

Bone Guide for Maxillary Reconstruction: A Case Report

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Abstract

Scientific development and increasing technological progress in the field of dentistry have allowed the use of many resources in the oral rehabilitation planning. In complex cases, in order to achieve projected final results, many procedures should be undertaken prior to implant surgery. Prosthetic rehabilitation planning and bone graft procedures can better restore the functional, aesthetic, social and emotional needs of the patient. This clinical case report shows the oral conditions of a woman who underwent several surgical procedures for maxillary reconstruction with autogenous bone grafts from the iliac crest. In this case, a bone volume guide was made to evaluate the bone volume requirement for correct labial support for metallo-ceramic fixed prosthesis. After graft integration, dental implant surgery was performed. After the osseointegration period, the prostheses was fabricated and installed on the implants, thus concluding the oral rehabilitation. In conclusion, the bone guide was a fundamental tool for final aesthetic outcome predictability.

Key words: Bone graft, Osseointegrated implants, Implant - supported metallo-ceramic prosthesis

Introduction

Bone tissue presents a dynamic process of formation/resorption. When a tooth is extracted, this process is altered due to the absence of the periodontal ligament. The lack of bone stimulation decreases the alveolar ridge height and trabecular density [1]. Thus, tooth loss causes a continuous alveolar ridge resorption that can be accelerated by the use of prosthesis [2]. Rehabilitation with implants in the completely edentulous maxilla is considerably more complex when compared to the mandible [3]. Important factors such as facial figure, incisal and cervical edge, upper incisors position, lips position, lip support, gingival display, midline and smile width, should be established before the implant surgery. These are critical steps in the planning of aesthetic prosthetic rehabilitation [4-6].

For an aesthetically pleasing and functional restoration, three-dimensional bone morphology should be similar to the arrangement observed in the healthy original ridge containing the teeth. It is assumed that, after the extraction, bone loss will be, on average, 40% of its height and 60% of its width. The type of restoration will depend on the amount of bone loss and the type of deficiency: horizontal, vertical or both [7,8].

Regarding atrophic maxilla rehabilitation planning, the grafting process should also consider whether atrophy is partial or total. In the case of full atrophy, one must evaluate whether the ridge relationship is normal or divergent, so that the correct type of graft can be indicated. In cases where 5-10cc bone volume is required, using intraoral donor sites is preferred, such as the symphysis and mandibular ramus [9]. These structures offer advantages such as easier access, high bone quality, surgery being able to be executed adjacent to receptor site, moderate cost, lower post-operation morbidity, absence of ambulation issues and patient perception that intra-oral surgery is shorter than extra-oral donor site surgery [10].

The utilization of iliac crest graft has proven itself satisfactory for intra-oral reconstructions, with an incorporation level of up to 100%, long-term follow-up varying from 1 to 17 years [11-14] and reabsorption rate ranging between 1.3-25% [15-17].

Objective

The objective of this report is to describe the technique of using a bone guide to assist in onlay block graft procedures in cases of maxillary aesthetic prosthetic rehabilitation.

Case Report

The case in question describes a 54-year-old woman, having presented a completely edentulous maxilla since the age of 26, suffering from maxillary bone atrophy and sinus pneumatization. The patient desire was to use metallo-ceramic fixed prosthesis. Due to the lack of bone thickness in the buccal anterior region, an autogenous block graft surgery was planned. For the posterior region, the residual ridge presented regular width but no height. In this case, a sinus lifting procedure was planned. The donor site for the graft selected was the iliac crest. This donor site provided the bone volume necessary to supply bilateral sinus filling and the anterior blocks necessary for this particular case.

After careful evaluation of patient's facial profile, a preliminary impression was made in alginate and a stone cast was poured for the maxillary arch. For the latter cast, a wax prototype was performed by filling the buccal anterior region, in order to restore the extra-oral profile allowing the correct lip position (*Figure 1*). The wax prototype extension included primary stress bearing area to improve guide stability.

After confirmation of correct buccal volume, the wax prototype returned to the master cast. The wax up was duplicated in putty silicon. The silicon mold was filled with

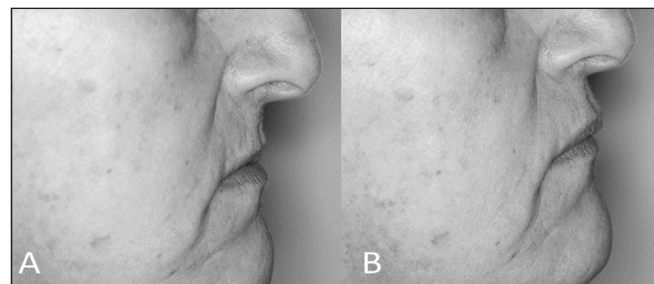


Figure 1. Evaluation of the face in lateral view. A) Patient without the superior prosthesis; B) Patient with the wax prototype positioned.

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auto polymerizing resin resulting in an acrylic resin guide. Before surgery, the guide was immersed in a 70% ethanol solution for 15 minutes for decontamination [18]. This guide allows the surgeon to see the amount of missing bone in each region, thus enabling optimization of blocks volume and adaptation (*Figure 2*).

Once the bone fragment from the iliac crest was removed, cancellous bone was also harvested for the sinus lifting procedure. The bone blocks were filed and adjusted for better contact with receptor sites, being held in place by 2-mm-thick titanium screws. Then, a sinus lifting procedure was performed, filling the sinus with cancellous bone harvested from the donor site. The same particulate bone was used to fill in the gaps between the blocks and the receptor site. The flap was released by scoring the connective tissue and the periosteal with the back of the scalpel blade for complete tension-free coverage of the grafted area. A mono-filament nylon 5-0 suture was utilized.

After six months, a conventional surgical guide was obtained by doubling the new wax up, to assist in the implant installation surgery. The guide was trimmed, keeping only the area that was in line with the teeth, so as not to interfere with the flap (*Figure 3*).

A new surgical procedure was performed to remove the graft fixation screws and install nine implants to support fixed metaloceramic prosthesis (*Figure 4*).

Six months after the implant surgery, prosthetic pillars were installed and the piece was cemented (*Figure 5*). The control radiograph showed no sign of bone resorption alterations (*Figure 6*) and the lateral radiograph presents the correct relationship between the soft tissue and the prosthesis position (*Figure 7*).



Figure 2. Bone guide positioned directly over the bone, helping to determine the amount of bone needed to obtain a correct facial profile.



Figure 3. Surgical guide in acrylic resin.

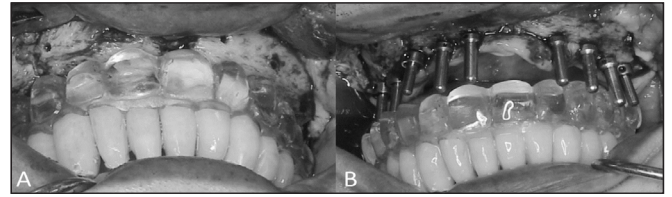


Figure 4. Surgical guide proof. (A) Surgical guide in position; (B) Parallel pins in position.

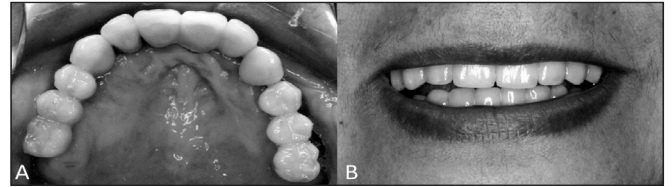


Figure 5. Installed prosthesis (A) Occlusal view; (B) Final aesthetic result.

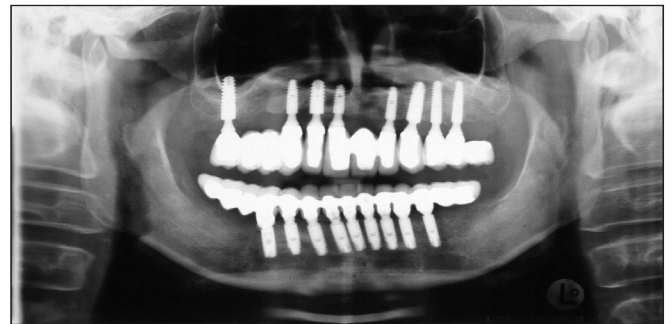


Figure 6. Panoramic radiography 14 month after the graft procedure.

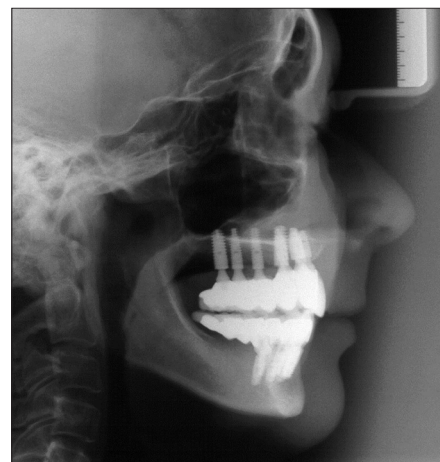


Figure 7. Lateral cephalometric radiography.

Discussion

According to Birda [6], total rehabilitation of the atrophic maxilla with fixed metaloceramic prosthesis is frequently chosen by many patients, even though it is expensive and complex. In this case, the same choice was made by the patient, as she did not want to use an acrylic prosthesis.

According to Drago [3], an absence of natural anatomic references occurs when one has extensive bone resorption, making it more difficult to identify the ideal jaw positioning, lip support and tooth positioning. The new prosthesis should be chosen before implant installation to ensure that results meet expectations. In this case, there was an extenuating factor- the chosen prosthesis was not applied to the direct planning of the case. Reverse planning was first necessary

for the grafting procedure selection. Once the graft was successfully integrated, a second reverse planning could be initialized which provided the surgical guide for implant placement.

According to Jivraj [19] and Avampou [20] evaluation using a lateral view of the patient is essential for correct indication of the prosthesis type. The absence of upper lip support is a problematic factor when considering fixed cemented metaloceramic prosthesis. In this particular case, the patient presented the need for lip support. For a correct graft procedure, it was necessary to quantify the amount of bone volume required to provide correct lip support. For this reason, a bone guide was utilized, to support the surgeon when adjusting and stabilizing the bone block, which allowed for a highly satisfactory result, both aesthetically and functionally.

The height and width deficiency presented by the patient indicated the need for sinus lifting and onlay block graft, as there was no discrepancy between the ridges and because the thickness gain was higher than 4 mm [7,9]. The adopted procedures involved the reconstruction of the jaw with autogenous graft from iliac crest, as it presents better osteogenic characteristics when compared to non-autogenous grafts as an option for improving implant fixation [10-12].

References

- Pietrokovski J. The bony residual ridge in man. *Journal of Prosthetic Dentistry*. 1975; **34**: 456-462.
- Wolff J. The laws of bone remodeling. Berlin, Springer (Translation by Maquet P, Furlong R). Originally published; 1892.
- Drago C, Carpentieri J. Treatment of maxillary jaws with dental implants: guidelines for treatment. *Journal of Prosthodontics*. 2011; **20**: 336-347.
- Minsk I. Osseous site development for optimal implant placement. *Compendium of Continuing Education in Dentistry*. 2003; **24**: 146-148.
- Rojas-Vizcaya F. Rehabilitation of the maxillary arch with implant-supported fixed restorations guided by the most apical buccal bone level in the esthetic zone: A clinical report. *Journal of Prosthetic Dentistry*. 2012; **107**: 213-220.
- Birda A. Three-dimensional esthetic analysis in treatment planning for implant-supported fixed prosthesis in the edentulous maxilla: Review of the esthetics literature. *Journal of Esthetic and Restorative Dentistry*. 2011; **23**: 219-236.
- Fu JH, Wang HL. Horizontal bone augmentation: the decision tree. *International Journal of Periodontics & Restorative Dentistry*. 2011; **31**: 429-436.
- Beltrão GC, Abreu AT, Beltrão RG, Finco NF. Lateral cephalometric radiograph for the planning of maxillary implant reconstruction. *Dentomaxillofacial Radiology*. 2007; **36**: 45-50.
- Ferri J, Dujonquoy JP, Carneiro JM, Raoul G. Maxillary reconstruction to enable implant insertion: a retrospective study of 181 patients. *Head & Face Medicine*. 2008; **4**: 31.
- Tecimer D, Behr MM. The use of autogenous bone grafting to reconstruct a mandibular knife edge ridge before implant surgery: a case report. *Journal of Oral Implantology*. 2001; **27**: 98-102.
- Tidstrom KD, Keller EE. Reconstruction of mandibular discontinuity with autogenous iliac bone graft: report of 34 consecutive patients. *Journal of Oral and Maxillofacial Surgery*. 1990; **48**: 336-346.
- McCarthy C, Patel RR, Wragg PF, Brook IM. Dental implants and onlay bone graft in the anterior maxilla: analysis of clinical outcome. *The International Journal of Oral & Maxillofacial Implants*. 2003; **18**: 238-241.
- Clayman L. Implant Reconstruction of the Bone- Grafted Maxilla: Review of the Literature and Presentation of 8 Cases. *Journal of Oral and Maxillofacial Surgery*. 2006; **64**: 674-682.
- Bianchi B, Ferri A, Ferrari S, Copelli C, Boni P, Sesenna E. Iliac crest free flap for maxillary reconstruction. *Journal of Oral and Maxillofacial Surgery*. 2010; **68**: 2706-2713.
- Klijn RJ, van den Beucken JJ, Bronkhorst EM, Berge SJ, Meijer GJ, Jansen JA. Predictive value of ridge dimensions on autologous bone graft resorption in staged maxillary sinus augmentation surgery using Cone-Beam CT. *Clinical Oral Implants Research*. 2012; **23**: 409-415.
- Sbordone C, Toti P, Guidetti F, Califano L, Santoro A, Sbordone L. Volume changes of iliac crest autogenous bone grafts after vertical and horizontal alveolar ridge augmentation of atrophic maxillas and mandibles: a 6-year computerized tomographic follow-up. *Journal of Oral and Maxillofacial Surgery*. 2012; **70**: 2559-2565.
- Spin-Neto R, Stavropoulos A, Dias Pereira LA, Marcantonio E Jr, Wenzel A. Fate of autologous and fresh-frozen allogeneic block bone grafts used for ridge augmentation. A CBCT-based analysis. *Clinical Oral Implants Research*. 2013; **24**: 167-173.
- Smith PN, Palenik CJ, Blanchard SB. Microbial Contamination and the Sterilization/Disinfection of Surgical Guides Used in the Placement of Endosteal Implants. *The International Journal of Oral & Maxillofacial Implants*. 2011; **26**: 274-281.
- Jivraj S, Chee W, Corrado P. Treatment planning of the edentulous maxilla. *British Dental Journal*. 2006; **201**: 261-279.
- Avrampou M, Mericske-Stern R, Blatz MB, Katsoulis J. Virtual implant planning in the edentulous maxilla: criteria for decision making of prosthesis design. *Clinical Oral Implants Research*. 2013; **24**: 152-159.
- Chiapasco M, Zaniboni M, Boisco M. Augmentation procedures for the rehabilitation of deficient edentulous ridges with oral implants. *Clinical Oral Implants Research*. 2006; **17**: 136-159.
- Boven. GC, Meijer HJA, Vissink A, Raghoobar GM. Reconstruction of the extremely atrophied mandible with iliac crest onlay grafts followed by two endosteal implants: a retrospective study with long-term follow-up. *International Journal of Oral and Maxillofacial Surgery*. 2014; **43**: 626-632.
- Sbordone C, Toti P, Martuscelli R, Guidetti F, Sbordone L, Ramaglia L. A 5-year Implant Follow-up in Maxillary and Mandibular Horizontal Osseous Onlay Grafts and Native Bone. *Journal of Oral Implantology*. 2014 Mar 4. [Epub ahead of print]

Conclusion

It may be concluded that the planning of maxilla rehabilitation is a complex procedure that involves several factors. The bone guide seems to optimize the graft procedures, providing visibility of the correct three dimensional bone reconstructions.