



**CASE REPORT**

**A TWELF YEARS EVALUATION OF A TOTAL RECONSTRUCTION OF THE UPPER JAW WITH VASCULARIZED FIBULA GRAFT AND IMPLANTS AFTER TOTAL MAXILLECTOMY with CAD/CAM AND GUIDED SURGERY WITH IMPLANTS IN THE LOWER JAW**

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**Abstract**

Oral and maxillofacial surgery focuses on the treatment of degenerative or traumatic diseases that mainly affect bone tissue. Therefore, bone reconstruction is an ongoing challenge and widely discussed topic within the scientific community. Each study group described its technique for regenerating bone loss over the past two decades. The authors present the results after 12 years of treatment of a patient who underwent a total maxillectomy due to complications of osteomyelitis. She underwent revascularized fibula surgery and application of supported implant prostheses. It is agreed that in severe bone loss the best method of reconstruction is with the use of revascularized bone whenever possible, this involves a large study of both the donor and recipient sites, the long-term success is confirmed by follow up.

**Keywords:** Implant guided surgery, Vascularized fibula graft, Maxillectomy, Upper jaw reconstruction

**INTRODUCTION**

The upper jaw forms the hard palate of the oral cavity and the floor of the nostrils, the maxillary sinus has respiratory functions such as moistening and warming the air, vocal functions as a resonance box for the voice, it also reduces the weight of the head, provides protection and isolation of the brain and orbits and participates in the formation of the skull (Fig. 1). The upper jaw gives us our identity as people in society and

a defect in it brings psychosociological and functional repercussions. The indications for a total maxillectomy are: Malignant tumors of the maxilla, benign tumors such as fibrous dysplasia that causes great destruction of the jaw, in fungal infections or granulomatous conditions, malignant tumors of the oral cavity that involve the palate, as a combined part of a resection of the skull in neoplasms. Defects of the upper jaw have been classified by Santamaria and Cordeiro into four categories: (figure 2 and 3).

Type 1 (limited maxillectomy) one or two walls palate preservation  
 Type 2 (subtotal maxillectomy) lower 5 walls orbital rim preservation  
 Type 3 (total maxillectomy) orbital preservation IIIA vs exoneration IIIB  
 Type 4 (orbit maxillectomy) upper, 5-wall palate preservation

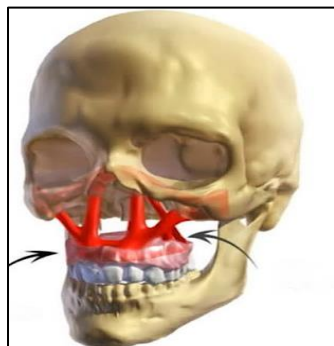


Figure 1

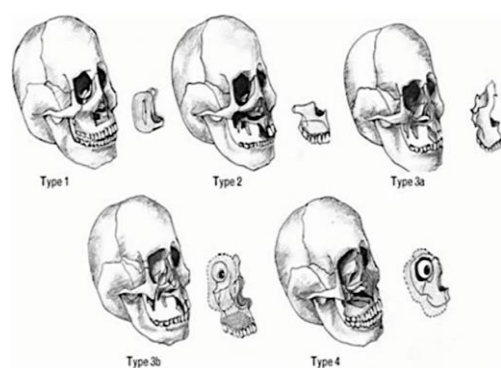


Figure 2

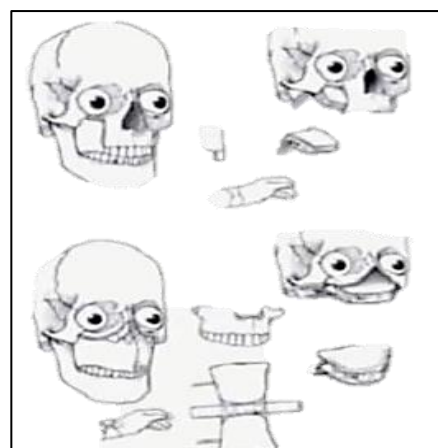


Figure 3

## CASE REPORT

Patient who underwent a total maxillectomy due to complications of osteomyelitis and implants at

the Gea Gonzales hospital in Mexico City. del Messico. A CT scan was performed to see the anatomical structures of the head, a Doppler ultrasound was performed to determine the patency of the fibula angiosome of the right leg and a microvascularized graft was performed to reconstruct the upper jaw, middle third of the facial massif and form the hard and soft palate. The fibula graft was attached to the right and left facial artery by vascular microsurgery. The viability of the graft placed with the island of skin that makes up the palate and serves as an irrigation control is checked, it is also checked by Doppler.

A prosthetic spacer was placed and surgery was performed to shape the buccal and labial vestibule with skin grafting; The tissue changes from skin to mucous membrane. Impressions are made, the models are assembled, and wax-ups and provisionals are performed to determine the craniomandibular relationships such as the Vertical Dimension and Centric Ratio, as well as the relationship of the microvascularized graft with the mandible to see if it is a Class 1,2 3. The prosthetic planning, placement and guidance of 6 upper implants donated by the Titanium Fix brand was carried out, avoiding the screws and fixation plates of the graft, as well as the artery of the microvascularized graft.

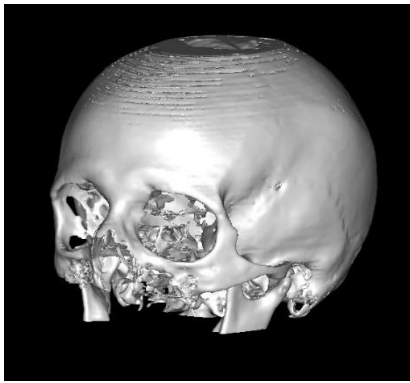
In the lower part, the placement of six implants donated by 3i Biomet by guided surgery was planned to avoid angiosome of the facial artery. Once the implants were integrated, the second phase was carried out to place healing plugs and the subcutaneous fatty tissue of the skin tissue island was thinned.

Upper and lower impressions were taken with an open spoon, the upper model was scanned based on a previous wax-up in Exocad and a bar in Laser sintered titanium was designed in the Phibo system on four implants. For the upper part, the paternal GC wax was copied and tested in the mouth to corroborate the craniomandibular relationships, spacing, contour, support, aesthetics and occlusion.

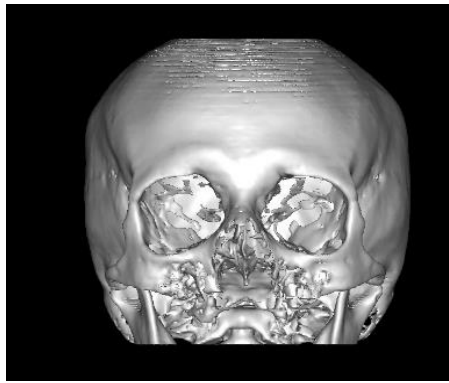
The lower model was scanned, based on a wax-up and a reduction was made in the 3D Shape system, the metals were made in cobalt chrome by Laser sintering in the Phibo system.

In the upper jaw, two implants were lost, so a titanium bar was made on four implants with three locator axial attachments. A metal housing was made for an overdenture without palate in acrylic because there is no hard palate and the width of the graft does not allow it, nor does the height for a fixed screwed prosthesis. In the lower rehabilitation, three screw-on crowns were made in metal, Phibon laser-sintered porcelain with Ceramco III porcelain on the left side, due to the loss of a lower right implant, a fixed prosthesis sintered in 3-unit Phibo laser was performed in Ceramco II of 3 screwed units. A bilateral bibalanced occlusion was established.

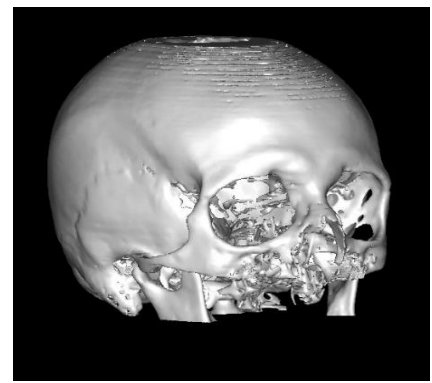
The objective of this case is to demonstrate the procedures in a total maxillectomy of the upper jaw (Figures. 5,6,7).



**Figure 5**

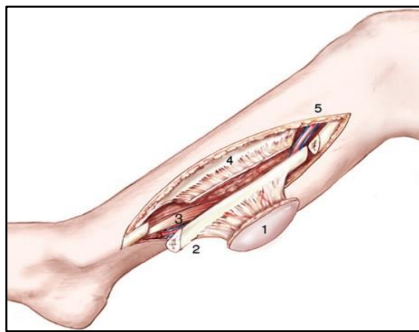


**Figure 6**



**Figure 7**

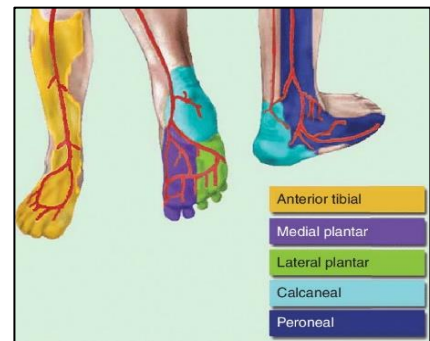
For this situation, a Doppler analysis is performed to assess the permeability of the veins and arteries of the leg and determine the angiosome that will be used for the reconstruction of the upper jaw, an angiosome is the cutaneous, subcutaneous and muscular anatomical territory supplied supplied by an artery and a vein. (Figures. 8,9,10)



**Figure 8**

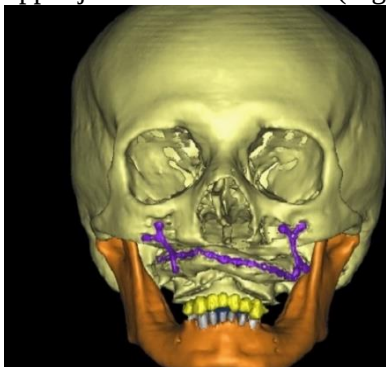


**Figure 9**

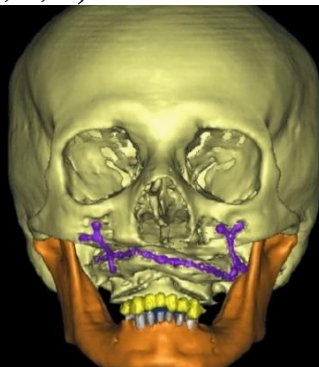


**Figure 10**

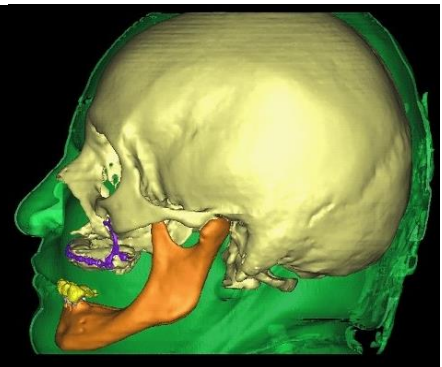
The microvascularized fibula graft is fixed by plates and screws to the malar and is connected with microsurgery to the facial artery (Figures. 11,12,13) a tomography is performed to analyze the craniomandibular relationships that keep the upper jaw and the mandible (Figures. 13,14,15,16).



**Figure 11**



**Figure 12**



**Figure 13**



**Figure 14**



**Figure 15**



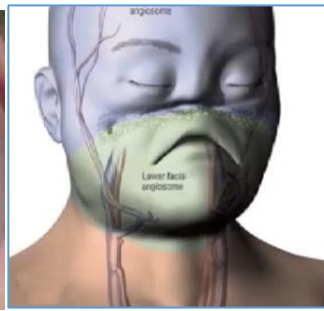
**Figure 16**

Subsequently, the soft tissue is formed as the skin is transformed into mucous membrane and the hair follicles disappear and the mucosa is keratinized. (figure. 17) Dental implant sites are established trying to avoid graft fixation plates

and screws, as well as the superior angiosome of the facial artery (Figure. 18). The company Titanix Fix donated 6 implants for the upper part and they were placed in the microvascularized fibula graft which had a type I and II density, the six implants were osseointegrated, later two intermediate implants were lost. (Fig. 19, 20, 21,22)



**Figure 17**



**Figure 18**



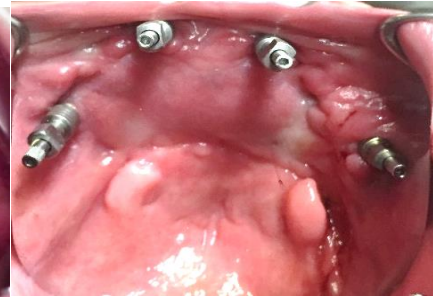
**Figure 19**



**Figure 20**

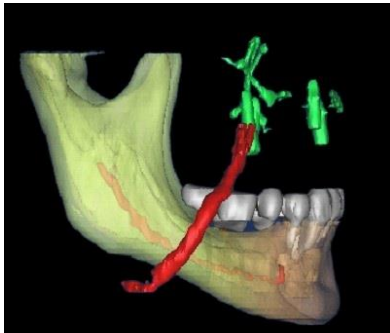


**Figure 21**

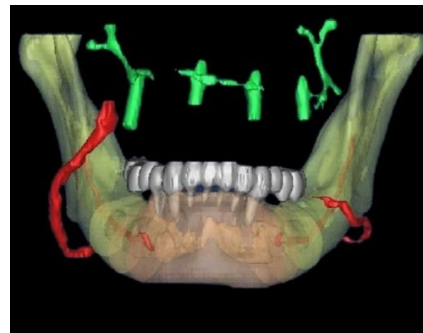


**Figure 22**

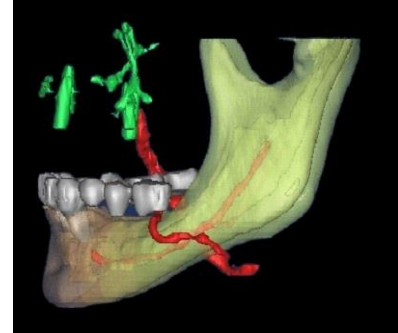
In the lower part, the inferior alveolar and angiosomes of the microvascularized graft were located to determine the position of six 3i Biomet implants with guided surgery (Figures. 23,24,25)



**Figure 23**



**Figure 24**



**Figure 25**

3D models and personalized guides were developed by the Replik 3D system for the lower surgery of the six implants placed, one of which had late failure and was removed from the lower jaw. (Fig. 26,27,28,29)



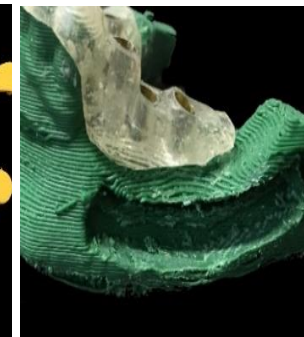
**Figure 26**



**Figure 27**



**Figure 28**



**Figure 29**

A wax-up was performed with placement of teeth on top, it was duplicated in GC Patern to determine the aesthetics, contours and space for a test in the mouth. (Figures. 30,31,32, 33,34,35,36)



Figure 30



Figure 31



Figure 32



Figure 33



Figure 34



Figure 35

The wax-ups and the upper models were scanned in exocad and a titanium bar was made with locators attachments to reduce the weight of the complete restoration of the overdenture with housing for the upper part (Figures. 36,37, 38,39,40, 41)

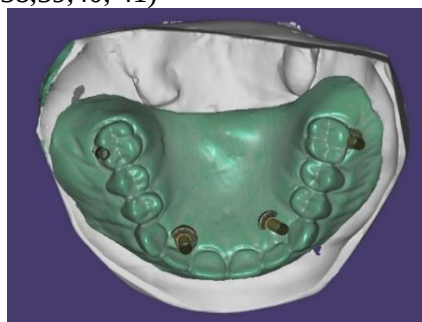


Figure 36

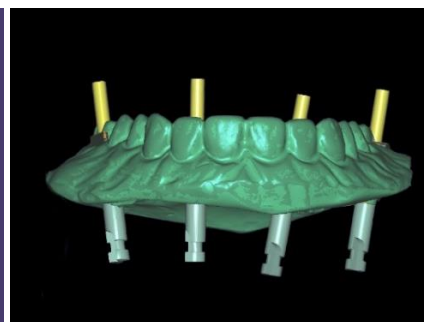


Figure 37

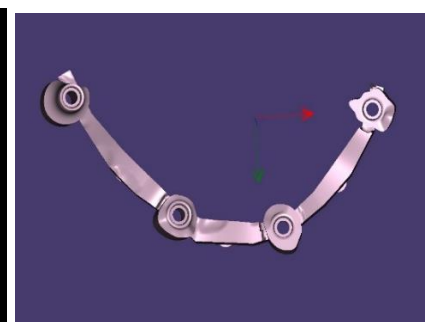


Figure 38



Figure 39



Figure 40



Figure 41

In the lower part, the models were scanned with the 3D Shape system (Fig. 42,43,44) and the structures were made with laser sintering in cobalt chrome with the Phibo system (Figures. 45,46,47,48,49,50)

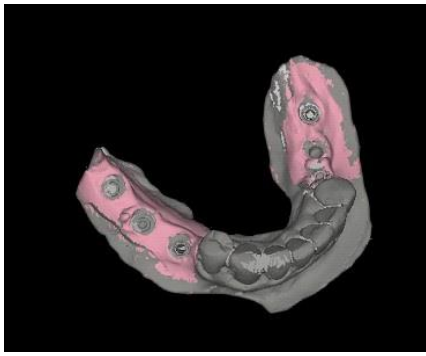


Figure 42

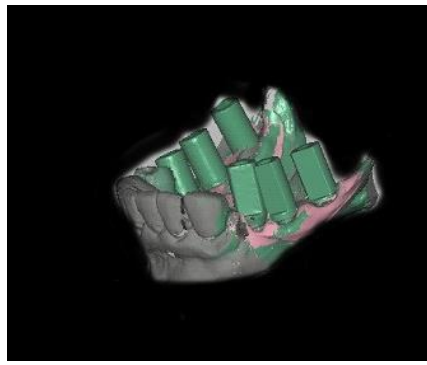


Figure 43

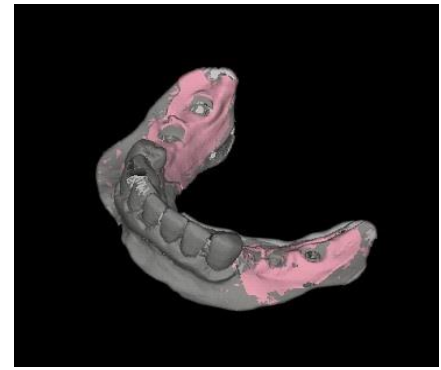


Figure 44

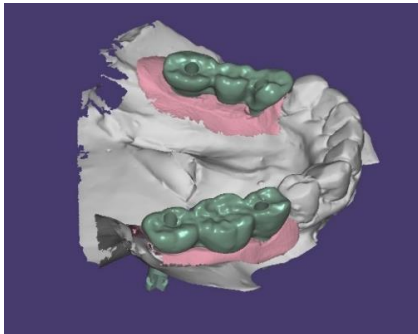


Figure 45

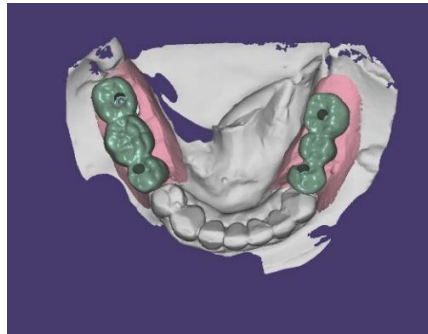


Figure 46

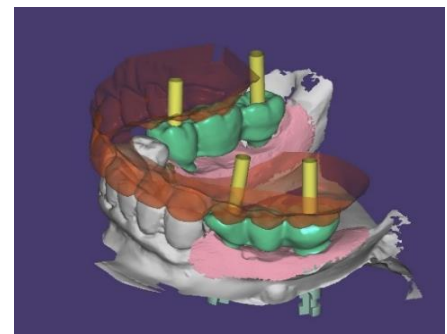


Figure 47

On the lower right side and on the lower left side a fixed prosthesis of 3 units due to the fact that an implant was not osseointegrated, the crowns were made with ceramco III due to the cobalt chromium alloy and the coefficient of linear thermal expansion. (Figures. 51,52,53)

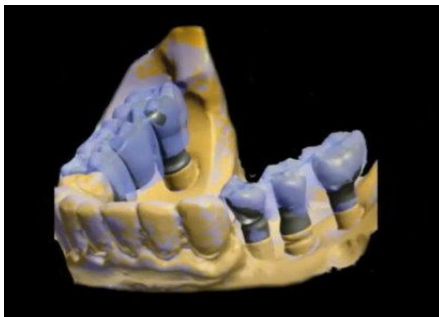


Figure 48

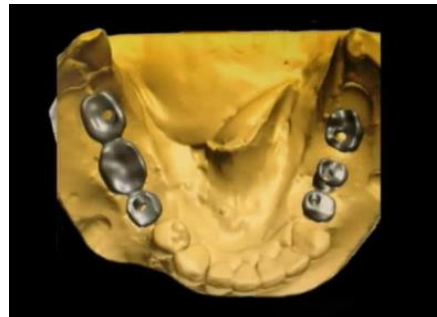


Figure 49



Figure 50

The prostheses were placed in the mouth, twisted and blocked the inlets of the chimneys with Teflon and resin. In the upper part, the bar was placed and twisted, sealing the entrance with resin, then the locators were captured in the overdenture and the occlusion was adjusted. (Figures. 51,52,53)



Figure 51



Figure 52



Figure 53

Twelve years after the patient has a check up for the whole situation after de surgery of the upper and lower implants, in the xray panoramic examen she lost a lower natural teeth by decay (Figure 54) .

In the examination of the locator atachments three of them had signs of wear in external diameter and in the internal part. The three of them were replaced as the nylon components, the oclusion was verified and the condition condition of the acrylic also, we suggested the elaboration of a new prosthetic device and the surgery of an implant in the lower right premolar, but the patient refused it because she needed first a colon surgery(Figure 55,56).



**Figure 54**

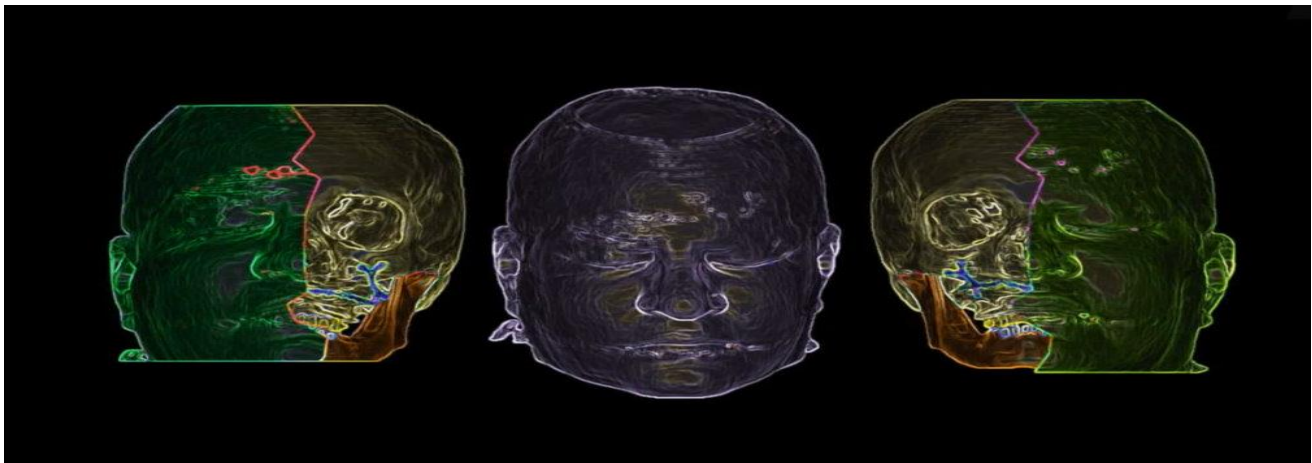


**Figure 55**



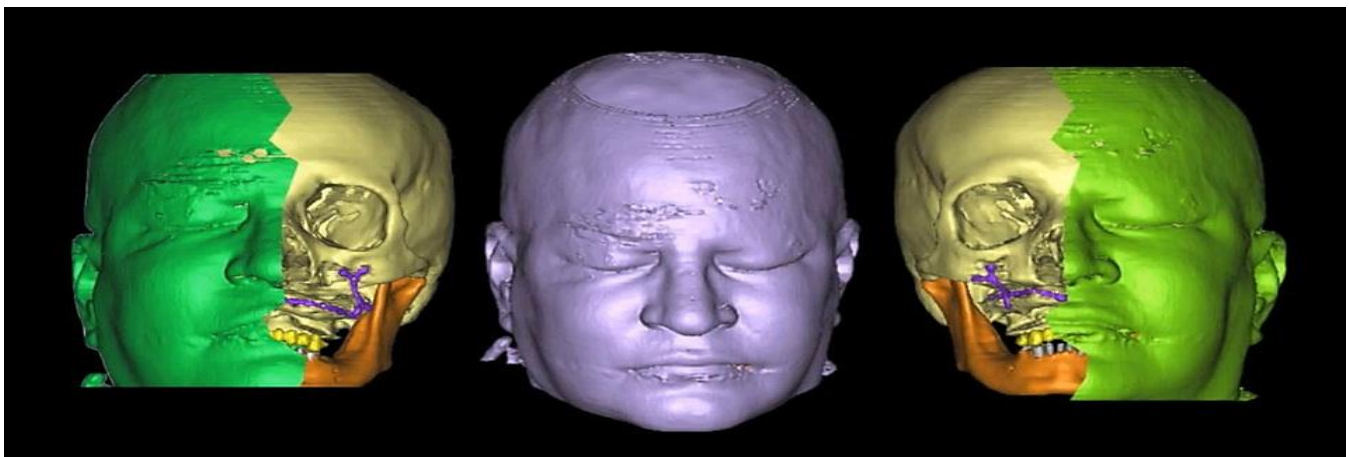
**Figure 56**

Complex cases of maxillectomies and vascularized grafts, it is necessary to perform an analysis using a computerized CT and a Doppler to visualize the arteries, veins, angiosomes of the fibula and face, as well as the soft tissues and Langers lines. (Figure.57)



**Figure 57**

Microvascularized fibula grafts can be used to restore the middle third of the upper jaw, restoring vertical dimension, phonation, chewing, and psychosocial safety, as well as the identity of the person who has undergone a maxillectomy. (Fig. 58)



**Figure 58**

The use of implants of hexagonal platform sometimes gives us advantages in the scenarios where the soft tissue is very thick and deep, the treatment with implants can offer the opportunity to establish in the different scenarios of maxilectomies an alternative for the elaboration of prosthetic treatments such as overdentures, guided surgery, scanning and design by cad-cam to elaborate the corresponding prostheses and restore function and aesthetics (Figures. 59, 60) the long term of this treatment is predictable if the patient attends to his continuous appointments like in this case that has been monitored for 12 years (Figures 61, 62).

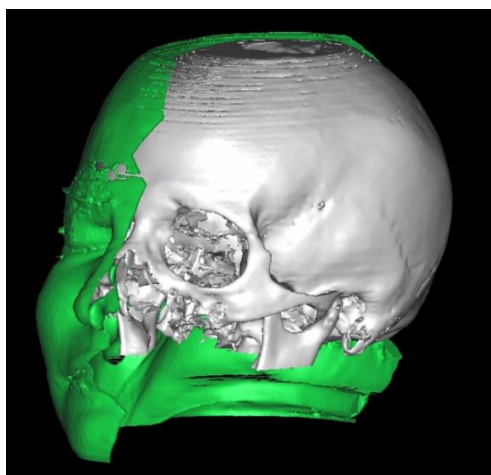


Figure 59

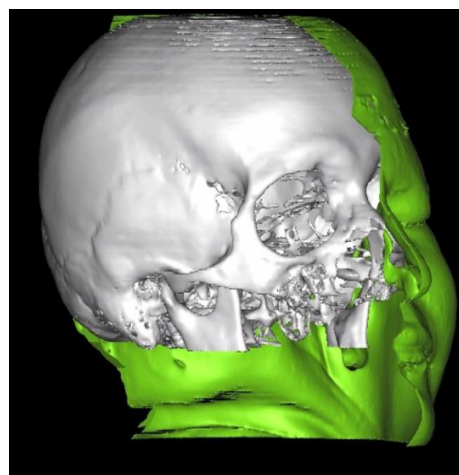


Figure 60



Figure 61 Year 2013



Figure 62. Year 2025

### CONCLUSION

The reconstruction of the maxillary with revascularized fibula offers a more stable biological support than the use of bone blocks, which tends to reabsorb quickly over time.

### DECLARATIONS

#### Ethics approval and consent to participate

Not applicable

#### Consent for publication

Not applicable.

#### Competing interests

The authors declare no conflict of interest.

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