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

1. Differences in Mechanical and Physicochemical Properties of Several PTFE Membranes Used in Guided Bone Regeneration.

   Qasim SSB, Al-Asfour AA, Abuzayeda M, Mohamed AM, Trajkovski B, Murray CA, Zafiropoulos GG. Materials (Basel). 2023 Jan 17;16(3):904. doi: 10.3390/ma16030904.

   https://pubmed.ncbi.nlm.nih.gov/36769909/

   Non-resorbable PTFE membranes are frequently used in dental-guided bone regeneration (GBR). However, there is a lack of detailed comparative studies that define variations among commonly used PTFE membranes in daily dental clinical practice. The aim of this study was to examine differences in physicochemical and mechanical properties of several recent commercial PTFE membranes for dental GBR (CytoplastTM TXT-200, permamem®, NeoGen®, Surgitime, OsseoGuard®-TXT, OsseoGuard®-NTXT). Such differences have been rarely recorded so far, which might be a reason for the varied clinical results. For that reason, we analyzed their surface architecture, chemical composition, tensile strength, Young's modulus, wettability, roughness, density, thickness and porosity. SEM revealed different microarchitectures among the non-textured membranes; the textured ones had hexagonal indentations and XPS indicated an identical spectral portfolio in all membranes. NeoGen® was determined to be the strongest and OsseoGuard®-TXT was the most elastic. Wettability and roughness were highest for Surgitime but lowest for OsseoGuard®-NTXT. Furthermore, permamem® was the thinnest and NeoGen® was identified as the thickest investigated GBR membrane. The defect volumes and defect volume ratio (%) varied significantly, indicating that permamem® had the least imperfect structure, followed by NeoGen® and then Cytoplast TM TXT-200. These differences may potentially affect the clinical outcomes of dental GBR procedures.

2. Adhesion of Oral Bacteria to Commercial d-PTFE Membranes: Polymer Microstructure Makes a Difference

   Begić G, Petković Didović M, Lučić Blagojević S, Jelovica Badovinac I, Žigon J, Perčić M, Cvijanović Peloza O, Gobin I. Int J Mol Sci. 2022 Mar;23(6):2983. doi: 10.3390/ijms23062983.

   https://pubmed.ncbi.nlm.nih.gov/35328404/

   Bacterial contamination of the membranes used during guided bone regeneration directly influences the outcome of this procedure. In this study, we analyzed the early stages of bacterial adhesion on two commercial dense polytetrafluoroethylene (d-PTFE) membranes in order to identify microstructural features that led to different adhesion strengths. The microstructure was investigated by X-ray diffraction (XRD), differential scanning calorimetry (DSC), and Fourier transform infrared (FTIR). The surface properties were analyzed by atomic force microscopy (AFM), scanning electron microscopy

(SEM), and surface free energy (SFE) measurements. Bacterial properties were determined using the microbial adhesion to solvents (MATS) assay, and bacterial surface free energy (SFE) was measured spectrophotometrically. The adhesion of four species of oral bacteria (Streptococcus mutans, Streptococcus oralis, Aggregatibacter actinomycetemcomitas, and Veilonella parvula) was studied on surfaces with or without the artificial saliva coating. The results indicated that the degree of crystallinity (78.6% vs. 34.2%, with average crystallite size 50.54 nm vs. 32.86 nm) is the principal feature promoting the adhesion strength, through lower nanoscale roughness and possibly higher surface stiffness. The spherical crystallites ("warts"), observed on the surface of the highly crystalline sample, were also identified as a contributor. All bacterial species adhered better to a highly crystalline membrane (around 1 log10CFU/mL difference), both with and without artificial saliva coating. Our results show that the changes in polymer microstructure result in different antimicrobial properties even for chemically identical PTFE membranes.

3. Bacterial Growth on Three Non-Resorbable Polytetrafluoroethylene (PTFE) Membranes-An In Vitro Study.

Zelikman H, Slutzkey G, Rosner O, Levartovsky S, Matalon S, Beitlitum I. Materials (Basel). 2022 Aug 18;15(16):5705. doi: 10.3390/ma15165705.

https://pubmed.ncbi.nlm.nih.gov/36013840/

GBR (Guided Bone Regeneration) procedure is challenged by the risk of membrane exposure to the oral cavity and contamination. The barrier quality of these membranes serve as a mechanical block from bacterial penetration into the GBR site. The purpose of this in vitro study was to evaluate the antibacterial effect of three commercial non-resorbable polytetrafluoroethylene membranes (Two d-PTFE membranes and one double layer e-PTFE +d-PTFE membrane). A validated in vitro model with two bacterial species (Streptococcus sanguinis and Fusobacterium nucleatum) was used. Eight samples from membrane each were placed in a 96-well microtiter plate. The experimental and positive control groups were exposed to a bacterial suspension which involved one bacterial species in each plate. Bacterial growth was monitored spectrophotometrically at 650 nm for 24 h in temperature controlled microplate spectrophotometer under anaerobic conditions. One- Sample Kolmogorov–Smirnov Normal test and the Kruskal–Wallis test was used for the statistical analysis. As shown by the bacterial growth curves obtained from the spectrophotometer readings, all three membranes resulted in bacterial growth. We have not found a statistical difference in F. nucleatum growth between different membrane samples and the positive control group. However, S. sanguinis growth was reduced significantly in the presence of two membranes (CYTOPLAST TXT-200 and NeoGenTM) when compared to the control ($p < 0.01$). The presence of Permamem® had no significant influence on S. sanguinis growth. Some types of commercial non-resorbable PTFE membranes may have an impact on the growth dynamics of specific bacterial species.

4. A new semi-orthotopic bone defect model for cell and biomaterial testing in regenerative medicine

Andrés Sastre E, Nossin Y, Jansen I, Kops N, Intini C, Witte-Bouma J, van Rietbergen B, Hofmann S, Ridwan Y, Gleeson JP, O'Brien FJ, Wolvius EB, van Osch GJVM, Farrell EBiomaterials. 2021 Dec;279:121187. doi: 10.1016/j.biomaterials.2021.121187.

https://pubmed.ncbi.nlm.nih.gov/34678648/

In recent decades, an increasing number of tissue engineered bone grafts have been developed. However, expensive and laborious screenings *in vivo* are necessary to assess the safety and efficacy of their formulations. Rodents are the first choice for initial *in vivo* screens but their size limits the dimensions and number of the bone grafts that can be tested in orthotopic locations. Here, we report the development of a refined murine subcutaneous model for semi-orthotopic bone formation that allows the testing of up to four grafts per mouse one order of magnitude greater in volume than currently possible in mice. Crucially, these defects are also "critical size" and unable to heal within the timeframe of the study without intervention. The model is based on four bovine bone implants, ring-shaped, where the bone healing potential of distinct grafts can be evaluated *in vivo*. In this study we demonstrate that promotion and prevention of ossification can be assessed in our model. For this, we used a semi-automatic algorithm for longitudinal micro-CT image registration followed by histological analyses. Taken together, our data supports that this model is suitable as a platform for the real-time screening of bone formation, and provides the possibility to study bone resorption, osseointegration and vascularisation.

5. *In Vivo* Analysis of the Biocompatibility and Macrophage Response of a Non-Resorbable PTFE Membrane for Guided Bone Regeneration

Korzinskas T, Jung O, Smeets R, Stojanovic S, Najman S, Glenske K, Hahn M, Wenisch S, Schnettler R, Barbeck M. 2018. Int J Mol Sci. Sep 27;19(10):2952.

https://pubmed.ncbi.nlm.nih.gov/30262765/

The use of non-resorbable polytetrafluoroethylene (PTFE) membranes is indicated for the treatment of large, non-self-containing bone defects, or multi-walled defects in the case of vertical augmentations. However, less is known about the molecular basis of the foreign body response to PTFE membranes. In the present study, the inflammatory tissue responses to a novel high-density PTFE (dPTFE) barrier membrane have preclinically been evaluated using the subcutaneous implantation model in BALB/c mice by means of histopathological and histomorphometrical analysis methods and immunohistochemical detection of M1- and M2-macrophages. A collagen membrane was used as the control material. The results of the present study demonstrate that the tissue response to the dPTFE membrane involves inflammatory macrophages, but comparable cell numbers were also detected in the implant beds of the control collagen membrane, which is known to be biocompatible. Although these data indicate that the analyzed dPTFE membrane is not fully bioinert, but its biocompatibility is comparable to collagen-based membranes. Based on its optimal biocompatibility, the novel dPTFE

barrier membrane may optimally support bone healing within the context of guided bone regeneration (GBR).

2. Clinical studies and case series

6. Reconstruction of vertical alveolar ridge deficiencies utilizing a high-density polytetrafluoroethylene membrane /clinical impact of flap dehiscence on treatment outcomes: case series/

   Palkovics D, Bolya-Orosz F, Pinter C, Molnar B, Windisch P. BMC Oral Health. 2022 Nov 15;22(1):490. doi: 10.1186/s12903-022-02513-7.

   https://botiss.com/product/reconstruction-of-vertical-alveolar-ridge-deficiencies-utilizing-a-high-density-polytetrafluoroethylene-membrane-clinical-impact-of-flap-dehiscence-on-treatment-outcomes-case-series/

   Objectives: The aim of this study was to evaluate the effects of membrane exposure during vertical ridge augmentation (VRA) utilizing guided bone regeneration with a dense polytetrafluoroethylene (d-PTFE) membrane and a tent-pole space maintaining approach by registering radiographic volumetric, linear and morphological changes. **Methods:** In 8 cases alveolar ridge defects were accessed utilizing a split-thickness flap design. Following flap elevation VRA was performed with tent-pole space maintaining approach utilizing the combination of a non-reinforced d-PTFE membrane and a composite graft (1:1 ratio of autogenous bone chips and bovine derived xenografts). Three-dimensional radiographic evaluation of hard tissue changes was carried out with the sequence of cone-beam computed tomography (CBCT) image segmentation, spatial registration and 3D subtraction analysis. **Results:** Class I or class II membrane exposure was observed in four cases. Average hard tissue gain was found to be 0.70 cm3 ± 0.31 cm3 and 0.82 cm3 ± 0.40 cm3 with and without membrane exposure resulting in a 17% difference. Vertical hard tissue gain averaged 4.06 mm ± 0.56 mm and 3.55 mm ± 0.43 mm in case of submerged and open healing, respectively. Difference in this regard was 14% between the two groups. Horizontal ridge width at 9-month follow-up was 5.89 mm ± 0.51 mm and 5.61 mm ± 1.21 mm with and without a membrane exposure respectively, resulting in a 5% difference. **Conclusions:** With the help of the currently reported 3D radiographic evaluation method, it can be concluded that exposure of the new-generation d-PTFE membrane had less negative impact on clinical results compared to literature data reporting on expanded polytetrafluoroethylene membranes.

7. The use of synthetic non-resorbable barrier membrane in alveolar ridge preservation technique: A case series

   K.N. Termizi, N.F.S. Abdul Nasser, A. Yuliana, F. Ariffin. 2022 Poster EuroPerio Copenhagen

Background: Alveolar bone resorption is one of the main outcomes of tooth extraction. Hence, to reduce the alveolar bone resorption, a technique known as alveolar ridge preservation (ARP) was advised. In this case series, the aims were to study the efficacy of synthetic non-resorbable barrier membrane and bone graft in ARP procedure as well as to measure the radiographical outcome involving alveolar bone height and width. **Description of the procedure:** Four patients indicated for tooth extraction and planned for a dental implant. These non-restorable teeth were atraumatically extracted without raising a flap. The socket was immediately grafted with spongious bone substitute particles (deproteinised bovine bone mineral (90%) in a collagen matrix (10%) (DBBMC)). Autologous concentrated growth factor (CGF) was placed onto the bone graft to aid with the healing process. The extraction socket was later covered using a synthetic, non-resorbable Polytetrafluoroethylene (PTFE) membrane, Permamem®. Multiple simple interrupted sutures were applied to provide primary closure. Evaluation of alveolar bone height achieved from the procedure was assessed using an intraoral periapical radiograph (IOPA) taken 6 months after ARP. **Outcomes:** Healing was uneventful in all patients. One of the PTFE membranes was dislodged one-day post-op but the other three were maintained until 3 weeks. Clinical and radiological follow-up examinations at three-month and six-month revealed stable and successful results related to functional and aesthetic outcomes. **Conclusions:** Within the limitation of this case series, the usage of non-resorbable PTFE membrane together with the CGF in the ARP procedure could reduce the patient's morbidity. In addition, the practicality of utilizing this membrane could aid the clinician in delivering a successful ARP procedure and eventually promote a promising outcome.

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

Cvetanovska Stojcheva D, Aleksandrovska A, Petrevska M, Micevski B. International Journal of Dental Biomaterials Research. 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.

9. DIODE LASER PHOTOCOAGUALTION AS A NOVEL METHOD FOR SOCKET SEALING DURING ALVEOLAR SOCKET PRESERVATION

Kamal, A. A., Khadr, A., Abd El Aziz, M., & Taalab, M. R. Alexandria Dental Journal. 2021 Aug; 46(2), 54-62. Doi: 10.21608/ADJALEXU.2020.28747.1066.

https://adjalexu.journals.ekb.eg/article_140523.html

Introduction: Socket preservation is a procedure after tooth extraction to limit the post-extraction reduction of the ridge volume. Non-contact laser photocoagulation is a simple and atraumatic method used for socket sealing. Objectives: Compare the effect of diode laser photocoagulation to the non-resorbable dense polytetraflouoroethylene (dPTFE) membrane on the bone dimensional changes. **Materials and methods:** Thirty-six patients (n =18 for each group) with non-restorable maxillary anterior or premolar teeth were included in this study. After extraction, sites were grafted with deproteinized bovine bone xenograft and sealed either with laser photocoagulation or a non-resorbable dPTFE membrane. Measurements of the alveolar bone width were performed on cone beam computed tomographs, taken at the baseline before extraction and after 4 months. Results: Both groups showed a reduction in bone width. At the crest, the mean amount of reduction was 0.69 (0.33) mm and 0.78 (0.15) mm for the laser and membrane groups, respectively. As for the middle third, less amount of reduction was observed by a mean of 0.56 (0.36) mm and 0.58 (0.18) mm for the laser and membrane groups, respectively. The least amount of reduction was in the apical third with a mean of 0.26 (0.36) mm and 0.41 (0.17) mm for the laser and membrane groups, respectively. However, this reduction in bone dimensions was insignificant between both groups. **Conclusion:** The laser photocoagulation is as effective as the dPTFE membrane in sealing sockets after grafting.

10. Use of NO-resorbable dPTFE membranes in preservation of the alveolar ridge- a case report

Spirov V, Veljanovski D, Baftijari D, Papraniku K, Stojanovski M. Clinical Oral Implants Research. 2020 Oct; 31: 296-296. doi: 10.1111/clr.234_13644.

https://onlinelibrary.wiley.com/doi/10.1111/clr.234_13644

Background: After the extraction, a biological remodeling phase of the alveolar ridge follows, resulting in resorption both vertically and horizontally. To a large extent, this has the effect of installing a dental implant in a correct 3D position. In order to maintain the width and height of the alveolar ridge, a large number of operative techniques for preserving the extraction wound are used. In our article, a preservation technique is presented using the NO-resorptive dPTFE membrane and xenograft. **Aim/Hypothesis:** Use of bone substitutes in combination with the NO-resorbable dPTFE membrane are examined, for preservation of the extraction socket. We expect to preserve the dimensions of the alveolar ridge in the vertical and horizontal direction in order to place the implant in the correct prosthetic position. **Materials and Methods:** At the University Dental Clinical Center “St. Pantelejmon

– Skopje", an intervention was performed for preservation of the alveolar ridge in the upper jaw after extraction, in projection of the premolar region. Alveolar preservation was performed using bovine xenograft (cerabone®, botiss biomaterials GmbH). Each preserved socket was covered with ultra-thin (˜0.08 mm) dPTFE membrane (permamem®, botiss biomaterials GmbH) and it was fixed with individual sutures (silk 3/0 Astra Med). The installed non-resorbable membrane was removed after 4 weeks without any additional surgery and the wound was left to heal freely, giving instructions to the patient to maintain oral hygiene by rinsing his mouth twice daily with 0.1% chlorhexidine gluconate. CBCT was performed before the time of tooth extraction and after 6 months from the application of the graft material. With this CBCT we measured the changes of the alveolar ridge and we accurately determined the extent of its dimensional remodeling. **Results:** Although the NO-resorbable membrane was left uncovered during wound healing, the patient showed no clinical symptoms such as pain, swelling, infection, allergic reaction, or loss. After removal of the membrane in the fourth week, a young granulation of NO-epithelial tissue was observed under the NO-resorbable membrane itself. Six months after the placement of the dental implants, complete healing and integration of the bone graft material was observed, and the performed CBCT images showed minimal remodeling in both horizontal and vertical direction of 1.5 mm. **Conclusions and Clinical Implications:** The use of NO-resorbable dPTFE membranes, which allow open healing of extraction wounds, in combination with bone substitutes of xenogenic origin, gives predictable and reliable results in the preservation of extraction wounds with minimal bone loss.

11. Open-Healing Socket Preservation with a Novel Dense Polytetrafluoroethylene (dPTFE) Membrane: A Retrospective Clinical Study

Zafiropoulos GG, Kačarević ZP, Qasim SSB, Trajkovski B. 2020. Medicina (Kaunas). 2020 Apr;56(5):216. doi: 10.3390/medicina56050216.

https://botiss.com/product/open-healing-socket-preservation-with-a-novel-dense-polytetrafluoroethylene-dptfe-membrane-a-retrospective-clinical-study/

Background and objectives: Non-resorbable dense polytetrafluoroethylene (dPTFE) membranes are widely used for regeneration procedures, alone or in combination with particulate materials. The aim of this work was to examine the efficacy of a newly developed dPTFE membrane in the management of extraction socket healing. **Materials and Methods:** The extraction premolar sockets of 44 patients (20 men and 24 women) were preserved. One group received prosthetic rehabilitation with a fixed partial denture (FPD) (PROS group, N = 19) and a second group received immediate implant placement (IMPL group, N = 25). The PROS group sockets were augmented with a bovine derived xenograft and covered with a newly developed dPTFE membrane prior to FPD rehabilitation. **Results:** In the IMPL group, socket preservation was combined with immediate implant placement. Before (T0) and 6 months after surgery (T1), horizontal and vertical dimensions were measured with customized stents. No significant differences in alveolar bone loss from T0 to T1 were observed between the PROS and IMPL groups in the horizontal dimension for any tooth type. There was a significant difference in alveolar bone loss from T0 to T1 between the two groups for only single-rooted maxillary premolars in the vertical dimension. **Conclusions:** The use of the examined new dPTFE membrane consistently led to the preservation of hard tissue in the extraction sites.

12. The Use of a Non-Absorbable Membrane as an Occlusive Barrier for Alveolar Ridge Preservation: A One Year Follow-Up Prospective Cohort Study

Papi P, Di Murro B, Tromba M, Passarelli PC, D'Addona A, Pompa G. Antibiotics (Basel). 2020 Mar;9(3):110. doi: 10.3390/antibiotics9030110.

https://botiss.com/product/the-use-of-permamem-as-an-occlusive-barrier-for-alveolar-ridge-preservation/

The aims of this study were to obtain preliminary data and test the clinical efficacy of a novel nonporous dense-polytetrafluoroethylene (d-PTFE) membrane (permamem®, botiss) in alveolar ridge preservation (ARP) procedures with a flapless approach. A traumatic extraction was performed in the premolar maxillary area, and a d-PTFE membrane was used to seal the alveolar cavity: no biomaterial was used to graft the socket and the membrane was left intentionally exposed and stabilized with sutures. The membrane was removed after four weeks and dental implants were placed four months after the procedure. The primary outcome variables were defined as the dimensional changes in the ridge width and height after four months. A total of 15 patients were enrolled in this study. The mean width of the alveolar cavity was 8.9 ± 1.1 mm immediately after tooth extraction, while four months later a mean reduction of 1.75 mm was experienced. A mean vertical reduction of 0.9 ± 0.42 mm on the buccal aspect and 0.6 ± 0.23 mm on the palatal aspect were recorded at implant placement. Within the limitations of this study, the d-PTFE membrane proved to be effective in alveolar ridge preservation, with the outcomes of the regeneration not affected by the complete exposure of this biomaterial.

13. A Novel Double-Membrane Technique For Guided Bone Regeneration With Complete Preservation Of Keratinized Mucosa

Mabel Manggang Unchat, TiangKoXun, Prof.Dr.Sunil Kumar Nettemu, Prof.Dr.SowmyaNettemu. 2020. Poster ICOI.

A 40-year old male patient came with a complaint of missing lower right tooth and wanted an implant replacement. Upon incision, residual roots were present. The roots were removed and immediate implant placement was done. Approximately 3.0mm jumping distance was noticed on the buccal aspect of the implant. A particulate bone graft was applied and a collagen membrane was placed over the bone graft. A high-density PTFE membrane (permamem®) was placed over the surgical site, left partially exposed to the oral cavity. Simple interrupted sutures were done on either side of the membrane. 30 days post-operative, permamem® was removed and the surgical site was followed up for another 120 days. **Conclusions:** With the presented double membrane technique minimal flap manipulation, no displacement of the muco-gingival junction and a wide zone of keratinized mucosa could be achieved.

14. Large horizontal bone augmentation using a xenogeneic bovine bone block and a non-resorbable (d-PTFE) membrane: a case report

Lázaro Calvo, P., González Ruiz, A., Díaz Castro, C., Castaño Aguilar, A., Zarco, W., García Sanz, A. 2019. Poster Osteology Barcelona.

https://botiss.com/wp-content/uploads/2023/03/Pedro-Lazaro_Osteology.pdf#new_tab

Objectives: To describe a case report of a reconstruction of a severe horizontal bone defect previous to the implant placement using exclusively biomaterials without the use of autologous bone graft, showing the histological findings and volumetric changes 12 months after the intervention. **Methods:** A systemically healthy, female patient requiring for a horizontal bone reconstruction at the anterior maxilla is presented. Once an accurate clinical and radiological analysis was done, the patient was selected for the intervention. After the elevation of the full-thickness flap, due to the extension and severity of the bony defect, two blocks of bovine bone xenograft (BBBX) (cerabone® block – botiss biomaterials) fixed with osteosynthesis screws (Maxil®) were used. The blocks were isolated and covered with a non-resorbable (d-PTFE) membrane (permamem® - botiss biomaterials), that was secured to the remnant bone with fixation pins (Klockner®) following a guided bone regeneration (GBR) procedure. Finally, the flap was advanced coronally and stabilized with sutures without tension, allowing primary closure of the wound. **Results:** After 11 months of healing without complications, re-entry was performed and a sample of bone tissue from the implant bed was extracted with a trephine. Implant placement was performed without the need for additional regeneration of the treated area. Three months after the placement of the implants, the provisionalization phase was carried out, lasting a period of at least 3 months. The radiological analysis revealed and augmentation of 3.8mm, 4.4mm and 5.3mm for the No. 12, No 21 and No 22, respectively. The volumetric gain obtained by comparing pre-treatment and post-treatment STL models in area 21-22 showed a gain of 189mm^3. The histological analysis of the sample obtained in the implant bed revealed the presence of a dense connective tissue with lacunae of bone formation and the presence of xenograft remains. **Conclusions:** Lateral bone augmentation using exclusively biomaterials can be a suitable alternative to the use of an autologous bone graft, avoiding problems associated with the autologous blocks, thus solving complex cases of severe bone loss. This procedure obtained satisfactory clinical results regarding the bone availability that allowed a proper three-dimensional implant placement as well as a volumetric gain measured both with CBCT and with intraoral scanner. However, the histological findings showed the limited ability of the bone front to completely colonize the outer part of the blocks. More studies are needed to evaluate the long-term clinical behaviour of this procedure.

15. Guided bone regeneration using high density PTFE membranes. Case Series.

Iker Bellanco, David Chávarri, Esteban Pérez, Markel Diéguez, Iratxe Viteri, Aritza Brizuela. 2019. Poster Osteology Barcelona.

https://botiss.com/wp-content/uploads/2023/03/Iker-Bellanco_Osteology.pdf#new_tab

The use of non-resorbable e-PTFE membranes in guided bone regeneration (GBR) is a well-known procedure, although its high risk of complications (eg: tissue dehiscence, membrane exposure,

membrane and graft infection...). Recently, a new membrane made of high density PTFE (microporosity <0.3 micra) could provide better surgical outcomes reducing post-surgical complications. The aim of this study is to determine the efficiency of d-PTFE in guided bone regeneration. **Results/Conclusion:** The use of d-PTFE membranes seems to present satisfactory results in GBR, although some incidents like membrane exposure were seen, they did not have a major importance in the final outcome. However more randomized clinical trials are needed to determine the effectiveness of this procedure.

16. Use of a new hd-PTFE membrane in alveolar socket preservation (Permamem®): a case series

Jean Michel Heurtebise, Séverine Vincent-Bugnas 2019. Poster EAO Lisbon.

https://botiss.com/wp-content/uploads/2023/03/6-2019_VincentBugnas_EAO-permamem.pdf#new_tab

Following a tooth extraction there is a post-extractional bone resorption. This is why an alveolar socket preservation technique is recommended to limit this pattern and to ensure the bone volume for an eventually implant prosthetic restauration. We want to check if an alveolar socket preservation is possible with no attempt of primary wound closure using a high density PTFE membrane (permamem®) exposed to the oral environment. Five patients aged from 23 to 61 who needed an extraction of a molar were chosen. In all cases a CBCT scanner was done before the extraction. Once the atraumatic extraction was completed, the alveolar socket was filled with a xenogenic bone graft (BioOss®, Geistlich) and covered with a high density PTFE membrane. There was no attempt of fully coverage of the membrane. Three months later another CBCT scanner was realised. No infection was registered for any of the patients and we obtained a total average of horizontal bone loss of 0.42mm and 0.55mm of vertical bone increase. These results might indicate that this high density PTFE membrane is secure in an exposed alveolar socket preservation technique.

17. Lateral bone augmentation with xenograft blocks: What could we achieve?

González-Ruiz, A., Gómez Menchero, A., Ríos, J.V, Bullón, P., Lázaro Calvo, P. 2018. Poster EuroPerio Amsterdam.

Background: There are clinical situations where the lack of bone in an atrophic jaw does not allow for an implant placement. Different techniques have been developed for lateral bone augmentation (LBA). Between them, guided bone regeneration (GBR) has demonstrated effective results in both experimental and clinical studies (Benic & Hämmerle 2014). However, when the atrophy is considerable the membrane may collapse compromising treatment results. Grafting wit intraoral autogenous bone blocks have been used to support the membranes, but the associated morbidity and the limited availability represents critical disadvantages. To solve these problems, GBR with xenograft blocks have been proposed, leading to adequate conditions for implant placement without the drawbacks as previously mentioned. **Clinical procedures:** We show three clinical cases taken from a case series of 11

patients requiring lateral bone augmentation before implant placement, both at the anterior and the posterior regions. Due to the extension and severity of the bony defects, patients were treated with xenograft blocks. Procedures on different scenarios using removable (collagen) or non-removable (ePTFE) membranes, or the combination of both, together with xenograft blocks and particulated xenografts, are presented. Case 1: Bovine bone xenograft block (BBXB) with a resorbable membrane. Case 2: BBXB with a combination of non-resorbable (inner) and resorbable (outer layer) membranes. Case 3: BBXB with a non-resorbable membrane. The re-entry procedures were performed after 10 months of healing. On this second stage, an optimal bone reconstruction of the alveolar crest allowed implant placement correctly**. Outcomes/Conclusions:** Of the eleven patients, 10 out of 11 grafts healed successfully without the need of re-grafting on a second surgery before implant placement. One patient had edema for three weeks, while nine patients had no post-operative complications. Implants were loaded after a period ranging between 3-4 months. Lateral bone augmentation with particulated and blocks of xenograft, both with resorbable and nonresorbable membranes, led to successful horizontal bone augmentation and allowed implant placement under suitable conditions. Grafting with xenograft materials avoids problems associated with intraoral/extraoral bone harvesting allowing for adequate clinical results and solving complex cases.

18. Horizonto-vertical bone augmentation, with notable attachment gain at the periodontally compromised neighboring dentition; a clinical case report with 8 months follow up

R. Kemper, T. Szamody, T. Chikany 2018. J. Clin. Periodontol. Poster PC348.

Background: A 27 year old female patient was referred to Parodont Dental Practice (Budapest, Hungary) with radiological and clinical signs of ankylosis and root resorption at her central incisor (11). History of the tooth involved total luxation followed by a replantation 10 years prior to the first visit. **Clinical Procedure:** Following fracture of the crown of the presented tooth, atraumatic extraction was performed, with meticulous debridement of the alveolar socket. Four months after tooth extraction mucoperiosteal flap elevation under local anesthesia revealed a deep intrabony defect at the mesial aspect of 12 tooth. Autogenous bone graft was harvested with trephine bur from the nasal spine, and fixed with osteosynthesis screw to the edentulous ridge. Root surface underwent periodontal scaling and root planing, conditioning of the surface with EDTA, and application of EMD (Emdogain® – Straumann AG). Bovine derived xenograft (BioOss® – Geistlich Pharma AG) mixed with EMD was applied to build up the missing crestal bone volume, covered with non-resorbable PTFE membrane (permamem® – botiss biomaterials GmbH) and resorbable collagen membrane (Creos Xenoprotect® – Nobel Biocare AG), fixed with titanium pins palatally, and buccally. After periosteal releasing incisions the surgical site was sutured. After 6 months of uneventful healing membrane removal with consecutive dental implant placement (Nobel Replace CC PMC – Nobel Biocare AG) was performed. Seven month postoperatively, long term temporary screw-retained crown was delivered. Impression was taken with individualized impression coping 6 months after implant uncovering. Final screw-retained prosthesis consisted of porcelain fused to individualized zirconia abutment. **Outcomes/Conclusion:** The presented procedure resulted in esthetically pleasing outcome (PES 12)

with significant clinical attachment gain at mesial aspect of the lateral incisor (12). This surgical procedure seemed to provide sufficient amount of bone for implant placement, with clinical and radiological defect fill of a periodontally compromised tooth.

06/2023