Bone Guide for Maxillary Reconstruction: A Case Report
Daniel de Paula Eduardo, Piero Rocha Zanardi, Fued Samir Salmen, André Luiz Mendes Vilela de Andrade, Carlos Eduardo Meira, Dalva Cruz Laganá
Department of Prosthodontics, School of Dentistry, University of São Paulo, São Paulo, Brazil

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 implantsurgery 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 maxillais 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 implantsurgery. 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 5-10 cc bone volume is required, using intraroral 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 the 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 sitesurgery [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, 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 aprimary 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.
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 metalceramic 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).

Discussion

According to Birda [6], total rehabilitation of the atrophic maxilla with fixed metalceramic 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 metalloceramic prosthesis. In this particular case, the patient presented the need for lip support. Fora 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 weight deficiency presented by the patient indicated the need for sinus lifting and onlay block graft, as there was no discrepancy between the ridgesand because the thickness gain was higher than 4 mm [7,9]. The adopted procedures involved the reconstruction of the jaw with autograft from iliac crest, as it presents better osteogenic characteristics when compared to non-autogenous grafts as an option for improving implant fixation [10-12].

The onlay graft procedure has a success rate ranging from 90 to 100%. Losses due to dehiscence orinfection happen in 3.3% of cases, while total loss happens in 1.4% of cases [21]. In post-surgery consultations, there were no signs of infection. Tension-free flap covering the graft allowed for the suture intact and preventing suture dehiscence.

During implant surgery, the graft presented no gaps between the receptor sites. The implant insertion torque was at least 32N in the anterior region and around 20N in the posterior area. In general, the survival rate of implants on maxillary reconstructions varies between 60% and 100% (average: 87%); showing that, in situations where a high amount of boneis needed, the onlay grafts a viable solution with a high success rate [21-23]. In this case, only one implant was lost during the second surgical stage. The position of the lost implant did not affect prosthetic planning.

**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.

**References**