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**ALVEOLAR RIDGE AUGMENTATION  
IN THE ANTERIOR MAXILLA  
USING THE TRI-LAYER GBR METHOD**

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# ALVEOLAR RIDGE AUGMENTATION IN THE ANTERIOR MAXILLA USING THE TRI-LAYER GBR METHOD



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Over the last ten years, dental rehabilitation using implants for edentulous patients has become a routine treatment plan, with reliable long-term results.

However, unfavorable local conditions of the alveolar ridge are not always ideal for implant restoration. Atrophy, periodontal disease and trauma can lead to three-dimensional bone loss (horizontal, vertical and sagittal) in the intermaxillary space, and this can affect the position of the implant, potentially damaging both functionality and aesthetics.

## AUGMENTATION METHODS

### 1. ONLAY GRAFT

A method that can be employed by harvesting autogenic bone from the intraoral (chin, ramus, tuberosity) or extraoral (calvarium, pelvis, tibia, fibula, scapula) sites, or by using an allogeneic bone block.

### 2. INLAY TECHNIQUE

This method is also known as the "Sandwich Technique". An osteotomy is performed to form a moveable segment in the alveolar ridge. It also separates it from the stationary segment, without damaging the blood supply, and creates a space into which the bone substitute is placed. The segments are then fixed with a titanium plate.

### 3. DISTRACTION OSTEOGENESIS

A method in which an osteotomy is performed to form a 5 mm bone segment. The distractor instrument is then adjusted to fit both the movable and stationary segments, and slowly separates them from one another, while the ridge and soft tissue are elevated.

### 4. REVASCULARIZED BONE GRAFT

A method in which vital bone is harvested, and located in close effective proximity to the blood vessels. This attachment provides immediate subsistence for the bone implant.

### 5. GUIDED BONE REGENERATION (GBR)

A method that uses bone substitutes and membranes to augment the alveolar ridge both horizontally and vertically, using a membrane to form a barrier between the bone substitutes and the soft tissue.

This study will focus on alveolar ridge augmentation in the anterior maxilla, using the tri-layer GBR method as preparation preliminary procedure for the insertion of implants.

## CASE PRESENTATION

A 57-year-old male patient was assessed for implant restoration in the anterior maxilla. A dental CT of the area demonstrated the buccal defect of the nose floor (Plate 1). We should stress that the palatal plate served as a reference point for the height of the augmentation. Additionally, teeth 12, 21 and 23 were slated for extraction.

The patient's medical history was not incongruous with surgical restoration and implant insertion.

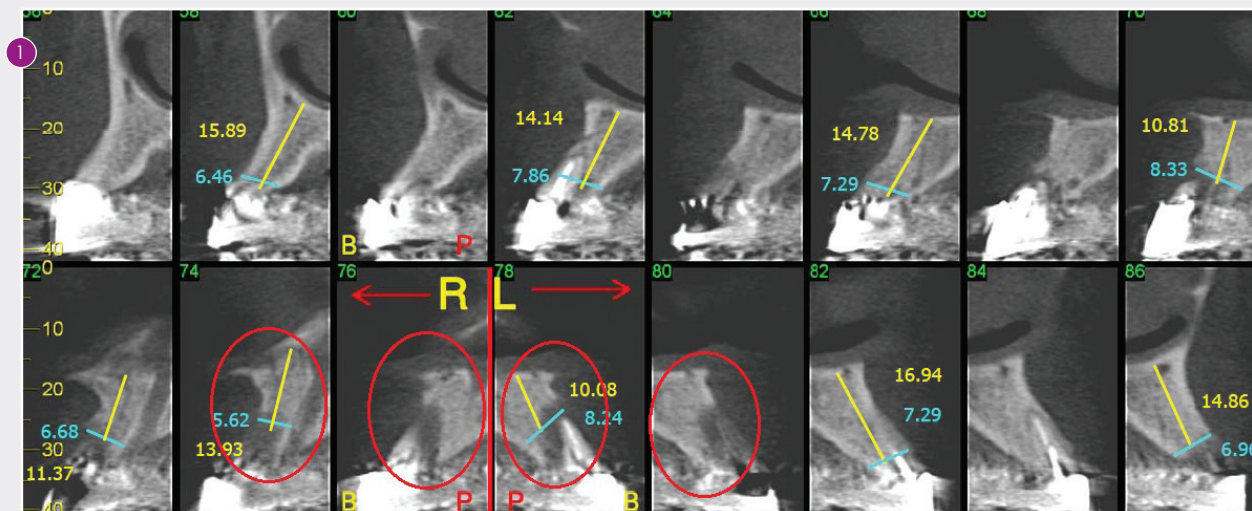
The case was presented to the patient and several options for lateral augmentation were suggested to him.

A two-stage procedure was agreed upon. During the first stage, augmentation would be performed using the tri-layer GBR method, and the second stage would involve the insertion of the implants. This was in order to prevent future complications, such as opening of the buccal flap (wound dehiscence), exposure of the bone, or initial instability of the implant simultaneous with the augmentation.

After non-traumatic extractions of teeth 12, 21, and 23, which were accompanied by deep cauterization of the granular tissue, the thickness of the alveolar ridge was measured at 2mm (A minimum of 5mm is required for an

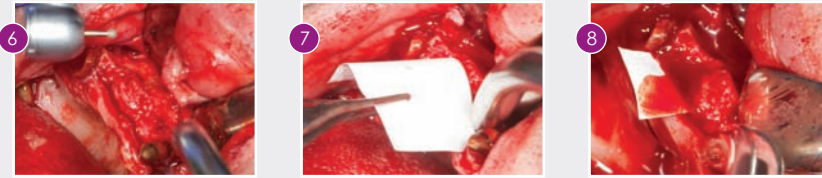
implant.) A waiting period of 6 weeks from the extractions is required, in order to enable the soft tissue to heal as much as possible (attached gingiva).

Using a local anesthetic, a palatal incision was performed, along the line of the ridge in the edentulous area, and vertical releasing incisions distal to teeth 13 and 22 (Plates 2-3). The buccal flap was raised until the nose floor (piriform notch) was exposed (Plate 4), and the buccal flap was released with an incision in the periosteum in a high area of the flap, to ensure tension-free stapled closure of the soft tissue after the augmentation (Plate 5).



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A number of holes were drilled in the cortical bone. This was done in order to encourage the supply of blood rich with growth factors and platelets towards the implant site (Plate 6), preparation of the membrane (pericardium) and its penetration into the buccal flap (Plates 7-8).



At the augmentation stage, it was decided to use 3 layers of bone substitutes:

#### 1. Putty

An allogeneic bone substitute, formed in the edematous tissue. This is elastic to the touch, and can reach hidden cavities and form a block-like volume in the implant site.

#### 2. CaSO4

A calcium sulfate allogeneic bone substitute for the augmentation of small buccal defects in the alveolar region with relatively fast bone absorption.

#### 3. Xenograft

A bovine bone substitute, for slow bone absorption.

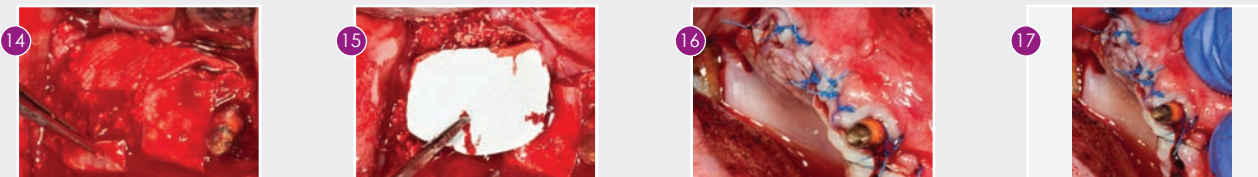
The augmentation was performed in three stages, with careful consideration as to how to preserve the bone implant with minimal absorption. The putty was implanted as a primary layer (Plates 9-10) due to the flexibility of the bone, completely sealing the hidden cavities in the implant site and forming a volume of bone that was no less stable than a bone block. Due to high temperature, and fluids, such as sputum and blood in the implant site that affected the

strength and stability of the bone (in vivo), it was decided to use CaSO4 bone substitute as a secondary layer, as a powdery component only (Plates 11 and 12).

This was in order to stabilize the external putty layer. The implant site was padded with bone powder (Xenograft), to cover the rapid resorption of bone substitutes 1-2 (Plate 13).



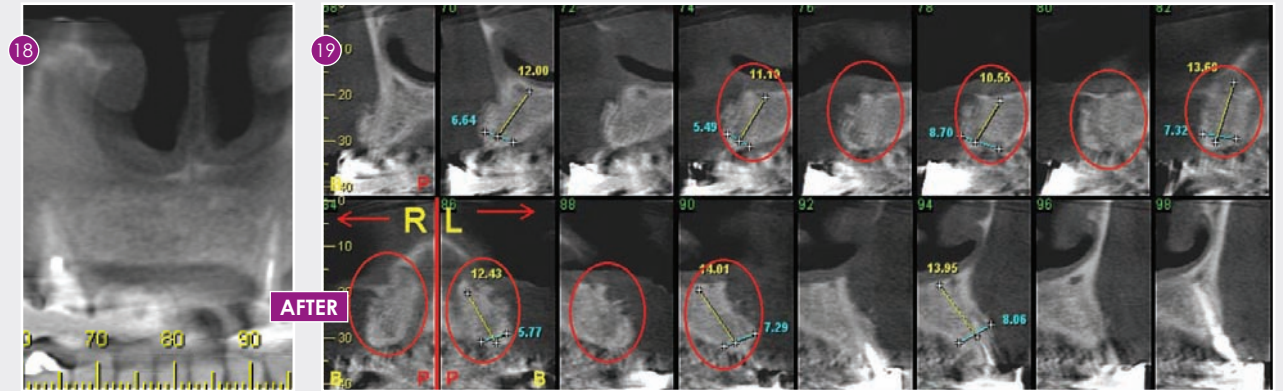
The membranes from the palatal area were replaced in the buccal area (utilizing the envelope technique) (Plate 14), as well as an additional membrane which was inserted to cover the implanted bone in the buccal area (Plate 15). The buccal flap was stapled in a tension-free manner using the vertical mattress method, and standard vertical sutures (interrupted) were implemented in the vertical incisions (Plates 16-17).



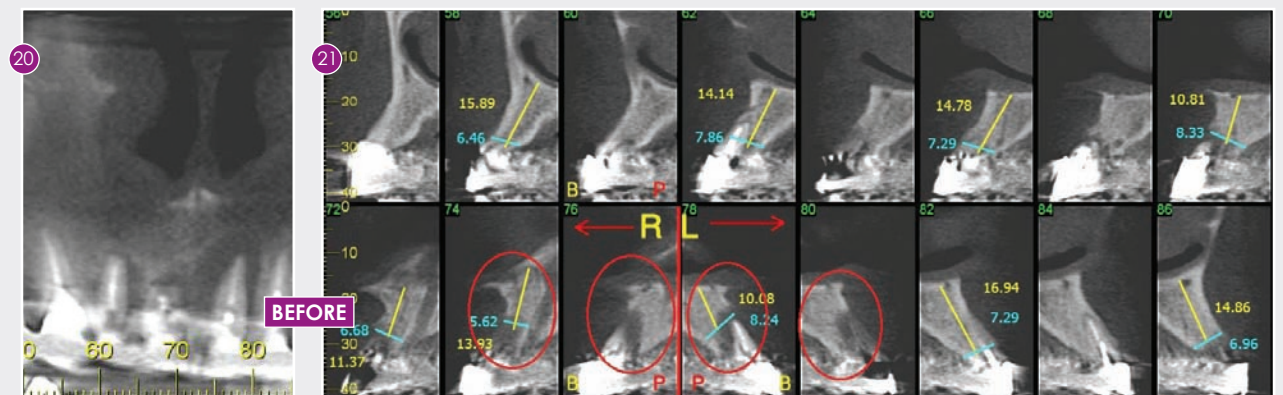
A temporary bridge was fitted prior to the procedure on the eyeteeth without applying pressure on the implant site.

A dental CT performed 7 months later demonstrated the augmentation of the lateral bone in the anterior maxilla region (Plates 18-19). The augmentation of the ridge can be compared with the initial state (Plates 21-22).

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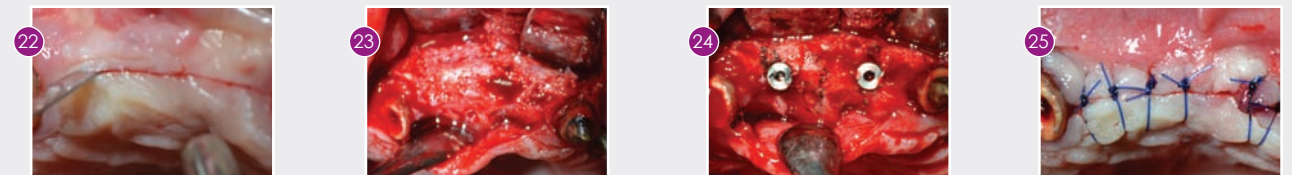


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A palatal incision was performed with a local anesthetic along the line of the edentulous ridge (Plate 22). The mucoperiosteal flap was raised, the implanted bone was exposed (Plate

23), 2 implants were inserted in the area of 12 and 21 (Plate 24) and the gums were stapled (Plate 25).



#### SUMMARY

Based on the scientific literature review, a wide variety of surgical procedures are being used to repair edentulous ridges; however, no one single procedure can be said to excel above all others. The advantages and disadvantages of each procedure must be assessed before the operation.

Understanding when augmentation can be used and which technique is preferable for a particular case will require a great deal of work over a long period of time. There is also no way to provide clear indications of these techniques and attribute them to various cases. Preference should

be given to using simple procedures, reducing risks and complications, and achieving the objective in a relatively short time.



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