



## THE ADVERSE EFFECT OF HEALING COMPLICATIONS TO THE OUTCOME OF GBR – A 'SPLIT MOUTH' CASE REPORT

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**ABSTRACT** Inadequate alveolar process width and height can be overcome by the utilization of distraction osteogenesis, split crest technique or a sinus lift, however many clinical scenarios require the use of guided bone regeneration (GBR). When vertical deficiencies are present, the collective opinion is that non-resorbable membranes should be employed in the augmentation procedure. While remaining form stable throughout the healing period is advantageous for vertical regeneration, the non-resorbable membranes' biological properties do not aid the primary intention closure over the grafted region in any way. As a result, membrane exposures occur which have emphatically negative effect on the regeneration process. There certainly is an abundance of evidence on the detrimental effect of healing complications on the GBR process, however the information regarding the outcome of the bone regeneration process involving exposed vs unexposed sites in the same individual is scarce.

**KEYWORDS :** vertical ridge augmentation, GBR complications, custom Ti-mesh, mesh exposure

### INTRODUCTION

Achieving the best outcome of the implant rehabilitation process depends on the patients' hard and soft tissue quality and quantity. One of the recommended approaches for management of vertical alveolar ridge deficiencies is guided bone regeneration with the use of non-resorbable rigid membranes – dense/expanded titanium reinforced polytetrafluoroethylene or titanium meshes [1]. Such materials, however, possess inferior soft tissue integration properties when compared to their resorbable counterparts. This drawback may lead to wound dehiscence causing suboptimal levels of bone augmentation [2]. In this case report we want to present such an instance in which half of our titanium lattice structure got exposed, whilst the other remained under mucosal enclosure. We are hoping the reported results will assist in the better understanding of the unfavorable impact healing complications have on GBR.

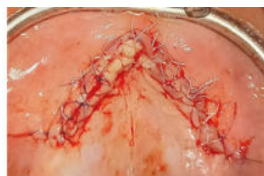
### CASE DESCRIPTION

Patient was a 49-year-old female who was referred to our institution after treatment involving removable complete denture, the patient was not pleased with. The chief complaints were both issues with the function of the prosthetic appliance and its esthetics. The problem with the retention of the denture during mastication originated from the extreme atrophic condition of the patient's maxilla, which drove us to look for alternative treatment in the form of ridge augmentation with delayed implant placement to enhance the retention of any future prosthetic device.

**Fig. 1**



**Fig.2**



Patient was first subjected to CBCT for preoperative measurement of the alveolar ridge dimensions. Furthermore, since the case involved a considerable in dimensions region of the maxilla, our group decided to use a custom designed 3D printed titanium mesh as a graft stabilization device (3D-Mesh®, Biotec Srl, Dueville, Vicenza, Italy). After adequate anesthesia, the procedure began by harvesting autogenous bone chips from the mandible. After enough tissue was scraped so that the graft ratio could be 1:1 (auto- +xenograft), a crestal incision spanning from one zygomatic buttress to the other was done. The tissues were elevated carefully to prevent mucosal tear of the mucoperiosteal flap. In standard fashion the maxillary alveolar process was perforated in aid of proper graft vascularization and the flap was

mobilized with periosteal releasing incision to obtain tension free closure. The graft substance was placed in the custom titanium mesh and the lattice structure was placed over the region of interest and stabilized with four screws (Fig. 1). Lastly, the wound was sutured in a bi-layered manner – with apical horizontal mattress sutures and coronal figure of eight sutures (Fig 2).

Two weeks postoperatively the sutures were removed with no sign of exposure (Fig. 3). Despite that, a month after, a small (Class I) exposure occurred on one side of the mesh, which gradually expanded and involved half of the titanium structure at the time of mesh removal (Fig. 4). In that way we unintentionally created a unique opportunity to observe the clinical behavior of the bone graft in such conditions – half of the graft material was exposed but covered by 'pseudoperiosteum', while the other part was unexposed.

**Fig. 3**

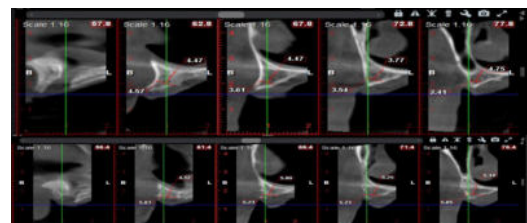


**Fig. 4**

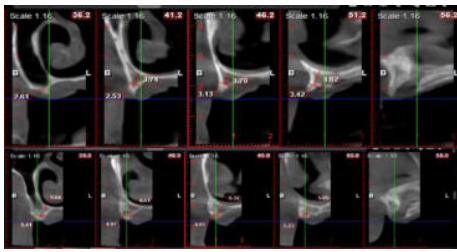


The radiographic data that was gathered from the case was assessed in the following way – we used the nasopalatine foramen as a reference point to place the first or last coronal slice. Subsequently, we calculated the average bone height and width collected from four adjacent coronal slices of the exposed and unexposed part separately. Both radiographic comparisons can be seen on the images below (Fig. 5, 6):

**Fig. 5 (Radiographic imaging of the exposed site)**



Having in mind the data gathered from CBCT, the average bone width and height of the exposed site preop was 3.52 mm and 4.36 mm respectively, while the postop measurements showed an average of 5.53 mm and 4.88 mm. The unexposed site showed an average width of 2.92 mm and height of 3,16 mm preop, whereas the postop values were 4.96 mm and 6.80 mm, correspondingly.

**Fig. 6 (Radiographic imaging of the unexposed site)**

## DISCUSSION

Of all the different techniques developed to overcome alveolar bone insufficiencies, GBR represents the perfect balance between bony gain and postoperative complications during the healing period [3]. Both animal and human studies [4] have shown the disruptive effect of membrane exposure to the alveolar ridge augmentation procedure. Emerging creation of custom 3D printed medical devices has assisted to some extent with the effort to prevent such complication from affecting patients, since the tailor-made titanium meshes, supporting the graft material, are designed in a way to fit snugly over the bony housing, to which the lattice structure is attached. Despite that, complications, associated with such membranes do occur [5,6].

The results from our edentulous ridge bone regeneration case fall in line with other literature findings in the field of hard tissue reconstruction [7,8]. The average linear measurements regarding the width of the regenerated regions (exposed and unexposed) showed similar pre- and postop values. On the other hand, the data extracted from the pre- and postop CBCT images, regarding the vertical augmentation, showed a different picture. Our findings demonstrated that the height of the unexposed region was increased by 3.64 mm, whereas the height of the area subjected to the healing complication was enhanced only by 0.52 mm. What is more, some of the radiographic slices of the exposed region showed signs of increased bone remodeling and lesser height values. This case is a part of a larger study, comparing the effectiveness of non-resorbable membranes on guided bone regeneration, the results of which are not yet published. However, the gathered data so far is showing the same pattern with regards to the results, in terms of height and width regeneration – that the former is affected to a bigger extend from healing complications than the latter. The outcome of the presented case is in favor of the same hypothesis and such a conclusion has not yet been drawn in the literature, to our knowledge.

The late nature of our mesh exposure gave the helped with the formation of 'pseudoperiosteum' over the developing bony surface [9]. This layer of tissue is taken into consideration in different guidelines concerning the clinical management of healing complications. One such protocol is Hartman's [10] which suggests that late membrane exposure results in a better outcome of the regeneration process in comparison to the early dehiscence. Our case further endorses the remarks about the protective nature of the newly formed 'pseudoperiosteum' over the graft's surface [11,12].

The main limitation of this study is that the findings are related only to one case and more data needs to be gathered in support of the statement that vertical regeneration is affected to a bigger extend from healing complications when compared to horizontal one. Another drawback of the presented clinical case is that theoretically the mesh exposure would not only disturb the healing process on the side that it appeared on, since the bacterial component of the saliva would freely trespass the macroporous structure of the mesh and contaminate the unexposed site as well. In practice, however, the results show that this unintentional development during the healing process resulted in noticeable differences when comparing the height gain of the exposed and unexposed sites. Even though membrane exposure is a well-established negative factor for bone regenerative procedures, we believe that further research should be conducted in the field, giving practitioners the opportunity to estimate the outcome of a case more accurately, utilizing the parameters (time, size, etc. of exposure) of an occurred healing complication.

## ETHICS APPROVAL

This study conforms to the Declaration of Helsinki ethical principles for medical research. Appropriate consent was obtained for the presented patient for use of the information and the pictures.

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