard (10-mm) implants placed in association with a bilateral sinus floor augmentation procedure. **Material and methods:** Full-arch FDPs supported by six implants were randomly placed in both groups. In the control group, all implants were 10 mm long and 4.1 mm in diameter. The distal implant in both sides of the maxilla was installed after 4 months from bilaterally sinus floor elevation. In the test group (short group), the distal implant in both sides of the maxilla was 4 mm long and 4.1 mm in diameter. No sinus floor elevations were performed in the test group. Clinical assessments and X-rays were taken at prosthesis delivering and after 6, 12, 18, and 24 months. Patient-reported outcome measures (PROMs) were also evaluated before surgery and after 6, 12, and 24 months. **Results:** The changes over time of the bone level for the short implants were -0.01 ± 0.11 mm, -0.04 ± 0.13 mm, -0.17 ± 0.29 mm, and -0.28 ± 0.37 mm after 6, 12, 18, and 24 months from prosthesis delivering, respectively. For the standard implants, bone changes were -0.21 ± 0.33 mm ($p = 0.103$), -0.30 ± 0.32 mm ($p = 0.023$), -0.40 ± 0.37 mm ($p = 0.144$), and -0.54 ± 0.49 mm ($p = 0.128$), respectively. A statistically relevant difference was found only at 12 months after loading between the two groups. **Conclusions:** Similar results on implant survival rate and marginal bone loss were observed for the short and standard implants, placed in association with a bilateral sinus floor augmentation procedure, used as distal support of a maxillary full-arch FDP. A statistically relevant difference was found only at 12 months after loading between the two groups ($p = 0.023$).

21. Reconstructive surgical treatment of isolated deep intrabony defects with guided tissue regeneration using entire papilla preservation technique: A prospective case series

Aslan S, Buduneli N, Cortellini P. *J Periodontol*. 2021 Apr;92(4):488-495. doi: 10.1002/JPER.20-0288.

<https://pubmed.ncbi.nlm.nih.gov/32822062/>

Background: The aim of this prospective study is to evaluate the clinical applicability of the entire papilla preservation (EPP) technique in the regenerative treatment of isolated deep intrabony defects using native collagen membrane and bone grafting materials. **Methods:** Fifteen healthy and non-smoker patients (nine males and six females; mean age: 47.73 ± 12.18 ; range 21 to 63 years) with one isolated deep intrabony defect each (baseline probing depth (PD): 9.03 ± 1.62 mm; clinical attachment level (CAL): 11.16 ± 1.81 mm) were treated with guided tissue regeneration. Surgical access to the defect was provided by a single buccal vertical incision with an interdental tunneling flap. Following the granulation tissue removal, intrabony defect was filled with bone substitutes. A collagen barrier was trimmed and placed under the intact defect-associated papilla with palatal positioning suture. Microsurgical sutures were used for primary closure. **Results:** At 1 week, healing of the 15 sites was uneventful. During the study, all sites showed 100% primary closure rate. At 1-year follow-up, an average CAL gain of 5.86 ± 1.28 mm ($P < 0.0001$), PD reduction of 6.1 ± 1.47 mm ($P < 0.0001$), and minimal increase in gingival recession of 0.23 ± 0.62 mm ($P = 0.168$) were observed. **Conclusion:** This novel surgical technique, that keeps the interdental papilla intact, seems promising to provide optimal biomaterial protection and healing conditions, even when a collagen barrier and bone substitutes are applied.

22. Alveolar ridge preservation in defect sockets in the maxillary aesthetic zone followed by single-tooth bone level tapered implants with immediate provisionalization: a 1-year prospective case series

Meijndert CM, Raghoobar GM, Vissink A, Meijer HJA. *Int J Implant Dent.* 2021 Feb 19;7(1):18. doi: 10.1186/s40729-021-00292-4.

<https://pubmed.ncbi.nlm.nih.gov/33604747/>

Background: Clinical studies of single-tooth replacement in compromised bone using bone level tapered implants in the aesthetic zone are scarce. **Aim:** To assess clinically, radiographically and aesthetically over 1 year the performance of a bone level tapered implant in the maxillary aesthetic zone in sites after alveolar ridge preservation. **Material and methods:** Thirty patients (16 male, 14 female) with a failing tooth and large bone defect after removal received alveolar ridge preservation. After 3 months, implants were placed with immediate provisionalization. Definitive restorations were placed after 3 months. The treatment was evaluated 1 year following the definitive restoration. **Results:** All the patients attended the 1-year follow-up. One implant was lost (96.7% implant survival rate). The mean implant stability quotient value was 68.9 ± 8.74 at implant placement. The mean marginal bone level change was minor (-0.07 ± 0.12 mm). The mean mid-buccal mucosa changed with $+0.01 \pm 0.45$ mm. The median Pink Esthetic Score and White Esthetic Score after 1 year were 6 [4; 7] and 8 [7; 9], respectively. The patients' mean overall satisfaction (0-100 VAS scale) was 86.6 ± 10.3 . **Conclusion:** Bone level tapered implants with immediate provisionalization perform well after alveolar ridge preservation in the maxillary aesthetic zone, according to implant stability, clinical, radiographic, aesthetic and patient-centred outcomes.

23. Effect of systemic antibiotics on the outcomes of regenerative periodontal surgery in intrabony defects: a randomized, controlled, clinical study

Pietruska M, Dolińska E, Milewski R, Sculean A. Clin Oral Invest. 2020 Oct;25:2959–2968. doi.org/10.1007/s00784-020-03616-7.

<https://link.springer.com/article/10.1007/s00784-020-03616-7#citeas>

Objectives: To assess the potential influence of systemic antibiotic administration on the healing of periodontal intrabony defects treated with deproteinized bovine bone mineral (DBBM) and collagen membrane. **Materials and methods:** Forty-one intrabony defects were treated by means of DBBM and collagen membrane (GTR). Postoperatively, the patients received either systemic antibiotics (i.e., 1 g of amoxicillin, twice daily for 7 days) (test) or no antibiotics (control). Clinical attachment level (CAL), probing depth (PD), and gingival recession (GR) were measured at baseline and at 1 year following regenerative surgery. The depth of the intrabony component (INTRA DD) and its width (INTRA DW) were measured during surgery and after 1 year at reentry. The depth (RxD) and width (RxW) of the intrabony defects were evaluated radiographically at baseline and at 1 year. Results: No adverse events were observed in any of the two groups throughout the entire study period. In the test group, mean CAL changed from 8.7 ± 1.4 mm at baseline to 5.0 ± 1.7 mm at 1 year ($p < 0.0001$), while PD decreased from 7.8 ± 1.5 mm at baseline to 4.0 ± 0.9 mm at 1 year ($p < 0.0001$). In the control group, mean CAL changed from 8.6 ± 1.9 mm to 5.9 ± 1.6 mm ($p < 0.001$) and mean PD improved from 7.4 ± 1.3 mm to 4.1 ± 1.3 mm ($p < 0.001$). Mean CAL gain measured 3.6 ± 1.6 mm in the test and 2.7 ± 1.6 mm in the control group, respectively. Defect fill (i.e., INTRA DD gain) at re-entry measured 3.7 ± 1.8 mm in the test and 2.7 ± 2.1 mm in the control group. A CAL gain of ≥ 3 mm was measured in 76% of the defects in the test group and in 40% of the defects in the control group, respectively. In both groups, all evaluated clinical and radiographic parameters improved statistically significantly compared with baseline, but no statistically significant differences were found between the two groups. **Conclusions:** Within their limits, the present study has failed to show any substantial added clinical benefits following the postoperative administration of amoxicillin in conjunction with regenerative periodontal surgery using DBBM and GTR. **Clinical relevance:** The post-surgically administration of systemic antibiotics does not seem to be necessary following regenerative periodontal surgery.

24. Tomographic Assessment on the Influence of the Use of a Collagen Membrane on Dimensional Variations to Protect the Antrostomy After Maxillary Sinus Floor Augmentation: A Randomized Clinical Trial

Imai H, Lang NP, Ferri M, Hirota A, Apaza Alccayhuaman KA, Botticelli D. Int J Oral Maxillofac Implants. 2020 Mar/Apr;35(2):350-356. doi: 10.11607/jomi.7843.

<https://pubmed.ncbi.nlm.nih.gov/32142572/>

Purpose: To evaluate the dimensional variations after elevation of the maxillary sinus floor and the healing of the antrostomy left unprotected or protected by a collagen membrane. **Materials and methods:** Twenty patients were included in the study. After the elevation of the sinus mucosa, natural bovine bone was grafted into the elevated space. In 10 randomly selected patients, a native collagen membrane made of porcine corium was placed on the antrostomy (membrane group). In the other 10 patients, the antrostomy was left uncovered (no-membrane group). Cone beam computed tomography (CBCT) images were taken for all patients before surgery (T0), 1 week after sinus floor augmentation (T1), and after 9 months of healing (T2), and evaluations of dimensional variations over time of soft and

hard tissues were performed. **Results:** At T1, the elevation of the sinus floor in the middle aspect was 12.5 ± 3.8 mm and 11.9 ± 3.6 mm in the membrane and no-membrane groups, respectively. At T2, the reduction in height of the elevated space was 0.6 ± 0.9 mm and 0.8 ± 0.8 mm in the membrane and no-membrane groups, respectively. The elevated area decreased between ~10% and 11% in the membrane group and between ~15% to 20% in the no-membrane group. However, no statistically significant differences were found. **Conclusion:** The use of a collagen membrane to cover the antrostomy after sinus floor elevation did not produce significant clinical effects on dimensional variations over time.

25. Rehabilitation of an extremely edentulous atrophic maxilla with a pseudoskeletal class III relationship

Zafiroopoulos GG, Yoon TH, Abuzayda M. 2019. *Case Rep Dent*; 2019:5696837.

<https://www.ncbi.nlm.nih.gov/pubmed/31179133>

Aim: Description of the rehabilitation of a 67-year-old patient with a pseudoskeletal class III relationship. The mandible was restored with two implant-supported bar-retained overdentures using clips for retention. The extremely atrophic maxilla was restored with a combination of sinus augmentation, implant placement, and classic prosthodontic treatment using an electroformed mesostructured overdenture with swivel lock attachments on an implant-supported bar. By performing minimal augmentative and implant surgeries and using the possibilities and advantages of classic prosthetic dentistry, the clinical situation described here could be managed and the atrophic maxilla could be rehabilitated.

26. Bone Graft Displacement After Maxillary Sinus Floor Augmentation With or Without Covering Barrier Membrane: A Retrospective Computed Tomographic Image Evaluation.

Ohayon L, Taschieri S, Friedmann A, Del Fabbro M. 2019. *Int J Oral Maxillofac Implants*; 34(3):681–691.

<https://www.ncbi.nlm.nih.gov/pubmed/30521657>

The aim of this study was to evaluate the stability of the bone substitute after a maxillary sinus floor augmentation procedure with or without using a covering membrane (collprotect® membrane).

MATERIALS AND METHODS: This retrospective study evaluated all patients who were enrolled between April 2016 and January 2017. The stability of the bone graft inside the sinus cavity as well at the level of the lateral bone window was assessed through preoperative and postoperative cone beam computed tomography images up to 6-month follow-up. The clinical postoperative morbidity was evaluated following a visual analog scale (VAS) protocol. **RESULTS:** Maxillary sinus floor augmentation with a lateral approach was performed in 41 patients. In 17 cases (10 women/7 men, mean age: 55.4 years), a barrier membrane (collprotect® membrane) was used to cover the lateral bone window (control group), and in 24 cases (13 women/11 men, mean age: 56.2 years), no

membrane was used (test group). The bone graft dislodgement within the buccal mucosa at 6 months postoperative ranged from 0 to 12.2 mm (mean value: 3.8 ± 3.1 [standard deviation] mm) in the test group and from 0 to 2.3 mm (mean value: 0.5 ± 0.4 mm) in the control group. The postoperative pain and swelling complications were significantly more important for the test group ($3.3 \pm 1.4/4.3 \pm 4.5$, respectively) than for the control group ($2.1 \pm 0.9/2.7 \pm 0.9$). **CONCLUSION:** On the basis of this preliminary study, it appears that, the use of a barrier membrane to cover the lateral bone window during maxillary sinus floor augmentation surgery with a lateral approach, reduces the postoperative dislodgement of the bone graft throughout the sinus antrostomy. Furthermore, it prevents the bone substitute particles to penetrate within the buccal mucosa, which is related to postoperative morbidity.

27. Effect of Deproteinized Bovine Bone Mineral at Implant Dehiscence Defects Grafted by the Sandwich Bone Augmentation Technique.

Wen SC, Fu JH, Wang HL. 2018. *Int J Periodontics Restorative Dent*; 38(1):79-85.

<https://www.ncbi.nlm.nih.gov/pubmed/29240209>

Aim of this study was to compare the amount of radiographic horizontal buccal bone thickness (BBT) at implant dehiscence defects grafted with the sandwich bone augmentation (SBA) and modified sandwich bone augmentation (MSBA) techniques. Compared to the SBA technique, the MSBA approach involved an additional outer layer of deproteinized bovine bone mineral (DBBM) to maintain the space for bone regeneration for longer periods. A total of 19 patients, each with a buccal implant dehiscence defect, were recruited. The control group was treated with SBA technique ($n = 10$), while the test group was treated with MSBA technique. Cone beam computed tomography (CBCT) scans, taken at three time points (before and immediately after implant surgery, and 6 months post-treatment) were used to assess the BBT at the implant platform (-1.8 mm), the rough-smooth junction (0 mm), and 2, 4, 6, 8, and 10 mm apical to the rough-smooth junction. At 6 months post-surgery, the mean BBT in control and test groups was 1.69 ± 0.38 mm and 2.55 ± 0.21 mm, respectively. Mean BBT was significantly greater in the test group at 2, 4, 6, and 8 mm apical to the rough-smooth junction. There was no statistical difference in the mean BBT at the implant platform, the rough-smooth junction, and 10 mm apical to the rough-smooth junction between the two groups ($P > .05$). Within the limitations of this study, it was concluded that the additional layer of DBBM enhanced BBT along the implant, except at the smooth collar.

28. Effect of sex-hormone levels, sex, body mass index and other host factors on human craniofacial bone regeneration with bioactive tricalcium phosphate grafts.

Knabe C, Mele A, Kann PH, Peleska B, Adel-Khattab D, Renz H, Reuss A, Bohner M, Stiller M. 2017. *Biomaterials*; 123:48-62.

<https://www.ncbi.nlm.nih.gov/pubmed/28160669>

The aim of this study was to elucidate the associations between these factors and bone formation after sinus floor augmentation procedures (SFA) utilizing a bioactive tricalcium phosphate (TCP) bone grafting material. We conducted a prospective study in a human population in which 60 male and 60 female participants underwent SFA and dental implant placement using a staged approach. BMI as well as levels of serum estradiol (E2), total testosterone (TT), and the free androgen index (FAI) were measured by radioimmunoassay and electrochemoluminescent-immunoassay. At implant placement, 6 months after SFA, bone biopsy specimens were harvested for hard tissue histology, the amount of bone formation was evaluated by histomorphometry and immunohistochemical analysis of osteogenic marker expression. The Wilcoxon rank-sum U test, Spearman correlations and linear regression analysis were used to explore the association between bone formation and BMI, hormonal and other host factors. BMI and log E2 were significantly positively associated with bone formation in male individuals ($p < 0.05$). Histomorphometry revealed trends toward greater bone formation and osteogenic marker expression with non-smokers compared to smokers. In male patients, higher E2 levels and higher BMI enhanced TCP stimulated craniofacial i.e. intramembranous bone repair.

29. Comparison of two different xenografts in bilateral sinus augmentation: radiographic and histologic findings.

Panagiotou D, Özkan Karaca E, Dirikan İpçi Ş, Çakar G, Olgaç V, Yılmaz S. 2015. *Quintessence Int*; 46(7):611-9.

<https://www.ncbi.nlm.nih.gov/pubmed/25699296>

The aim of this study was to evaluate the radiographic and histomorphometric results of two different xenografts in bilateral sinus augmentation in patients with posterior maxillary atrophy. **METHOD AND MATERIALS:** Eight patients with less than 5 mm residual alveolar bone height were included in this study. One side was augmented with bovine bone graft-1 and the other side with bovine bone graft-2. Radiographic analyses were performed before and after augmentation, and before the implant placement. After 8 months of healing period, bone biopsies were obtained during implant placement. **RESULTS:** No statistically significant difference was found between the groups, based on post-augmentation and pre-implantation graft heights ($P > .05$). Histomorphometric evaluation demonstrated 24.63 % and 29.13 % newly formed bone in the graft-1 and graft-2 groups, respectively. Intergroup differences were not significant for the mean percentage of new bone formation ($P > .05$). **CONCLUSION:** Within the limitations of this study, it can be concluded that xenograft materials resulted in satisfactory bone height and trabecular new bone formation, and they could be used for the rehabilitation of atrophic maxillae.

30. The concept of Screw-Guided Bone Regeneration (S-GBR). Part 2: S-GBR in the severely resorbed preimplant posterior mandible using bone xenograft and Leukocyte and Platelet-Rich Fibrin (L-PRF): a 5-year follow-up.

Toeroek R. and Dohan Ehrenfest DM. 2013. *POSEIDO*; 1(2): 85-92



<http://www.poseido.info/publication/volume-1-2013/poseido-20131285-92-toeroek.pdf>

A specific form of GBR was developed using screws as space maintainers and regenerative pillars for the protection and bone growth orientation of the bone regenerative compartment, and was termed **Screw-Guided Bone Regeneration (S-GBR)**. This approach appeared particularly adapted to the posterior mandible sites, as the screws are efficient support and protection for the bone regenerative chamber against the various mechanical constraints. This form of GBR can be associated with non-resorbable or resorbable membranes and various combinations of bone materials, but the use of Leukocyte- and Platelet-Rich Fibrin (L-PRF, Intra-Spin system, Intra-Lock, Boca-Raton, FL, USA) membranes became a very logical addition to any S-GBR protocol.

*Study refers to BoneProtect Guide (Dentegris), which is a private label of collprotect® membrane.

06/2023