

# GUIDED BONE REGENERATION IN ANTERIOR MANDIBLE FOR PREDICTABLE IMPLANT PLACEMENT – CASE REPORT

## ВОДЕНА КОСКЕНА РЕГЕНЕРАЦИЈА ВО АНТЕРИОРНА ЗОНА НА МАНДИБУЛА ЗА ПРЕДВИДЛИВО ПОСТАВУВАЊЕ НА ДЕНТАЛНИ ИМПЛАНТИ - ПРИКАЗ НА СЛУЧАЈ

Nacevski D.<sup>1</sup>, Malenkov H.<sup>1</sup>, Baara Simonovska T.<sup>1</sup>, Markov M.<sup>1</sup>, Terzievski G.<sup>1</sup>, Apostolova G.<sup>2</sup>

<sup>1</sup>Residents of Oral Surgery at Ss. Cyril and Methodius University in Skopje, Faculty of Dentistry, <sup>2</sup>Associate Professor of Oral Surgery at Ss. Cyril and Methodius University in Skopje, Faculty of Dentistry

### Abstract

**Introduction:** The rehabilitation of missing teeth with the use of dental implants is an established treatment with high success rate. Unfavorable clinical conditions may be present in many cases that would prevent the possibilities for implant placement. Augmentation of the alveolar bone with the use of the guided bone regeneration method, GBR, gives successful and long-term results. **Material and Method:** A male patient, aged 32, with present periodontal infection around the roots of three mandible incisors. Removal of the affected teeth and complete removal of the periodontal lesion at the same time after which GBR was performed using xenograft (Cerabone plus – Bottis) and allograft (Maxgraft cortico cancellous – Bottis) materials covering them with collagenous membrane (Jason membrane – Bottis) as preparation for implant placement. Nine months later, perfect conditions are achieved for placement of implants. **Discussion:** Using evidence-based protocols, GBR is indicated in many cases when there is need to extend or to preserve the alveolar bone width. Ensuring the appropriate thickness of the alveolar ridge, like we have achieved in this case, significantly reduces the risks of peri-implantitis and other complications related to healing and maintenance of dental implants. **Conclusion:** Horizontal bone augmentation in patients with significant bone loss in the region of future implantation zone, using bone substitutes of the xenograft type in combination with allograft and their appropriate fixation with a resorbable collagenous membrane, gives positive results in ensuring the appropriate thickness of future toothless alveolar ridge as precondition for proper placement of dental implants. **Key Words:** GBR, guided bone regeneration, dental implants, xenografts, allografts.

### Апстракт

**Вовед:** Рехабилитацијата на заби кои недостасуваат со употреба на дентални импланти е вообичаен метод и со висока стапка на успех. Во многу случаи постојат неповолни услови каде поставувањето на имплантите е контра индицирано. Задебелувањето на алвеоларната коска со употреба на методот на водена коскена регенерација, ВТР, дава успешни и долгорочни резултати. **Материјал и метод:** Машки пациент, 32 години, со присуство на пародонтална инфекција околу корените на три мандибуларни централни инцизиви. Отстранување на зафатените заби како и целосно отстранување на пародонталната лезија по што е направен ВТР со употреба на ксенографт (Cerabone plus – Bottis) и алографт (Maxgraft cortico cancellous – Bottis), покриени со колагенозна мембрана (Jason membrane – Bottis) како подготовка за поставување на импланти. Девет месеци подоцна постојат совршени услови по што се поставуваат имплантите на предвидените места. **Дискусија:** Користејќи однапред докажани протоколи, ВТР е индицирана во многу случаи кога има потреба да се задебели или да се зачува ширината на алвеоларната коска. Обезбедувањето на соодветна дебелина на алвеоларниот гребен, како што постигнавме во овој случај, значително ги намалува ризиците од пери-имплантит и други компликации поврзани со здравувањето и одржувањето на имплантите. **Заклучок:** Хоризонталната коскена аугментација кај пациенти со значително губење на коска во предел на идната имплантациона зона, со користење на коскени супституенти од типот на ксенографт во комбинација со алографт и нивна соодветна фиксација со колагенозна мембрана, дава позитивни резултати во обезбедувањето на соодветна дебелина на идниот беззаб алвеоларен гребен како предуслов за правилно поставување на импланти. **Клучни зборови:** ВТР, водена коскена регенерација, дентални импланти, ксенографт, алографт.

### Introduction

The rehabilitation of totally or partially edentulous jaws, as well as to single-unit edentulous patients, with the use of dental implants is a usual method and established treatment with high success rate<sup>1</sup>. However, unfav-

orable clinical conditions may be present in many cases that would prevent the possibilities for implant placement, such as those where there is a lack of height and width of the alveolar bone ridge. Augmentation of the alveolar bone with the use of the method of guided bone regeneration presents option for treatment in such cases

where osseous support is needed for proper osseointegration of the dental implants<sup>2</sup>. The known procedures for bone augmentation of the alveolar bone with the use of the guided bone regeneration method, also known as GBR, gives successful and long-term results<sup>3-5</sup>.

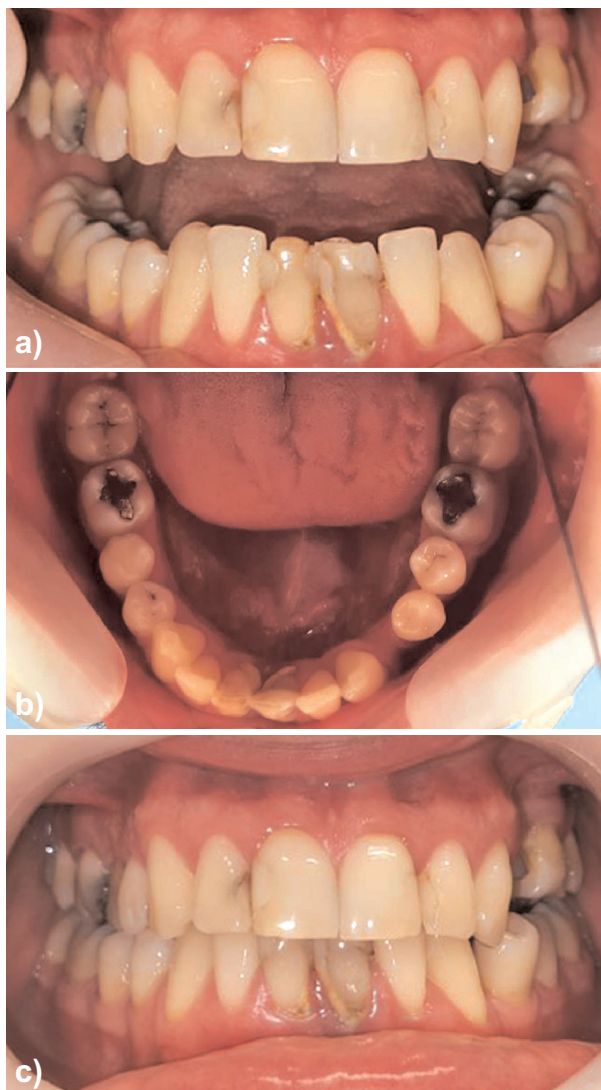
Autogenous bone grafts are considered as the “golden standard” in terms of material used during augmentation of the bone, because it is the only biomaterial that possess perfect combination of properties like osteogenesis, osteoinduction and osteoconduction<sup>6-7</sup>. However, disadvantages like morbidity at the donor site, limited availability, tooth sensitivity and risk of dehiscence of the wounds [6,8-10] have led to investigations of the development and application of bone substitutes for the regeneration of the alveolar bone ridge<sup>10-12</sup>.

Xenografts and allografts have shown to be excellent alternative with exceptional properties for GBR, like its biocompatibility, formation of a scaffold (osteoconduction), slow resorption rates, and the ability to define and maintain the volume for bone gain<sup>11-13</sup>. However, there is a relative disadvantage in the use of these materials compared to the autogenous bone in terms of the maturation period of the material, which can take from nine to twelve months<sup>9,11-13</sup> as well as the demand and need of collagen membranes for guided bone regeneration procedures, which must provide cell occlusion and a better biocompatibility with the soft tissue, reducing the risk of complications such as wound dehiscence<sup>10-13</sup>.

The aim of this case report is to describe guided bone regeneration with the use of xenograft and allograft materials covered with collagen membrane in horizontal bone augmentation of intercanine part of the mandible, performed immediately after the removal of three mandibular incisors as well as removal of large chronic diffuse periodontal infection. In addition, post-operative healing time is shown after which implant placement is completed and follow-up of the implants is described.

## Case report

Male patient, aged 32, came to our clinic seeking to solve functional and aesthetical problem which was present in the front part of the lower jaw (Figure 1). After the initial clinical exam and the analysis of his orthopantomogram x-ray (Figure 2), it was found that the patient was missing one tooth in the upper jaw (upper left second premolar), several teeth had large composite fillings and three teeth had root canal treatments, one of which was the lower left central incisor. Additionally, during the analysis of the x-ray, indistinct lesion around the roots of the lower central incisors and the right lower lateral incisor was detected, however it was unclear



**Figure 1.** (a),(b),(c) - Intraoral view of the initial situation

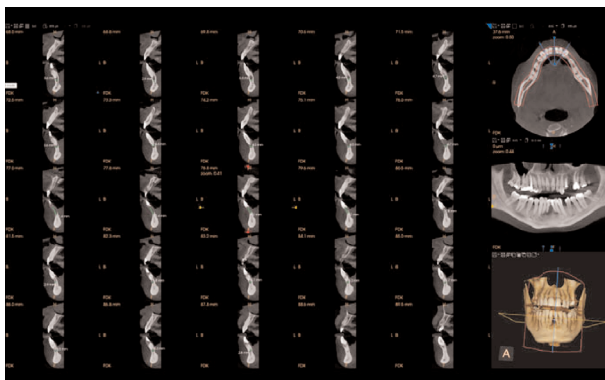


**Figure 2.** Orthopantomogram x-ray shows visible pathologic change in the part of the mandible incisors

whether the left lower lateral incisor was affected as well. The clinical exam also showed presence of gingival recession on the buccal as well as the lingual side around the central incisors and presence of bad and inad-



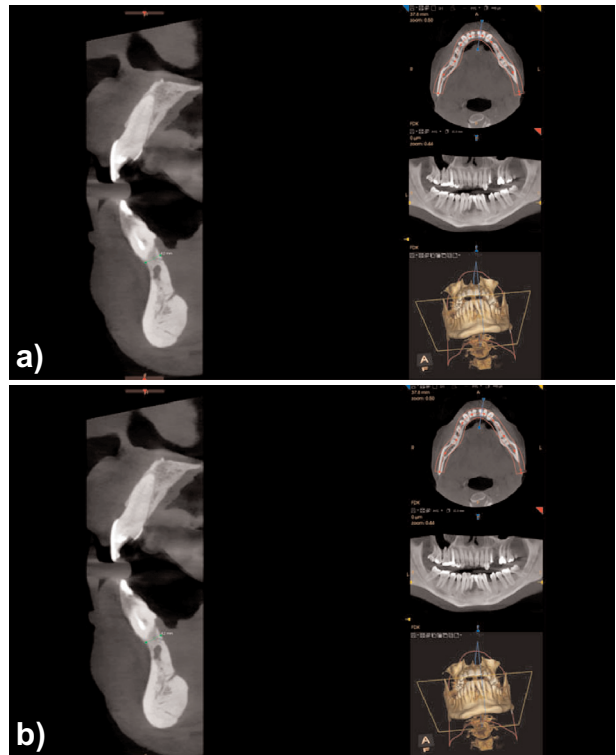
**Figure 3.** Retroalveolar x-ray to confirm the presence of pathologic change around the mandibular incisors



**Figure 4.** Cone Beam Computer Tomography with measurements of the change and its dimensions

equate composite fillings on those teeth (Figure 1). In order to confirm the existence of pathological lesion around the roots of the mandibular incisors, (Figure 3) cone-beam computer tomography imaging (CBCT) was done as well (Figure 4). The CBCT analysis confirmed that infection was present in that region in the form of chronic diffuse periodontal infection that affected teeth #31, #41 and #42. The measurements that were done on the CBCT showed that the infection in the part between the two central incisors was 11.2 mm cranio-caudally and 4.5 mm in antero – posterior direction (Figure 4).

It was decided that the affected teeth (#31, #41 and #42) should be extracted and the lesion will be surgically removed. Following this, a guided bone regeneration would be performed with the use of xenograft (Cerabone plus – Bottis) and allograft (Maxgraft – Bottis), material that would allow predictive results, an acceptable percentage of success and a small percentage of complications as well as reduction of the morbidity of the patient<sup>14</sup>. In addition, the placement of a collagenous membrane



**Figure 5 (a), (b).** Measurements of the width of the future alveolar bone ridge where implants should be placed. (a) Measurements of position 31, prior to extraction shows 4.7 mm in width. (b) Measurements of 42, prior to extraction shows 6.2 mm in width

(Jason - Bottis) was also planned, in order to preserve the dimension of the residual bone ridge. At positions #31 and #42, the future positions of the dental implants, the thickness of the ridge at the site of the left mandibular incisor gave a value of 4.7 mm, which is insufficient for adequate implant placement, while the position for the second implant at the site of the right mandibular incisor gave a satisfactory value of 6.7 mm (Figure 5).



**Figure 6.** Shows the enormous bony defect after the removal of the incisors and the curettage of the pathologic change

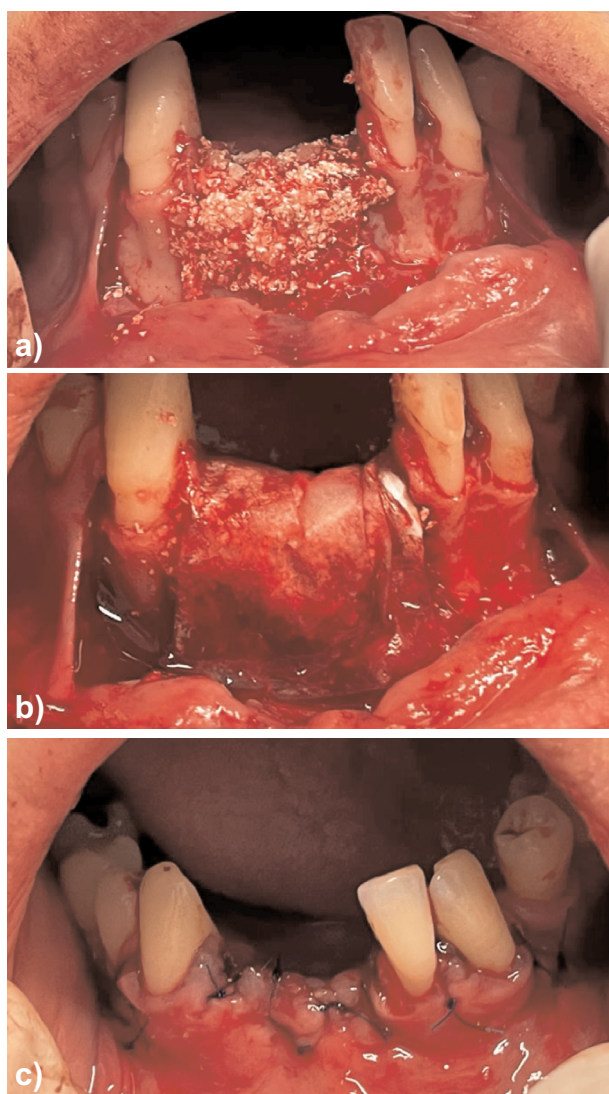


At the beginning of the treatment, local anesthetic, articaine (artinibsa 4%) was applied buccally and lingually to all six frontal mandibular teeth. The incision was intrasulcular in the region from #43 to #33, with small vertical releases at the distal of this incision. The mucoperiosteal flap was raised, after which the two central mandibular incisors as well as the right lateral incisor were extracted (Figure 6). Curettage of the pathological lesion and the surrounding alveolar bone was done. After the complete removal of the lesion, which was not a compact entity and due to the frequency of recurrences of this type of lesions, soft tissue debridement was also performed. Due to the size of the lesion itself and the expected bleeding from it, a dressing with 2 ml of a solu-

tion of hydrogen peroxide diluted to 3% was used occasionally. A copious saline rinse was performed and after the lesion was removed, the wound was rinsed with 4 ml of povidone-iodine (Betadine) 1% solution, intended for oral use, which was left in the wound for one minute.

In the second part of the treatment, the application of the regeneration materials followed. Xenograft 0.5mg (Cerabone plus – Bottis) and 0.5mg allograft (Maxgraft cortico cancellous granules – Bottis) were properly prepared and hydrated in combination with pure saline solution 0.9%, after which they were applied to the site of the bony defect, as well as to the placement sites of the future implants (Figure 7-a). After the application of the xenograft and allograft was completed, a collagenous membrane (Jason membrane – Bottis) with dimensions of 30x20mm was placed (Figure 7-b). Proper adaptation was performed over the grafted area, covering the lingual, occlusal and buccal sides of the alveolar ridge. The membrane was fixed with two sutures of resorbable polymer (P.G.A – 4-0). After the collagenous membrane was properly fixed, sutures were placed, using non-resorbable monofilament (Polyamide 4-0). Two horizontal mattress sutures were placed for additional fixation of the membrane above which several individual single sutures were placed (Figure 7-c). At the very end of the treatment, an ampoule of corticosteroid (Dexamethasone 4 mg) of 1 ml was applied I.M.

Written recommendations for appropriate behavior and wound care were given to the patient. An antibiotic was prescribed, amoxicillin cum clavulanic acid, a.1000, s.2x1 – one tablet every 12 hours, starting one hour after the treatment, as well as serapeptase capsules, a.250000 i.e. at least five days, one per day, starting from the next morning, 30 minutes before the first meal. In addition, recommendations were given for analgesics as needed, nimesulide a.100 mg. Cold compresses after the treatment were suggested, at an interval of 15-20 min application of the compress and a 30-40 min break during the



**Figure 7. (a),(b),(c).** – (a) Shows the grafted bone with Xenograft and Allograft, (b) Shows the collagen membrane placed over the bone graft, (c) Shows the completed surgery with polyamide sutures over the grafted bone



**Figure 8.** 10<sup>th</sup> day after treatment, the look of the wound at the date of suture removal





**Figure 9.** 3 months after treatment

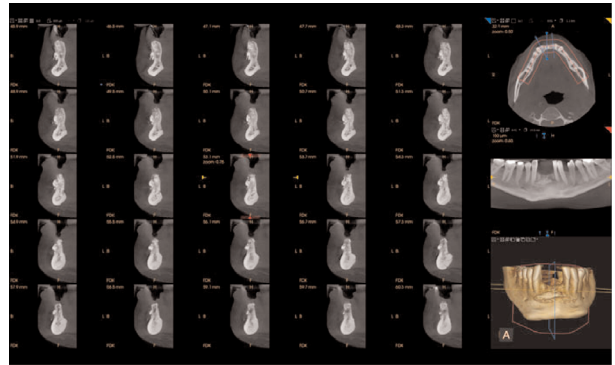


**Figure 10.** 6 months after treatment

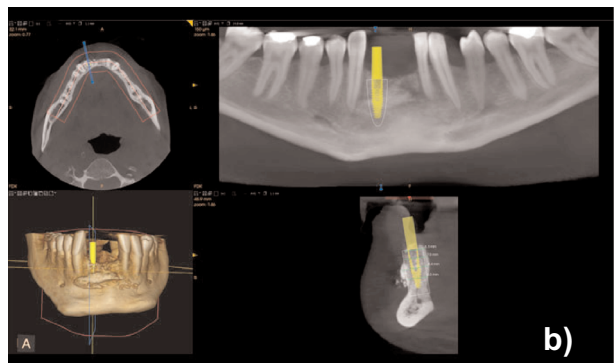
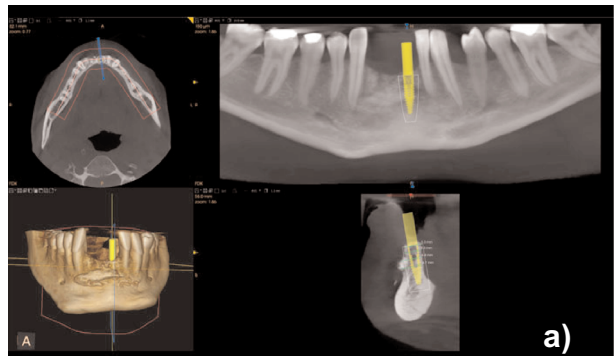
first day, as well as recommendations for rinsing the wound the next day with a solution based on chlorhexidine 0.20%, two times a day, seven days, morning and evening.

The patient came for check-up the second day of the treatment, the wound was without any signs of infection or loosening of the sutures. On the 10th day from the intervention, the sutures were removed, and the healing was progressing well (Figure 8). Three months from the day of the operation (Figure 9) and six months after the treatment, control examinations were done again, adequate healing was visible (Figure 10). In the period between the eighth and ninth month from the intervention, a control CBCT image was done (Figure 11). Sufficient values of bone were visible and it was determined that the next phase, placement of the dental implants, could be continued (Figure 12).

Nine months after the teeth extraction, the patient was again scheduled for surgery. Plexus anesthesia was applied, buccally and palatally, articaine (artinibsa 4%) after which an incision was made along the edentulous ridge and two sulcus incisions buccally, on teeth #32 and #43. After the mucoperiosteal flap was raised, small smoothing of the bony ridge was done and the preparation of the implant beds was completed.

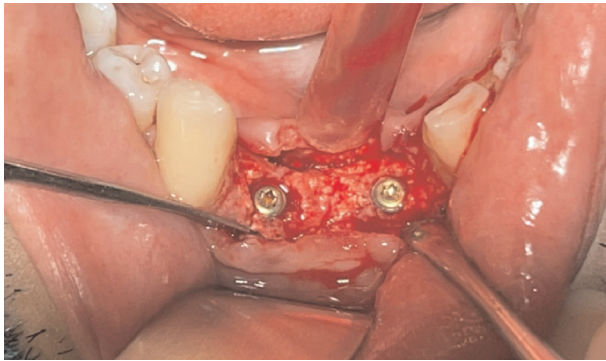


**Figure 11 (a), (b).** (a) CBCT before implant placement; (b) Orthopantomogram x-ray before implant placement

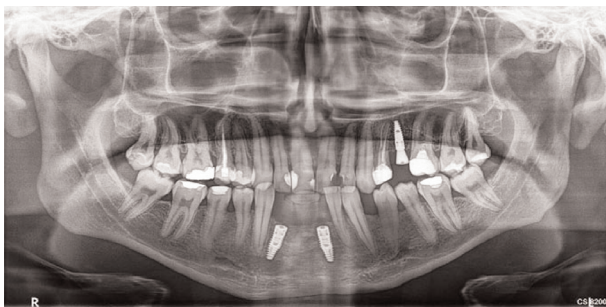


**Figure 12 (a), (b).** (a) Shows the values and width of the bone at position #31; (b) Shows the values and width of the bone at position #42

Two implants were placed, at position #42 (Straumann BLT – SLA, 3.3 – 12mm) and at position



**Figure 13.** Implants placed at the correct position. Sufficient bone is evident around the placed implants



**Figure 14.** Orthopantomogram x-ray after the implant placement

#31 (Straumann BLT – SLA, 3.3 – 12mm) (Figure 13-14). Sutures, non-resorbable monofilament (polyamide 4-0) were placed. After the end of the treatment, 1 ml of dexamethasone was administered locally, in the submucosal tissue around the wound area. The same recommendations that were given after the first treatment were repeated this time as well. The same antibiotic prophylaxis using amoxicillin cum clavulanic acid was repeated.

At the follow-up examination, the second day after the treatment, the wound had good postoperative course. The patient had no complaints. On the tenth day from the intervention, the sutures were removed. The first month after



**Figure 15.** One month after implant placement

the treatment (Figure 15), a control examination was performed and everything was in order and the third month after the placement of the implants, the sulcus formers were placed, after which the patient began the prosthetic procedure for making a bridge over the two implants.

## Discussion

Using evidence-based protocols, guided bone regeneration (GBR) is indicated in many cases when there is a need to extend or to preserve the alveolar bone width. Using xenograft and allograft material in combination with collagen membrane gives high level of success and survival of the placed dental implants in regions that previously had a significant defect and bone loss<sup>5,9,15</sup>. Adequate grafting of an edentulous alveolar ridge, immediately after tooth extraction, provides significantly better conditions for the placement of dental implants compared to ridges that heal spontaneously<sup>16</sup>.

Maintenance of bone crest thickness at position 42 and increasing the ridge thickness at position 31 by more than 1 mm is a clear indicator of the importance of adequate grafting as a preparation for implant placement (Figure 5 and 12). Bone crest thickness at position 42 before tooth extraction was 6.7 mm, and nine months later is slightly reduced to 6.3 mm, which is still satisfactory and has enough bone for implant placement. Bone crest thickness at position 31 before tooth extraction was 4.2 mm and after nine months it is increased to 5.3 mm which shows bone gain of more than 25% in antero-posterior distance.

Moreover, GBR can compensate huge bone defects caused by pathological processes<sup>3</sup>. The complete removal of the existing periapical change in this case and the maintenance of the thickness of the alveolar ridge itself in certain zones, and the thickening of those zones is a clear indicator of the significance of this procedure.

Adequate healing of the soft tissues after the first operation, without additional complications such as exposure of the collagenous membrane, was of great importance for the success of regeneration (Figure 8, 9, 10). In addition, the correct healing of the soft tissues after the second operation, the placement of the implants, was also of great importance for proper osseointegration and prevention of the occurrence of peri-implantitis (Figure 15).

The collagenous resorbing membrane with its hydrophilic properties and the excellent interaction with blood coagulum and fibrin, further accelerate wound healing and epithelization and minimize the risk of dehiscence of the wound.

Ensuring the appropriate thickness of the alveolar ridge, like we achieved in this case, significantly reduces the risks of peri-implantitis and other complications related to the healing and maintenance of dental implants. Our



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findings are in accordance with the findings of Chiapasco and Zaniboni, 2009<sup>1</sup>, Aghaloo and Moy, 2007<sup>3</sup> and Hämmerle, Jung, Yaman, and Lang, 2008<sup>11</sup>.

## Conclusion

After the description and analysis of this case, it can be concluded that horizontal bone augmentation in patients with the presence of significant bone loss in the region of the future implantation zone, using bone substitutes of the xenograft type in combination with allograft and their appropriate fixation with a resorbable collagenous membrane, showed positive results in ensuring the appropriate thickness of the future toothless alveolar ridge as precondition for proper placement of dental implants.

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