Bone defect rehabilitation using lyophilized bone preshaped on a stereolithographic model

Lauren Oliveira Lima Bohner, Eduardo Mukai[1], Sueli Mukai[2], Pedro Tortamano, Newton Sesma

Abstract

Bone grafting provides ideal conditions to the patient's rehabilitation with dental implants. In addition, prototyped tridimensional models allow the surgical procedure to be simulated and enable important anatomic structures to be visualized. To present a bone defect rehabilitated with xenogenic bone preshaped on a stereolithographic model and the follow-up after 7 years of treatment. The present case report describes a bone defect rehabilitated with a lyophilized bone block preshaped on a stereolithographic model. The patient, a 56-year-old woman, was referred to the dental office presenting a bone defect in the anterior maxilla. Bone regeneration intervention was performed with xenogenic grafting and barrier membrane. The follow-up of the postoperative period and after 7 years is presented. After 7 years, the tomographic exam showed the maintenance of bone at the grafted site, representing the long-term success of the treatment.

Keywords: Bone, dental implants, bone transplantation, grafting

Introduction

The key factor for an esthetic and successful oral rehabilitation with dental implants is the presence of an appropriate quantity of bone for supporting the final restoration.[1] Nevertheless, clinical situations as periodontitis or tooth extraction may lead to bone resorption, and result in inadequate conditions for dental implant placement. In case of an insufficient amount of bone, surgical procedures involving bone grafts are usually required.[2]

The use of a xenogenic bovine bone has emerged as a real and effective possibility in dental implant rehabilitations.[3] Furthermore, the surgical procedure may be optimized using prototyped models, which allow simulation of the surgical procedure and visualization of important anatomic structures, improving planning of the procedure.[4] This clinical report describes a 7-year period of follow-up of a bone defect reconstructed with lyophilized bone after preshaping on a stereolithographic model.

Department of Prosthodontics, School of Dentistry, University of São Paulo, [1]Department of Implantology, APCD, [2]Department of Implantology, School of Dentistry, University of Guarulhos, SP, Brazil

Correspondence: Prof. Eduardo Mukai,
Av Conselheiro Carrão 1530, 03402-001, São Paulo-SP, Brazil.
E-mail: emukai@allnet.com.br

Access this article online	
Quick Response Code:	Website: www.contempclindent.org
	DOI: 10.4103/0976-237X.188578

Case Report

The patient MMC, a 56-year-old woman, was referred to a private dental office for dental implant rehabilitation. The patient presented absence of a lateral incisor and canine on both sides of maxillary arch; and absence of premolars in the right quadrant. A preoperative cone-beam computed tomography exam showed the presence of a residual root and a buccal bone defect on both sides of the arch, which prevented rehabilitation with dental implants [Figure 1]. Hence, a treatment plan was defined to reconstruct the bone defect by a bilateral onlay-inlay bone graft before implant placements.

Bone graft blocks (OrthoGen, Genius, Baumer SA, São Paulo, Brazil) measuring 15 × 15 × 5 mm and 30 mm × 20 mm × 10 mm were used in this procedure. We decided to optimize the treatment by using a stereolithographic model that allowed the bone graft blocks to be shaped before surgery, ensuring their optimal adaptation to the maxillary bone [Figure 2].

After adequate local anesthesia and preparation, a surgical incision was performed on the alveolar crest, with vertical

How to cite this article: Bohner LO, Mukai E, Mukai S, Tortamano P, Sesma N. Bone defect rehabilitation using lyophilized bone preshaped on a stereolithographic model. Contemp Clin Dent 2016;7:398-400.

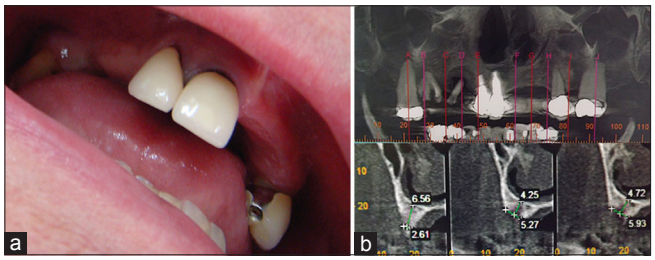

Figure 1: Initial clinical (a) and radiographic (b) exam showing a vertical and horizontal buccal bone defect

releasing curvilinear incisions. After flap elevation, buccal bone was accessed, and the shaped block was positioned and fitted into the bone defect. Afterward, the site was decortified to enhance vascularization, and the block was stabilized with metal screws. A biological resorbable membrane (GenDerm Genius, Baumer SA, São Paulo, Brazil) was adapted and applied over the graft surface [Figure 2]. Finally, the flaps were repositioned over the membrane and sutured. Nine months after surgery, the result of rehabilitation was shown to be successful and allowed the placement of dental implants (3.8 mm × 11.5 mm, Implac SA, São Paulo, Brazil). After 7 years of follow-up, tomographic exam showed the maintenance of bone, representing the long-term success of the treatment [Figure 3].

Discussion

The present case report described a successful treatment of a bone defect rehabilitated with a preshaped bone graft block. The technique allowed not only an esthetic result but also an optimal quantity and quality of bone to support dental implants. Clinical evaluation after 9 months showed a healthy and highly vascularized bone, and even after 7 years, the maintenance of bone structure could be observed in radiographic exams.

Block grafts are considered the treatment of choice in cases of resorbed ridges, for which "onlay" and "inlay" techniques are available. Although both methods show a potential for dimensional graft loss, inlay grafts have some advantages, such as the assurance of volume stability due to the interposition of bone.[5,6] We chose to combine the two procedures because of the horizontal and vertical resorption presented by the patient. Surprisingly, the inlay-onlay graft provided bone gain and showed a successful long-term result.

A key factor for successful treatment is the choice of an appropriate graft material. The autogenous graft is considered the gold-standard for rehabilitation of bone defects,[1,7] due to its osteogenic properties.[3] However, the main disadvantages of autogenous bone are the need for a second surgical procedure that causes the patient morbidity and discomfort.[3,6] Furthermore, the bone gained is limited, and especially for large bone defects, an extra-oral donor site

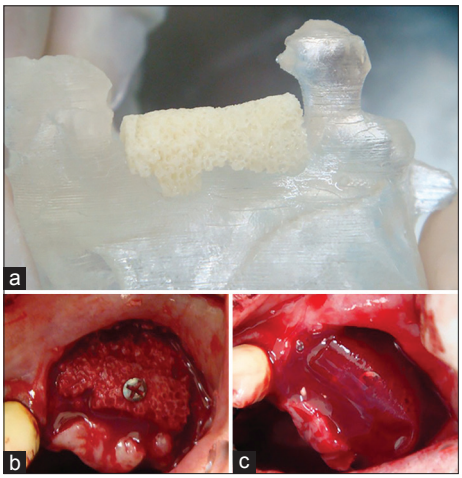

Figure 2: (a) Bone graft block preshaped on a stereolithographic model. (a) Bone graft block stabilized in the defect (b) and covered by a barrier membrane (c)

is required, involving general anesthesia and hospitalization,[8] thus, it may not be well-accepted by patients. Hence, we decided to use a xenogenic bone graft, which allowed a less invasive procedure and provided a clinically acceptable result. However, it has some drawbacks, as it shows no osteogenic and osteoinductive capacity[9] and its integration process is slower when compared with that of allografts. Indeed, the outcome provided by xenografts is uncertain.[10]

Guided bone regeneration may be improved by the association of different biomaterials. San-Sanchez *et al*. (2015) reported that the use of a barrier membrane over the graft resulted in better results when compared with the graft alone.[7] In this case report, the use of barrier membrane may have contributed to the success of treatment.

Another important feature for the treatment outcome is stabilization of the block in the bone defect. Intraoperative modeling of the graft is a challenging procedure and may result in poor mechanical stability of the block. This situation could impair the biological response and subsequently prevent bone gain.[5]

In this case report, a stereolithographic model was used to model the block after surgery. Thus, the exact shape and size of bone block required for dental implant rehabilitation could be determined. It is important to emphasize that the surgical intervention described here was performed 7 years ago. At present, with the advance of digital technologies, the block can be designed and milled into the shape of the bone defect. Studies have reported the use of anatomically shaped blocks combining tomographic exams and computer-aided-design/computer-aided-manufacturing technologies, showing favorable results.[5]

In summary, innovative approaches are available for dental surgeries, enhancing productivity, decreasing the time of

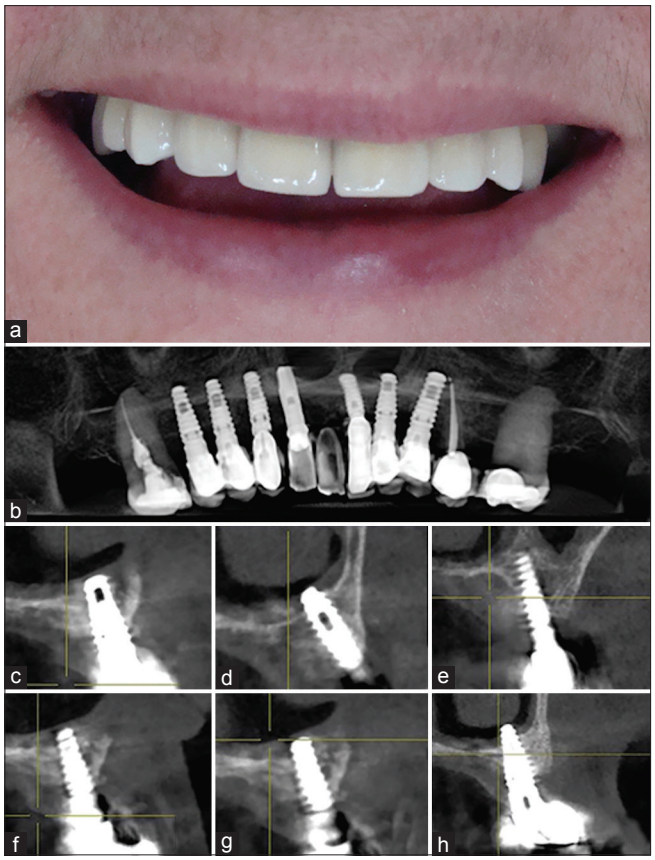

Figure 3: Clinical (a) and radiographic (b) aspect after the installation of implant-supported dental prostheses. Dental implants (c) 11, (d) 12, (e) 13, (f) 21, (g) 22, (h) 23

surgery and enabling a reliable procedure to be performed. The use of preshaped bone graft blocks allowed placement of the dental implant and long-term maintenance of treatment.

Conclusion

A reliable treatment was performed with stereolithographic models and preshaped bovine bone blocks for bone defect rehabilitation.

Financial support and sponsorship
Nil.

Conflicts of interest
There are no conflicts of interest.

References

1. de Carvalho PS, de Carvalho MC, Ponzoni D. Reconstruction of alveolar bone defect with autogenous bone particles and osseointegrated implants: Histologic analysis and 10 years monitoring. Ann Maxillofac Surg 2015;5:135-9.
2. Araujo DB, de Jesus Campos E, Oliveira MA, Lima MJ, Martins GB, Araujo RP. Surgical elevation of bilateral maxillary sinus floor with a combination of autogenous bone and lyophilized bovine bone. J Contemp Dent Pract 2013;14:445-50.
3. Manfro R, Fonseca FS, Bortoluzzi MC, Sendyk WR. Comparative, histological and histomorphometric analysis of three anorganic bovine xenogenous bone substitutes: Bio-oss, bone-fill and gen-ox anorganic. J Maxillofac Oral Surg 2014;13:464-70.
4. Kamposiora P, Papavasiliou G, Madianos P. Presentation of two cases of immediate restoration of implants in the esthetic region, using facilitate software and guides with stereolithographic model surgery prior to patient surgery. J Prosthodont 2012;21:130-7.
5. Mangano FG, Zecca PA, van Noort R, Apresyan S, Iezzi G, Piattelli A, *et al*. Custom-made computer-aided-design/computer-aided-manufacturing biphasic calcium-phosphate scaffold for augmentation of an atrophic mandibular anterior ridge. Case Rep Dent 2015;2015:941265.
6. Felice P, Barausse C, Pistilli R, Spinato S, Bernardello F. Guided sandwich technique: A novel surgical approach for safe osteotomies in the treatment of vertical bone defects in the posterior atrophic mandible: A case report. Implant Dent 2014;23:738-44.
7. Sanz-Sánchez I, Ortiz-Vigón A, Sanz-Martin I, Figuero E, Sanz M. Effectiveness of lateral bone augmentation on the alveolar crest dimension: A systematic review and meta – analysis. J Dent Res 2015;94(9 Suppl):128S-42S.
8. Zétola AL, Verbicaro T, Littieri S, Larson R, Giovanini AF, Deliberador TM. Recombinant human bone morphogenetic protein type 2 in the reconstruction of atrophic maxilla: Case report with long-term follow-up. J Indian Soc Periodontol 2014;18:781-5.
9. Issa JP, Gonzaga M, Kotake BG, de Lucia C, Ervolino E, Iyomasa M. Bone repair of critical size defects treated with autogenic, allogenic, or xenogenic bone grafts alone or in combination with rhBMP-2. Clin Oral Implants Res 2016;27:558-66.
10. Athanasiou VT, Papachristou DJ, Panagopoulos A, Saridis A, Scopa CD, Megas P. Histological comparison of autograft, allograft-DBM, xenograft, and synthetic grafts in a trabecular bone defect: An experimental study in rabbits. Med Sci Monit 2010;16:BR24-31.