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## Appositional bone graft tunneled: Technical note

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## ABSTRACT

**INTRODUCTION:** A satisfactory positioning of the dental implants is very important in the cosmetic and functional outcome in this treatment for edentulous. Insertion of an endosseous implant in the correct positioning requires sufficient bone volume. Therefore, bone-grafting procedures are becoming increasingly common, especially for the augmentation of horizontally deficient ridges. **PRESENTATION OF CASE:** Many patients have been treated with this technique of appositional Bone Graft Tunneled at our clinic since 2005. The method will be completed through the technical note of a surgical procedure involving a dental implant used for edentulous space rehabilitation in the jaws and the tunnel technique with an appositional bone graft, using the mandibular arch as the donor area.

**DISCUSSION:** The substitution of screws to stabilize the bone graft for the tunnel technique allowed the surgery to be performed in a shorter time. The advantages were as follows: the absence of complications associated with conventional titanium screws, the preservation of the integrity of the periosteum, and the fact that there was no need to remove the screws through relaxing incisions in the gingival mucosa before placing the implant.

**CONCLUSION:** The tunnel technique for onlay bone grafting is a simple and easy to perform technique, which is completed with less surgical time and at a lower cost and has presented highly predictable results and high success rates.

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## 1. Introduction

The use of autogenous bone grafts with osseointegrated implants was originally discussed by Breine and Branemark in 1980 [1]. Since then, numerous papers have been published that have presented a variety of procedures involving different types of implants, bone grafts, and other graft materials for oral and craniofacial reconstructions [2,3].

The ideal materials to use as biocompatible bone grafts ideally must be absorbed after the formation of new bone, must provide

structure for bone regeneration, and physiologically allow mechanical stability, as well as having osteogenic, osteoconductive and osteoinductive properties [4]. The best grafting material is autogenous bone, since it is the only material to adhere to all of the abovementioned biological properties and is unlikely to be rejected by the body [5]. Studies have shown that there are many advantages to using the tunnel technique for bone grafting. The fact that the periosteum is kept intact, when using the tunnel technique, is a crucial element for the survival and viability of the graft block. Furthermore, there is no need to use a membrane, since the periosteum is intact. This procedure presents minimal complications [6].

With the technical and scientific developments in implant surgery, the search for surgical procedures with lower morbidity, and an ability to create satisfactory conditions for implant placement is necessary. The aim of our work is to describe the appositional (i.e., onlay) bone graft technique using a the tunnel technique, with the implant system Bionnovation, providing stability to the graft, without the need for fixing screws, through a description of technical notes through case reports.

## 2. Presentation of case

Many patients have been treated with this technique at our clinic since 2005.

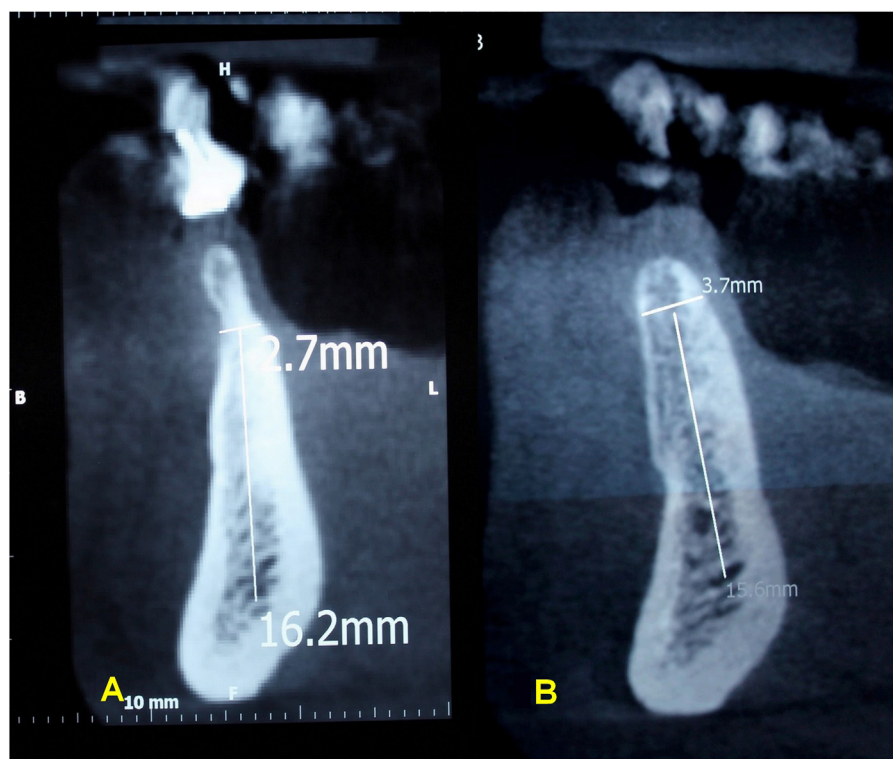
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**Fig. 1.** A: Alveolar ridge resorption in thickness and 1B: osseointegration bone graft to the recipient bed, gain in bone thickness.

Their average age was 35 years, 4 males (50%) and 4 women (50%), with 6 cases in the anterior maxillary region (75%) and 2 case in the anterior mandibular region (25%). All patients free from systemic conditions or having any immuno-compromising state. Inclusion criteria of the cases: the patients involved must have presented alveolar ridge resorption in thickness (deficiency of the bucco-lingual width or diameter) (Figs. 1 A and 6 A) in the mandible or maxilla anterior region and aesthetic and functional concerns.

### 2.1. Description of technique

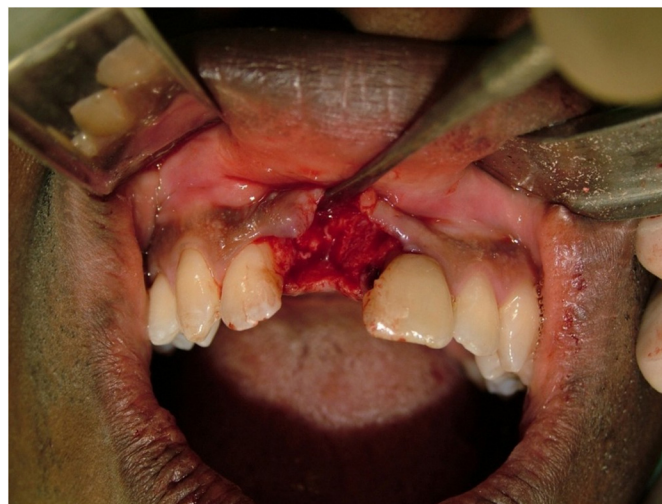
The tunnel technique is used to place an appositional bone graft in the anterior mandible and maxilla with bone defects corresponding to a dental unit, using the mandibular branch as the donor area.

First, locally infiltrative anesthesia should be applied to the graft recipient bed, an incision is made to expose the bone defect.

The incision is made with a scalpel blade n° 15 in the alveolar crest of the edentulous area, slightly toward the palatal and in the middle of the mandible. The incision should extend to the mesial and distal tooth intrasulcularly.

By carefully using a Molt periosteal elevator, a total subperiosteal detachment is carried out to promote tunnelization to the edge of the bone defect (Fig. 2). Then, the receiving area is prepared, and the exposed buccal bone plate is completely cleaned of small adhesions of fibrous tissue resulting from the bone defect. At this time, small holes are carried out in the cortical wall, with a round bur (¼), with the aim of obtaining maximum vascularization between the receiver bed and the graft. The third step is to expose the donor area (i.e., mandibular arch): The inferior alveolar, lingual, and buccal branches next to the infiltration are anesthetized in order to stop any bleeding.

The donor area is accessed through an envelope type incision. The subperiosteal detachment must be done carefully, exposing part of the mandibular arch and body.



**Fig. 2.** Incision and exposure of the bone defect.

Using a #701 or #702 frusto-conical bur in a dental handpiece, piercing markings that are linked to the bur also the lateral osteotomies are carried out initially. In an apical osteotomy, along with the vertical osteotomy, are performed with the aid of a round bur (number ¼) for the dental handpiece.

The graft is extracted with the aid of a straight chisel, removed with forceps, and kept in a saline solution. Its edges are regularized, watered thoroughly with saline solution, and then the suture is carried out. Then, the graft is adapted and inserted in the recipient bed (Fig. 3). The removed bone graft is prepared and adapted to the anatomy of the recipient bed with the aid of a delicate rongeur or even a milling bur, at low speed and under deep irrigation with saline. The edges must be rounded. The graft adaptation is tested to ensure its stability. Then, the receiving area must be sutured to



Fig. 3. Graft is adapted and inserted in the recipient bed.



Fig. 5. Final positioning.

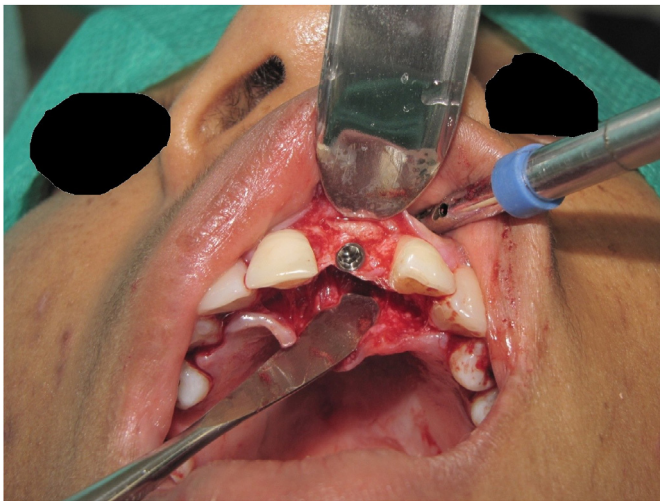


Fig. 4. Observed the osseointegrated bone graft in the recipient bed, the installed implant.

assure full coverage of the graft and an absolutely airtight suture of the region is essential.

The sutures are completed with nonabsorbable materials, such as mononylon 4-0, and they are removed after a minimal period of 14 days. The next step involves prosthetic care. Whenever possible, a provisional fixed prosthesis should be used for aesthetic issues. However, this should be far from the buccal face, thus, avoiding pressure on the operated area and allowing access to the incision line. After this, a second surgery time for the placement of the implant should be scheduled. It is performed after a period of 6–8 months and it consists of an incision identical to the incision made when the bone graft was completed. The bone graft is clinically assessed, and the implant is placed following the original protocol described by Branemark (Fig. 4). At the reopening, which occurred 6 months after the tunnel technique, we clinically observed the osseointegrated bone graft in the recipient bed, the installed implant (Fig. 4), and its final positioning (Fig. 5). All reported cases underwent Cone Beam Computed Tomography [13] before and after the surgical procedure to observe osseointegration bone graft to the recipient bed, gain in bone thickness (Figs. 1 B, 6 A and B) and the final positioning of the well adapted implant to

the bone graft (Fig. 6C). We had no implant loss with the tunnel technique in the only bone graft (Fig. 7).

### 3. Discussion

The modeling of the graft by the surgeon is an important step, and it demands considerable surgery time [7]. We consider this principle of modeling of the graft one of the major requirements for the success of the tunnel technique for grafts, since a good adjustment of the graft into the recipient bed promotes greater stability to the graft.

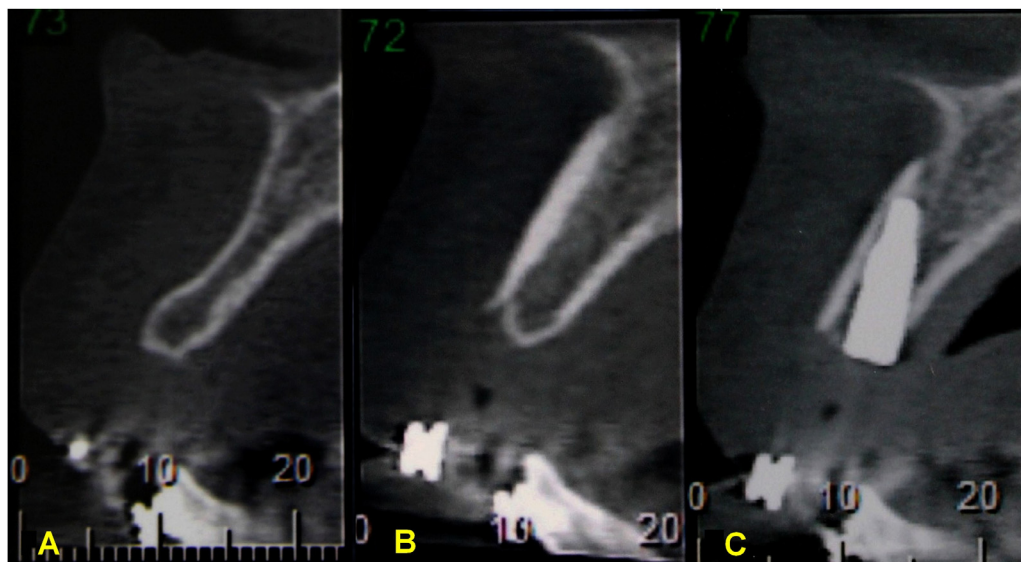
Currently, most of the appositional (i.e., onlay) bone grafts are stabilized to the receptor through rigid fixation with titanium screws. However, the use of this type of screw requires its removal in a second surgical procedure before the placement of dental implants. This need makes the surgical procedure more morbid by causing a more painful experience for the patient during the removal of the fixing screws. Another drawback associated with the removal of the screws is that it takes a long relaxing incision to access them, often in a high-demand aesthetic region [8].

During access to remove the titanium fixing screws, it is necessary to detach the periosteum covering the bone graft. We believe that preservation of the periosteum on the bone graft provided by the surgical technique described in this work is one of the factors contributing to the successful integration of the graft to the receptor bed.

Despite the fact that fixing screws are generally made of a poorer titanium alloy, it is possible that these screws osseointegrate to the graft, which can hinder their removal and even cause damages that compromise the bone graft [5].

The substitution of screws to stabilize the bone graft using the tunnel technique allowed the surgery to be performed in a shorter time. In addition to the disadvantages in common with the use of non-resorbable screws, the use of resorbable materials brings different drawbacks, such as greater tissue reaction to the material, increased risk of fracture of the screws during fixation, and the presence of polymer (i.e., waste) after 9 months, which may interfere with the sequence of implant treatment [5].

The utilization of the tunnel technique does not share the disadvantages previously cited. The suture of the incision edges, especially in the receiving area, should have no tension in order to avoid dehiscence, which is a frequent complication of graft surgeries [9]. We believe that in the tunnel technique, the incisions in the periosteum must be conservative and only completed when extremely necessary to close with tension, as the stability of the graft in this technique is due to the support promoted by the periosteum and suture tension.



**Fig. 6.** A: Alveolar ridge resorption in thickness, 6B: and osseointegration bone graft to the recipient bed, gain in bone thickness and 6C: and the final positioning of the well adapted implant to the bone graft, observed in Cone Beam Computed Tomography before and after the surgical procedure.



**Fig. 7.** Final appearance of the patient with good buccal outline and satisfactory papillary condition.

Autogenous bone is considered to be the best grafting material, since it is the only material to show all the previously mentioned biological properties, in addition to the absence of rejection [5,10]. Currently, autogenous bone is the gold standard for the reconstruction of alveolar ridge atrophy [11]. The biggest advantage of an intraoral donor area is the proximity of the donor site and the receptor site, which can reduce surgery time and the amount of anesthesia needed, making ideal for outpatient implant surgery. Furthermore, patients have reported minimal discomfort [5,12]. In the present work, we used autogenous bone grafts that were removed from the mandibular arch.

#### 4. Conclusion

The tunnel technique for onlay bone grafting is a simple and easy to perform technique, which is completed in less surgical time and at lower cost and has presented highly predictable results and high success rates. Nonetheless, more studies are necessary to consolidate and disseminate the technique more thoroughly in-academic and professional environments.

#### Conflict of interest

No conflict of interest.

#### Sources of funding

None declared.

#### Ethical approval

The study was fully approved by the ethic committee of the Federal University of Bahia.

#### Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images.

#### Author contributions

All authors contributed to either the writing, reviewing, submission and surgical procedure of this case reports.

#### Guarantor

The Author Dr. Roberto Azevedo.

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