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Case Report

Horizontal Bone Augmentation in the Pre-Maxilla Region with Used the Bone Block Xenogeneic Origin - Clinical and Tomographic Analysis

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Abstract

Tooth loss, especially in the anterior region, generates a loss of local bone structure affecting the aesthetics and function for the patient and a viable tactic is the use of deproteinized bovine bone block graft. This reconstructive method allows the possibility of partial or total reconstruction of the maxilla and mandible in a safe and predictable way, where it seeks the maintenance of the three-dimensional structure, viability of bone neoformation and favoring implant-supported rehabilitation. This case report aims to reveal and support the longitudinal follow-up of 5 years of a horizontal alveolar reconstruction in the anterior maxillary region with heterogeneous bone block and subsequent implantation and rehabilitation with metal-ceramic crown.

Keywords: Maxillary graft; Rehabilitation; Heterogeneous bone block; Anterior implant; Horizontal alveolar graft.

Introduction

The loss of tooth elements constitutes a local loss of bone structure affecting the aesthetics and function for the patient [1]. For such condition, the installation of implants end up being a viable and predictable alternative, as long as there is adequate remnant bone tissue for the installation and later rehabilitation of the lost elements [2]. According to Cho et al. 1998 and Martins et al., 2021, the use of bone grafts is substantially clarified, mainly regarding its origins, them being autologous, homologous, heterogeneous, and synthetic, whereas the bone with autologous origin is considered the golden standard, because of its characteristics, such as its osteogenic, osteoconductive, osteo-

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inductive capacity, and lesser immune specific response [3,4]. Within the alternatives to the autologous bone is the use of the heterogenous bone of bovine origin, which has, besides a favorable osteoconductive characteristic, also has a three-dimensional structure similar to the bone, possessing, according to some authors [5,6], bioactive factors such as TGF-β and BMP-2. The heterogenous bone particles of bovine origin must be exempt of protein, once it could cause some kind of immune reaction in the patient regarding the origin proteins [7,8]. When the affected region doesn't present enough bone inhibiting a rehabilitation with the implant-supported restorations, re-constructive techniques are related to the volume lost in height, thickness or both. Due to this, the operator has the option to search for other origins such as, the homologous bone origin, being associated, or not, to the use of heterogeneous or synthetic bone origin, or the use of the direct application of heterogeneous bone origin alone [9,10]. An efficient reconstructive method that allows the partial or total reconstruction of the maxilla and mandible [11], just as donor areas when they are involved in the reconstructive process [12] is the use of bone graft block as a substitute mean [13]. The use of a heterogeneous origin bone block aims to supply some disadvantages found in the use of the autologous bone, one of them being the limited availability in some cases, complex removal technique in either intraoral or extraoral areas, increasing the morbidity degree to the patient due to the surgery procedures [14].

Research objective

The main objective of this case report is to bring and provide relevant clinical information in the use of the heterogeneous bone block as a possibility of substitution of other modalities in horizontal and posterior bone volume increase implant-supported rehabilitation in the anterior maxilla region.

Case report

Patient CSM, 52 years of age, female, presented the loss of dental element 22 (Figure 1). Complementary tests were requested, and no alteration was observed. The initial analysis was done through a Cone Beam type CT scan, it revealed the need of bone thickness volume gain due to the local bone defect (Figure 2). As an option, the placing of 1 bone block of heterogeneous origin of 10X10X5mm was done (Lumina-bone porous block from Critéria Biomateriais, Brazil), (Figure 3). As a prophylactic preoperative measure, 2g amoxicillin prescription was opted in the preoperative, together with 4mg of dexamethasone, both 1 hour before the surgical procedure. Proceeded to the extraoral antisepsis with chlorhexidine at 2%. The chosen anesthetic technique was the infiltrating with anesthetic articaine salt (dilution of 100.000:1).

Figure 1: The loss of dental element 22.

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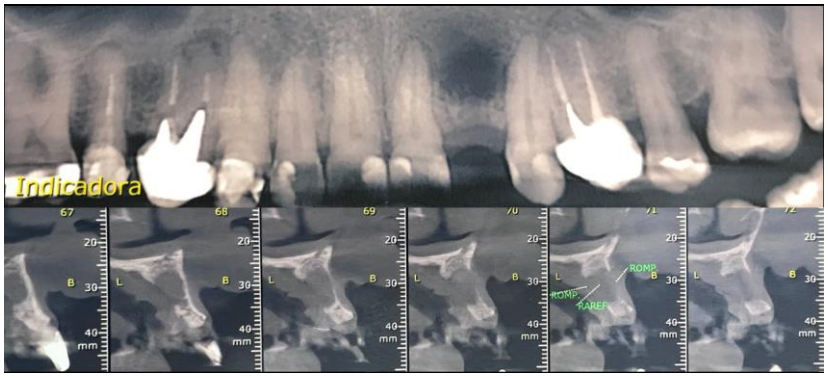

Figure 2: Cone Beam type CT scan revealing the need of bone thickness volume gain due to the local bone defect.

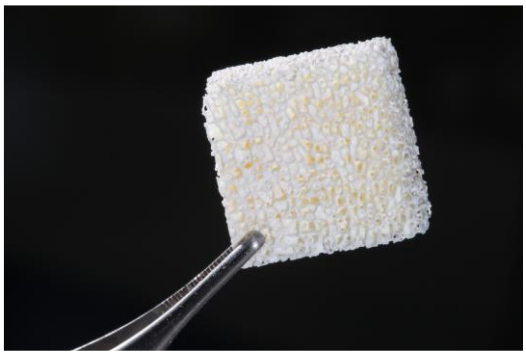

Figure 3: 1 Bone Block of Heterogeneous origin of 10X10X5mm.

The surgical technique of choice was through relaxing trapezium shaped incisions with inverted base with accesses in the 21 and 23 elements region and ridge between 21 and 23, followed by total diffusion and dislocation of the entire patch (Figure 4). Next, the block preparation was performed, with multi-laminated maxi-cute drill in reducer 1:1, at 1400 RPM, for the modeling according to the base of the pristine bone receptor (Figure 5), preparing the receptor region with a descorticalization, utilizing the multi-laminated drill FG01 (Figure 6), performing grooves and perforations in the receptor region, with the intent of causing bleeding for nutrition.

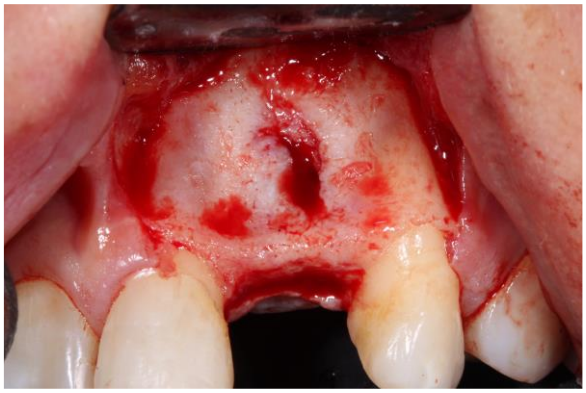

Figure 4: Relaxing trapezium shaped incisions with inverted base with accesses in the 21 and 23 elements region.

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Figure 5: The block preparation with multi-laminated maxi-cute drill.

Figure 6: Preparing the receptor region with a descorticalization, utilizing the multi-laminated drill FG01.

The block perforation was performed before the installation in the pristine bone, with a 1,3mm helicoidal milling cutter, installed with the use of a screwdriver, passing through the block entirely, being placed in the element 22 region, and immediately inserted with 1 fixation (Figure 7), screw, size 1,5X9mm (Titanium Fix, Brazil), manually in the 84 degree axis (perpendicular) of the block in the direction of the pristine bone (Figure 8). The filling between the gaps of the block and the pristine bone was performed with particulate bone of heterogeneous origin (Lumina Bone Porous Small Critéria Biomateriais, Brazil) (Figure 9).

Figure 7: The block perforation.

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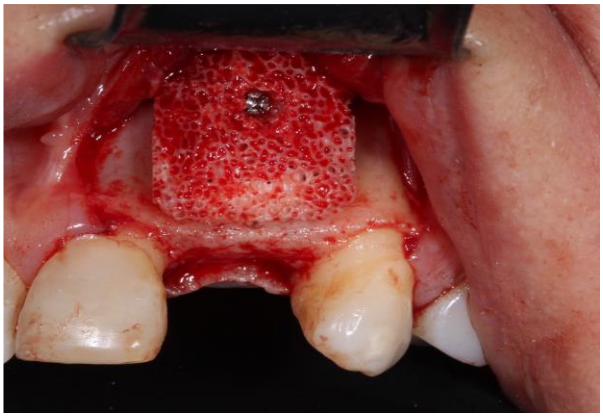

Figure 8: Screwing manually in the 84-degree axis (perpendicular) of the block in the direction of the pristine bone.

Figure 9: The filling between the gaps of the block and the pristine bone was performed.

The grafts were coated with collagen membrane of 2X20X10mm (Lumina Coat Double Time from Critéria Biomateriais, Brazil) and L-PRF membrane Choukroun Protocol (Figure 10). The suture was performed utilizing 5-0 Polipropilen surgical thread, in continuous technique (Figure 11). Postoperative analyses were done in the following periods: 3, 7, 15, 30, and 60 days. New CT scan was requested with 180 days (Figure 12,).

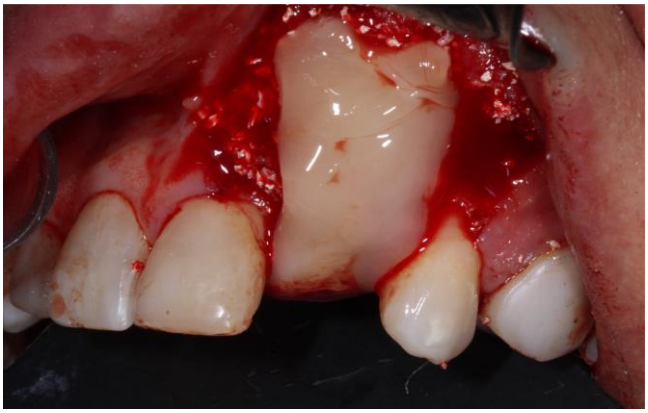

Figure 10: Collagen membrane coating of graft of 2X20X10mm.

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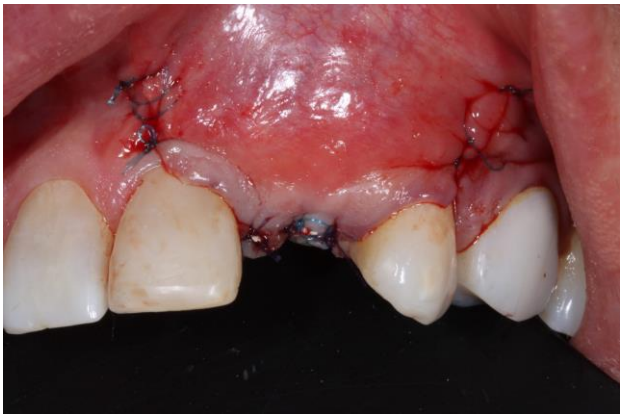

Figure 11: Suturing with a thread.

Figure 12: Postoperative analyses.

After the period of 180 days of the first intervention the reopening was performed and 2g of amoxicillin were prescribed in the preoperative, along with 4mg of dexamethasone, both 1 hour before the surgical procedure, as a prophylactic preoperative element. The extraoral antisepsis with 2% chlorhexidine proceeded. The sedation technique was the infiltrating with anesthetic articaine salt (dilution of 100.000:1). The screw in which the block was fixated with was removed and the milling proceeded (Figure 13), which followed the drill sequence starting with the 2mm diameter drill bit using the 20:1 reducer at 1200 RPM. In the next step, at 750 RPM, milling with the conical of 2,8mm, with the same reducer, followed by the installation of the Nobel Replace Conical Connection 11X3,5mm (Nobel Biocare, EUA) in the element 22 region at 48 RPM, obtaining 40N torque (Figure 14). Postoperative analyses were followed after 3, 7, 15, 30, and 60 days (Figure 15).

After 120 days, a new CT scan was obtained and the reopening of the implant was scheduled (Figure 16), installations of implant prothesys and ceramic veneers were fabricated and installed in the elements 13, 12, 11, 21, and 23 (Figure 17). Next the control (Figure 18, 19) and final analysis was done through a Cone Beam type CT scan (Figure 20).

Discussion

The long-term success of a treatment with implants depends on a lot of the bone presence in the region [6]. In cases where the volume is found to be damaged, reconstructive techniques relate to the loss, being in height, thickness or both [15,16].

In order to restore the volume loss, some clinical and surgical considerations need to

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be regarded, such as, which volumization method and bone gain are intended to apply and which kind of graft material is intended to use. The biomaterials can be of autologous, homologous, heterogeneous or synthetic origins [9,17].

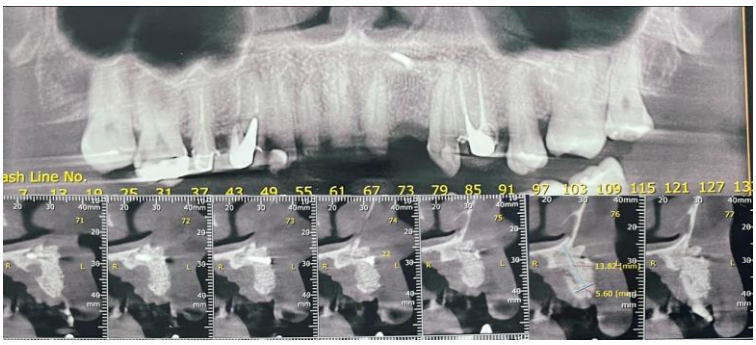

Figure 13: New CT scan after 180 days.

Figure 14: The installation of the Nobel Replace Conical Conection 11X3,5mm.

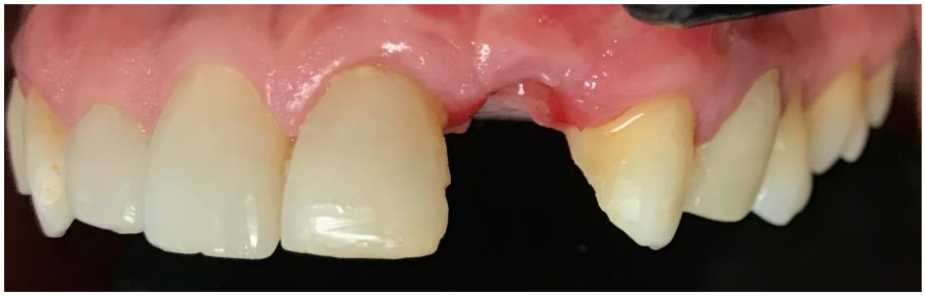

Figure 15: Postoperative analyses.

Figure 16: Installations of Fabricated implant prothesys and ceramic veneers.

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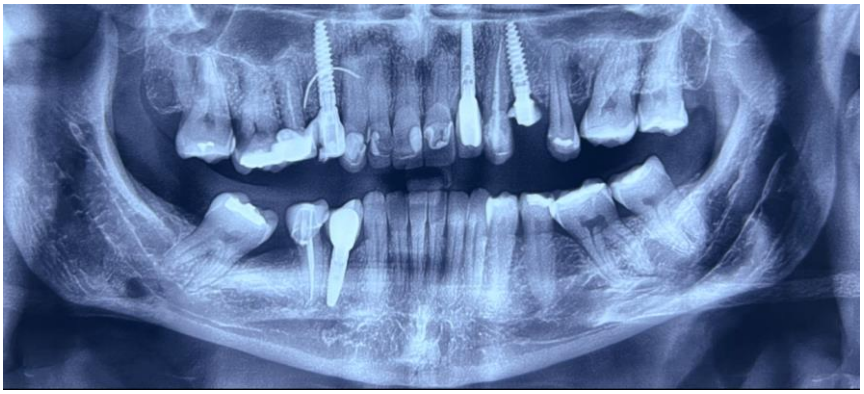

Figure 17: New CT scan after 120 days.

Figure 18: Control Post Implant.

Figure 19: Postoperative analyses.

Figure 20: Postoperative analyses.

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The autologous bone, considered the golden standard, promotes osteogenesis, osteoinduction, and osteoconduction, in addition to smaller specific immune response [17], presenting in its matrix potential growth factors such as PDGF (platelet derived growth factor) and TGF-β (transformer growth factor-β) [18,19]. The biomaterial utilized in this job was the lyophilized bone graft block of bovine origin, in which presents a three-dimensional osteoconductive matrix in order to favor neovascularization and cellular migration to promote a future osteogenesis [9,18]. Such methodology, regarding the use of the autologous bone, had a center axis to avoid the gathering of materials in other areas, which, makes the postoperative longer, more painful, and in some cases complicated in terms of the morbidity of the case [13]. The heterogeneous graft, as well as the autologous, may present a range of ways, either being particulate [11] or in block [9]. Another favorable factor is its applicability, as it was the case in this study where the horizontal increase of the ridge, which for some authors is more viable since the material has a three-dimensional structure - Scaffold - already set [13].

The lyophilized mineral bovine bone graft presents high biocompatibility, good osteoconductive properties, low cost, and easy handling [6], but it is very limited when utilized in lateral reconstructions [20] or vertical reconstructions [21,22].

Regarding the applied technique, the block fixation in the pristine bone was executed with similar technical parameters as described by Schwarz et al. (2016) [13], where the main difference is in the better suitability of the edges of the biomaterial with the use of the reducer and the handpiece in order to avoid immediate or long-term postoperative dehiscence. Such incoherence is reduced once the use of collagen membranes of slow resorption helps in the protection of the grafted area, as well as reducing the chances of the contamination of the region [9].

The current work had its explanation of the success of the integration of the heterogeneous block based on the findings of the proposed biopsies and evaluated by Schwarz et al. (2016) [13], where the bone formation on the block from the migration, adhesion and proliferation of the osteoprogenitor cells for the future extracellular osteoid matrix [6], was homogenous and in a appositional manner, in such a way that the gaps have been properly filled. Another indicative of the success is in the choice of the utilized implant. The replenishment technique of the unitary element (22) utilized of an insertion implant in the bone level and with the prosthetic fitting platform of inner conic standard, in order to provide a good remodeling, maintenance of the residual and newly formed ridge, and reduced loss standard to the clinical inquiry [1,23].

Given the increase of the horizontal ridge worked in this study, the excess and quality of the patient's local gingival mucosa at the start of the treatment was enough to maintain the tissue standard of the soft tissue [1,24] and the crestal bone [15] after the suture, as well as in the period of the monitoring along the weeks. This study applied two kinds of lyophilized bovine heterogeneous bone: in block and particulate, where the particulate bone had its function right after the fixation and stabilization of the heterogeneous block with focus in the gaping areas between the pristine bone and the block (gaps) and

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subsequent protection with the collagen membrane of slow resorption. Such methodology shares the same results found by Schwarz et al. (2016) [13] and Thoma et al. (2015) [11], whereas in the second study the authors found improvement in the biological performance when utilized in association with the recombinant morphogenetic protein-2 (rhBMP-2) regarding the bone turnover.

In case of the use of membranes of slow resorption or double layer function second Freitas et al. 2021, its primary role is to avoid the displacement of unwanted cells and fibrotic tissue, as well as possible contaminated factors on the remodeling pristine bone associated with the biomaterials applied [9,13].

Another matter to be considered is the reason why the heterogeneous bone and not the homologous bone, which also presents easy handling, characterized mineral substance, viable three-dimensional structure, and osteoinductive and osteoconductive capabilities. However, as safe as its procedure might seem, the homologous bone has the capability of promoting sensibility to the Human Leucocyte Antigen (HLA), as it promotes a certain risk of disease transmission [18]. An observation of the contamination possibility is on the process and sterilization of the heterogeneous bone, in order not to promote contamination risks by proteins originating from the animal creating the risk, for example, for the spongiform encephalopathies [24].

Another condition is the patient's personal factor, which also has to be considered, once the surgeon responsible for the planning and execution of the case must, together with the patient, evaluate the ethical and religious conflicts at the time of the biomaterial choice to be applied [11].

Conclusion

In the face of the clinical case exposed, with all its methodology shown, accompanied, and supported in the literature, the authors conclude that the use of the lyophilized heterogeneous bone of bovine origin is a safe alternative, predictable and effective, in order to reduce operational setbacks such as limited gathering area, immune reaction possibilities, and postoperative morbidities, in the face of an accessible cost-benefit and favorable logistics.

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