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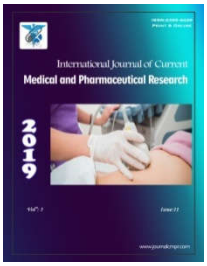

Review Article

ANTEROSUPERIOR HORIZONTAL RECONSTRUCTION OF CYSTIC DEFECT WITH TITANIUM MESH AND XENOGRAFT. CLINICAL CASE AND LITERATURE REVIEW

Erick Rafael Fernández Castellano

AV Juan Mendez EL Viejo. CC LA Alhondiga Local 11.Buenavista Del Norte Santa Cruz De Tenerife CP38480

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ABSTRACT

Introduction: Maxillary and mandibular bone defects are quite common. Among the different procedures that can be used to regenerate such defects we can find guided bone regeneration (GBR). This technique mainly uses a barrier membrane that can be resorbable or non-absorbable.
Clinical Case: A 58-year-old female patient comes to the hospital for implant rehabilitation. Upon observing the CBCT and seeing a radiolucency compatible with root cyst at the level of the 12th piece, we decided to extract this piece, perform cystectomy and wait three months to make a GBR with titanium mesh, resorbable membrane and xenograft. After 6 months the reentry is made, the titanium mesh is removed, and two implants are placed. After 4 months, the prosthetic rehabilitation is performed with metal-ceramiccrowns.
Discussion: After reviewing the literature, we observed that the average vertical and horizontal gain for GBR was 5.9mm and 5.6, obtaining in the present case an approximate horizontal gain of 5mm. It was found that the most predictable material for bone regeneration was autologous bone and as an alternative to it, no work was found that fully used xenografts (Cerabone).
Conclusions: I can affirm that the use of titanium mesh together with resorbable membrane and Cerabone, is a useful alternative to GBR procedures that use autologous bone.

INTRODUCTION

Nowadays, rehabilitation with dental implants is an effective therapeutic option to replace missing teeth in patients with total or partial edentulism. For this to be possible it is essential to ensure the success and survival of the same, being a crucial factor sufficient bone availability to prevent dehiscences, fenestrations and in turn to successfully support the functional loads. (1,2,3)

Since patients often show bone defects with variable characteristics as a result of different processes such as tooth loss, periodontal disease, trauma, tumors and cysts such as the present case, the correct three-dimensional placement of implants is often complicated. That is why different surgical techniques have been proposed such as onlay/inlay bone grafts, distraction osteogenesis, maxillary sinus augmentation, transposition of the inferior alveolar nerve, split crest and guided bone regeneration (GBR). (1-7)

Bone augmentation by GBR can be performed before or simultaneously with implant placement. (7,8) This technique, first described by Hurley and others in 1959, bases its biological justification on the mechanical exclusion of undesirable soft tissue cells so that they do not grow into bone defects, allowing only populations of osteogenic cells derived from parental bone to repopulate the space of the bone defect. (5,7,9). The barrier membranes usually used for these procedures may be resorbable and non-absorbable, such as polytetrafluoroethylene (PTFE) or titanium. (1,3,4,6)

Titanium mesh has been widely used in oral and maxillofacial surgery for reconstruction of bone defects. It is biocompatible and rigid enough to maintain the grafted space. However, its use is sensitive to the technique and not free of complications. The main cause of GBR failure is related to early or late exposure of the barrier device, leading to contamination and infection of the biomaterial, which can irreversibly compromise bone regeneration (3,4,8,10). To avoid this, it is imperative to close the flaps without tension, as well as the correct manipulation of the mesh, which must be cut and bent carefully as any sharp edge can cause an exposure of it. (1,2)

The objective of the present case is to present a horizontal regeneration of the anterosuperior sector with titanium mesh, resorbable membrane and xenograft (Cerabone), as well as a literature review.

Clinical Case

A 58-year-old female patient with no significant medical history comes to dental clinic for implant rehabilitation. Upon observing the CBCT and seeing that there was not enough width, as well as the presence of a radiolucide compatible with root cyst at the level of the 12th piece, a decision was made to

Corresponding author:* **Erick Rafael Fernández Castellano
AV Juan Mendez EL Viejo. CC LA Alhondiga Local 11.Buenavista Del Norte Santa Cruz De Tenerife CP38480

exodonate this piece at the same time as performing cystectomy, and wait for three months to then make a guided bone regeneration that would allow gaining sufficient bone volume for the subsequent placement of implants in the area of the 12th and 11th. The patient is also placed in treatment for the maxillary sinusitis. See figure 1a. The surgical treatment carried out after three months began after the signature of the informed consent with the anesthetic infiltration of 1.8mml of lidocaine with epinephrine 1:80.000, with a crestal incision in the edentulous area slightly towards the palate, together with two incisions of liberation in the vestibular mucous membrane, at the distal ends of pieces 21 and 13 obliquely, to obtain a trapezoidal flap of total thickness, evidencing the bone defect left by the cyst. Figure 1b.

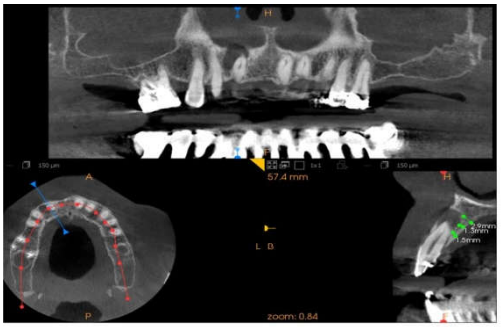

Figure 1a. Initial CBCT

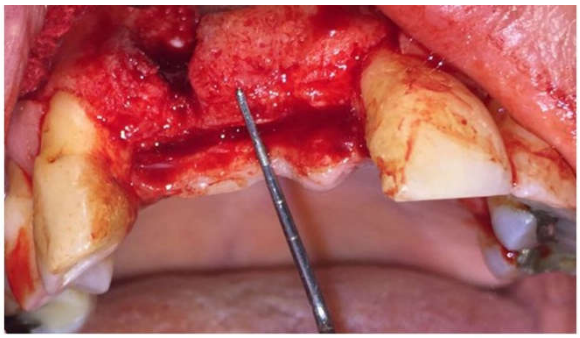

Figure 1b Cystic defect after 3 months

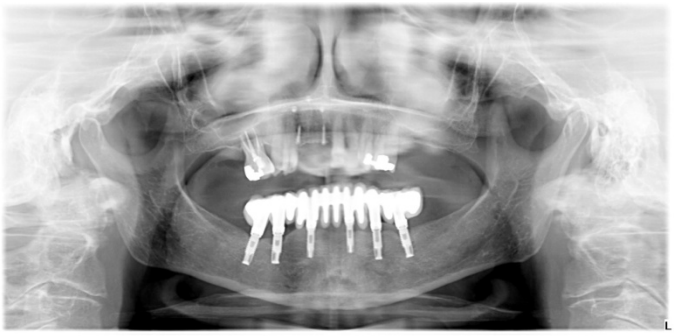

Figure 1c Panoramic radiography with regeneration

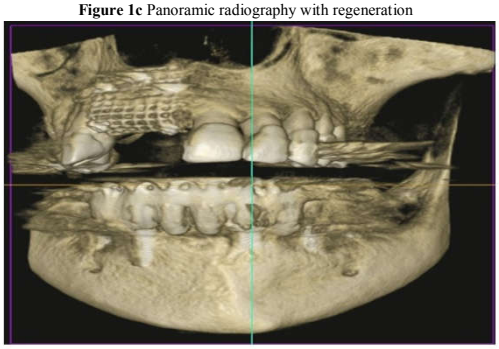

Figure 1d 3d image with titanium mesh

The preparation of the area included small holes with a round drill and a handpiece with plentiful irrigation to promote bleeding and revascularization. Subsequently, the cystic defect and vestibular crest were filled with xenograft particles (Cerabone, Botiss Biomaterials, Germany) and everything was covered with a titanium mesh previously formed of 0.1mm (Klockner) which was fixed with 1.6 x 8 mm (Klockner) self-threading micro-screws. At the same time, the titanium mesh was covered with a collagen membrane (Bio-Gide, Geistlich Pharma AG, Wolhusen, Switzerland 25 x 25).

See figure 1c and 1d. The flap was repositioned without tension using Rehrmann's maneuver and sutured with 5-0 monofilament nylon (LaboratorioAragó, S.L.Esp.) with simple stitches and mattresses. The patient was medicated with amoxicillin + clavulanic acid 875 mg / 125 mg three times a day for 7 days, ibuprofen 600mg one every 8 hours for 4 days, omeprazole 20mg one a day for 7 days and fortecortin 4mg 1 every 12 hours for two days.

A 0.20% chlorhexidine wipe was also ordered with chitosan three times a day for two weeks and an essix splint was placed with acrylic teeth in 12 and 11 without contact with the tissues of the regenerated area. The sutures were removed after 12 days and the re-entry was done in the sixth month, showing a good health of the tissues without exposure of the mesh. figure 2a.

For this, a previous incision periostotome was used to remove the tissues and a partial coverage of the titanium mesh by the newly formed bone was observed, which prevented its correct removal. See figure 2b.

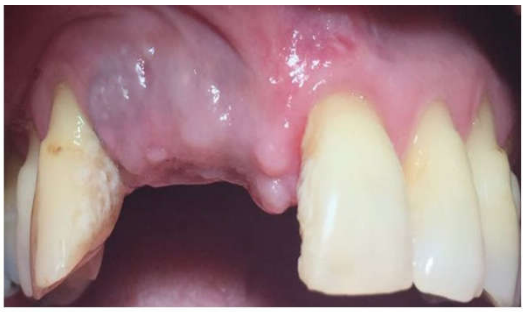

Figure 2a Situation of tissues after 6 months

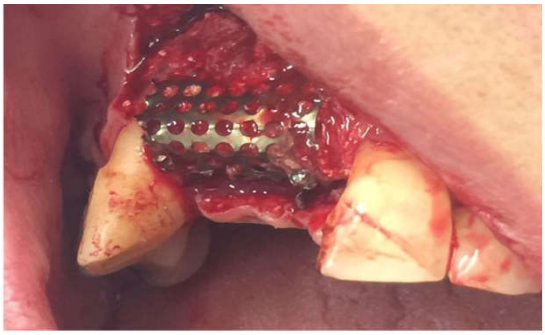

Figure 2b Moment of removal of the titanium mesh

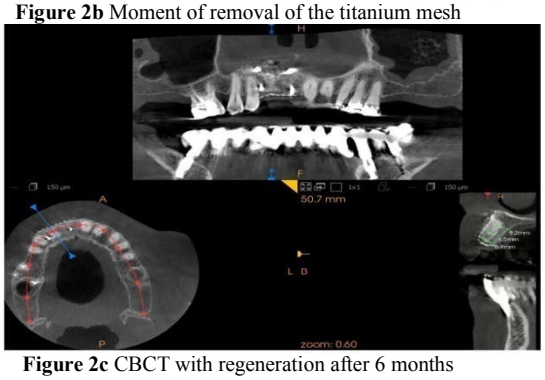

Figure 2c CBCT with regeneration after 6 months

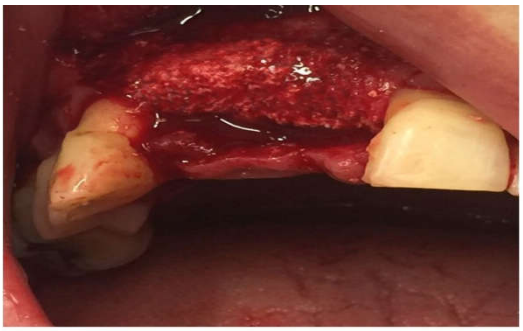

Figure 2d Bone situation after mesh removal

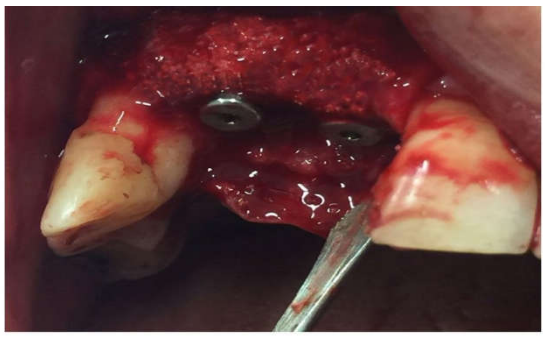

Figure 2e Placement of the implants when removing the titanium mesh.

In general, the clinical and radiographic findings revealed a significant gain in bone mass that allowed the placement of 3.5x14 implants with an insertion torque of 35Ncm. See figure 2c, 2d,2e. Four months after the implants were placed, the prosthetic restoration was fabricated and two year later, the patient was called again to perform a control that consisted of a panoramic radiography and a periodontal probe that was not greater than 4mm in the area of the implants. Figure 3.

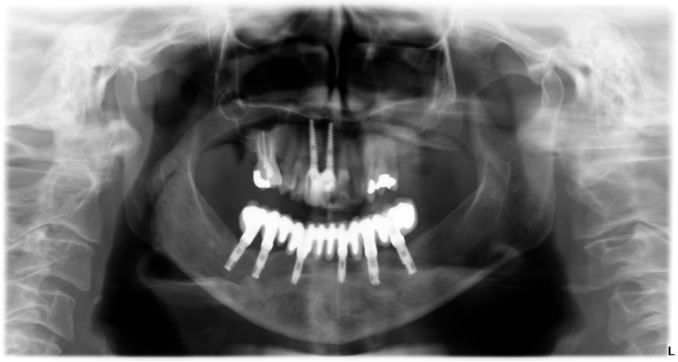

Figure 3 Panoramic after two year of implant placement

DISCUSSION

A review of the literature found a total of 23 articles in which titanium-guided bone regeneration was carried out on a total of 352 patients. The average waiting period to remove the titanium mesh was 6.7 months, with ranges from 3 to 9 months, in our case its removal was carried out at 6 months practically coinciding with the average of the studies and in particular with the works of Torres *et al*, Sagheb *et al* and Poli *et al*. (2,7,10) See table 1.

The average vertical and horizontal gain was 5.9mm and 5.6. In only 4 studies (Akiyoshi *et al*, Raquel *et al*, Sagheb *et al* and Alessandro *et al*, GRB were carried out using the combination of titanium meshes with resorbable membranes, coinciding with the present case and based on the theory that these could help osteogenic cell migration, preventing soft tissue invasion through the micropores of the mesh. (2,3,4,11).

Table 1 MVA: Mean Vertical Augmentation; MHA: Mean Horizontal Augmentation; NE: Not Evaluable; ----Not used

Author	Year	N. Patients	Harvest	Resorbable Membrane	Time of mesh removal (months)	Type of augmentation	MVA (mm)	MHA (mm)
Malchiodi et al. (25)	1998	25	Particulated autogenous bone	------	8	Horizontal	------	5.65
Leghissa et al. (26)	1999	10	None	------	3.5	Vertical	8.6	------
Von Arx et al. (27)	1999	15	Particulated autogenous bone	------	6.6	Vertical	5.8	-------
Lozada et al.(23)	2002	1	Particulated autogenous bone	------	7	Vertical	10	-----
Artzi et al. (16)	2003	10	Xenograft(Biooss)	------	9	Vertical + Horizontal	5.2	-----
Roccuzzo et al. (21)	2004	18	Autogenous bone: onlay + particulate	------	4.6	Vertical + Horizontal	4.8	-----
Proussaefs et al. (12)	2006	17	Autogenous bone + Xenograft(Biooss) (1:1 ratio)	------	8.47	Vertical + Horizontal	2.56	3.75
Roccuzzo et al. (22)	2007	12	Autogenous bone: onlay + particulate	------	4.6	Vertical	4.8	-----
Frank et al. (20)	2007	14	Nanocrystalline hydroxyapatite (Ostim)	------	6-7 (6,5)	Horizontal	----.	2
Pieri et al. (13)	2008	16	Autogenous bone + Xenograft(Biooss) (70:30 ratio)	------	8.5	Vertical + Horizontal	3.71	4.16
Louis et al (19)	2008	44	Particulated autogenous bone	------	6.9	Vertical	13.7	-----
Corinaldesi et al. (18)	2009	24	Particulated autogenous bone	------	8.5	Vertical + Horizontal	5.5	NE
Torres et al. (10)	2010	30	Xenograft(Biooss)	------	6	Vertical + Horizontal	3.3	3.9
Ciocca *et al.* (14)	2011	1	Autogenous bone + Xenograft(Biooss)	------	8	Vertical + Horizontal	2.57	3.41
Akiyoshi et al.(11)	2013	19	Autogenous bone + Xenograft(Biooss) (1:1 or 4:1 ratio) + rhPDGF	Yes	8	Vertical	8.6	-----
Jung et al. (1)	2014	10	Autogenous bone + Allograft (Sure-Oss;)(1:1ratio)	------	4	Horizontal	NE	1,4
Poli et al (7)	2014	13	Autogenous bone + Xenograft(Biooss) (1:1 ratio)	------	6	Vertical + Horizontal	NE	NE
Cássio et al (24)	2015	1	Autogenous bone	------	5	Vertical	NE	NE
Raquel et al.(3)	2016	25	Xenograft(Biooss)	Yes	3-4 (3,5)	Horizontal	-----	3.67
Sagheb et al. (2)	2017	17	Autogenous bone + Xenograft(Biooss or Autogenous bone alone	Yes	6	Vertical + Horizontal	6.5	5.5
Alessandro et al. (4)	2017	20	Autogenous bone + Allograft (Sure-Oss;)(50:50ratio)	Yes	9	Vertical	4.1	------
Jegham et al (6)	2017	1	Autogenous bone +Xenograft(Cerabone)	------	4	Horizontal	-----	2
Ciocca et al (14)	2018	9	Autogenous bone + Xenograft(Biooss) (1:1)	------	6-8 (7)	Vertical	3.83-3.95 (3,89)	------
TOTAL		352			6,7		5,9	5,6

It was found that the most predictable material for bone regeneration was autologous bone, due to its potential, osteoinductive, osteocondutor and osteogenic. (6) However, this material requires the collection of other anatomical sites (intra or extra-orally), which can often be insufficient and cause greater postoperative morbidity to the patient. As an alternative to this, several studies have used GBR procedures with titanium mesh and various bone graft materials among which we can find autologous bone, bovine bone mineral, alloplastic materials, and their combinations. (1,2,7)

Among the available bone substitutes, Bio-oss bovine bone has received a large number of reports in the literature demonstrating its long-term success when used in combination with autologous bone and titanium mesh in bone augmentation procedures, as reflected in studies by Proussaefs *et al* (2006), Pieri *et al* (2008), Ciocca *et al* (2011), Akiyoshi et a (2013), Sagheb *et al* (2017), Ciocca *et al* (2018), and Poli *et al* (2017) and Poli *et al* (2018). (2,7,11,12,13,14,15). There are also studies that support the use of this material in a unique way for GBR, such as Artzi *et al* (2003), Torres *et al* (2010), Her *et al* (2012) and Raquel *et al* (2016). (3,9,10,16)

As for the use of other bovine bone materials such as Cerabone, little scientific evidence has been found. Mazor *et al*, placed a total of 100 implants in 32 patients, by performing joint nasal floor elevations using as biomaterial the Cerabone and obtained an average gain of 3.4 ± 0.9 mm, without recording any failure. (17)

Riachi *et al*, published an article in which this one was compared with the Bio-oss, in which a lesser vertical bone loss was observed after 4 years in the apexes of the implants placed after the maxillary sinus elevations in favour of the Cerabone. (18)

Recently Trajkovski *et al* compared a total of 8 types of biomaterials such as cerabone® 0.5-1 mm, Bio-Oss® 0.25-1 mm, NuOss® 0.25-1, SIC® 0.3-1 mm, maxresorb® 0.5-1 mm, Straumann® BoneCeramic 0.5-1 mm, NanoBone® 0.6 m and Ceros® 0.7-1.4 mm. They determined that Cerabone had the highest degree of hydrophilicity when absorbing the first drop of blood in only 0.41s and the second drop in 0.37s. On the other hand, the Bio-Oss showed the lowest hydrophilicity capacity, since it took a total of 33.66s to absorb the blood and only after the accumulation of four drops in a larger and heavier drop. Such variations could influence volume stability at the graft site, manipulation, as well as speed of vascularization and bone regeneration. (19)

Regarding GBR with titanium mesh in combination with Cerabone, only one case was found published by Jegham *et al* (2017), in which it was successfully mixed with autologous bone to obtain more than 2mm of gain in a horizontal regeneration. (6) Hence the peculiarity of this case, since the regeneration of the horizontal cystic defect was carried out with this material in its entirety obtaining a gain of up to 5mm.

CONCLUSION

Within the limitations of being a clinical case and in the absence of further studies, we can state that the use of titanium mesh in conjunction with resorbable membrane and Cerabone can be a useful alternative to GBR procedures that use autologous bone for horizontal augmentations, thus eliminating the need for a donor site and therefore decreasing the postoperative morbidity of patients.

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