Nasal Floor Elevation with Simultaneous Implant Placement: A Case Report

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Abstract

Objective: The aim of this paper is to report a clinical case of nasal floor elevation and simultaneous dental implant placement.

Case report: The patient presented to the clinic of the Center of Education and Research on Dental Implants (CEPID) in the Department of Dentistry at the Federal University of Santa Catarina (UFSC, Florianópolis, Brazil), for follow-up for peri-implantitis control. After clinical and radiographic assessment, two of three implants on anterior maxilla were removed. A cone beam computed tomography (CBCT) scan revealed no bone height for conventional length implant insertion. Nasal floor elevation and simultaneous implant placement were performed, with nasal cavity augmentation carried out with bovine bone graft. After six months, the implants were reopened successfully.

Conclusions: Nasal floor elevation proved to be a reliable method for dental implants insertion on the anterior atrophic maxilla when bone height reconstruction was necessary. The use of bovine bone substitutes for nasal cavity augmentation showed predictable results as well as simultaneous implant placement.

Key words: Anterior teeth, bone augmentation, dental implants, graft, nasal cavity.

Introduction

The use of osseointegrated implants has revolutionized the form of rehabilitation of edentulous jaws over the past few decades (Brånemark *et al.*, 1977; Adell *et al.*, 1981; Brånemark, 1983; Albrektsson *et al.*, 1988; Esposito *et al.*, 2005). However, as a consequence of tooth loss, the alveolar ridge passes through dimensional alterations (Cardaropoli *et al.*, 2003; Araújo and Lindhe, 2005) that can make the placement of dental implants impossible. Various techniques have been developed to overcome this situation, including bone grafting to the maxillary antral cavities.

In the posterior maxilla, elevation of the sinus floor has become highly successful and predictable for bone augmentation when the height between the maxillary sinus floor and alveolar crest is insufficient for dental implant placement (Wallace and Froum, 2003; Fermergård and Astrand; 2008; Pjetursson *et al.*, 2008; Altintas *et al.*, 2013). First published by Boyne and James (1980), the most common technique consists of bone graft insertion through a lateral window, after a careful Schneiderian membrane elevation. The original approach uses autologous bone as graft material, although several other materials have been used over the years with high success rates (Manso and Wassal, 2010; Kolerman *et al.*, 2012).

Despite the anatomical proximity, rehabilitation of the anterior part of the maxilla is even more challenging. The pattern of remodeling after tooth loss leads to vertical and horizontal bone resorption, leaving an inadequate alveolar ridge for dental implantation (Cardaropoli *et al.*, 2003; Araújo and Lindhe; 2005; El-Ghareeb *et al.*, 2012). Additionally, the high aesthetic and functional demands of the patient (Mazor *et al.*, 2012) makes the necessity of immediate provisionalization an obstacle for large reconstructions. As the nasal cavity is usually the height limit for implant placement in the anterior area, nasal floor augmentation emerges as a possibility for rehabilitation of the anterior-superior region.

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Considering the limitation of vertical bone gain by resorting to conventional graft approaches, this paper describes a little-discussed technique that aimed at a less costly and faster treatment to rehabilitate atrophic maxilla. The purpose of this paper is to present a case of anterior maxillary rehabilitation performed by dental implants and simultaneous nasal floor elevation with an osteoconductive graft material.

Case report

A 48-year-old female patient presented to the Center of Education and Research on Dental Implants (CEPID), in the Department of Dentistry at the Federal University of Santa Catarina (UFSC, Florianópolis, Brazil), with a cemented implant-retained prosthesis replacing the four superior incisors, over three implants localized in the region of the right upper lateral incisor, left upper central incisor and left upper lateral incisor. After prosthesis removal, clinical and radiographic examinations were performed to evaluate soft and hard tissues around the implants. Probing depths of 5 mm associated with bone loss (>50% of the implant length) were observed and resulted in a diagnosis of peri-implantitis (*Figure 1*). Despite the surgical and non-surgical therapies for decontamination, the patient returned to the follow-up appointments presenting with continuous bone loss and increasing probing depths, and a new assessment revealed the failure of the left upper incisors implants. Those implants were removed and the patient underwent a cone beam computed tomography (CBCT) scan (I-Cat® Next Generation, Hatfield, USA), which showed insufficient height (5 mm of remaining bone) for standard length implants placement (*Figure 2*). Considering the situation and the patient's wishes, nasal floor elevation and immediate implantation emerged as the main option for the case management.

Preoperative preparation

Classified by the physical status classification system of the American Association of Anesthesiologists (ASA) as a patient class II, no special preparation was necessary, except for preoperative medication. Prophylactic antibiotics (amoxicillin, four capsules of 500 mg) and steroidal anti-inflammatory (dexamethasone, two tablets of 4 mg) were administered 1 hour prior to surgery. Just before the procedure, the patient performed a mouthrinse with chlorhexidine 0.12%. A local anesthetic (articaine 4% with epinephrine 1:100.000) was administered in the buccal side of anterior maxillary region and palatine soft tissues.

Surgical procedure

The entire procedure was performed through an intraoral approach. The surgical technique included a full-thickness incision on the crest of the anterior maxillary ridge, followed by flap elevation with piriform rim and anterior nasal spine exposure (*Figure 3a*). The implant of the right upper lateral incisor region was removed to facilitate the prosthetic resolution (*Figure 3b*). The elevation of the nasal mucosa was carefully performed with a Freer elevator (Quinelato; Schobell Industrial Ltda, Rio Claro, Brazil) maintaining attachment of the nasal septum soft tissues (*Figure 3c*).

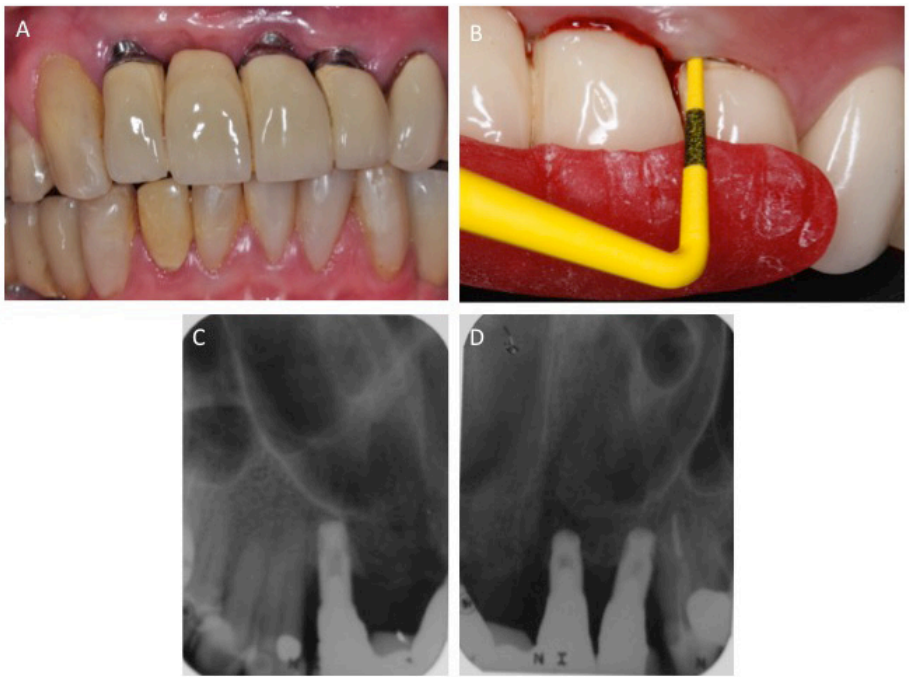

Figure 1. A) Clinical aspect after 10 years with a cemented-retained fixed prosthesis over implants replacing anterior incisors in the maxilla. Soft tissue alterations in implant areas can be observed; B) A probing depth of 5 mm was observed in the clinical evaluation. A probing guide made of Duralay acrylic resin (Reliance Dental Mfg., Worth, IL, USA) was used in order to have the probing assessments always done at the same point; C, D) Radiographic aspect of the implants. Peri-implant bone loss led to removal of implants.

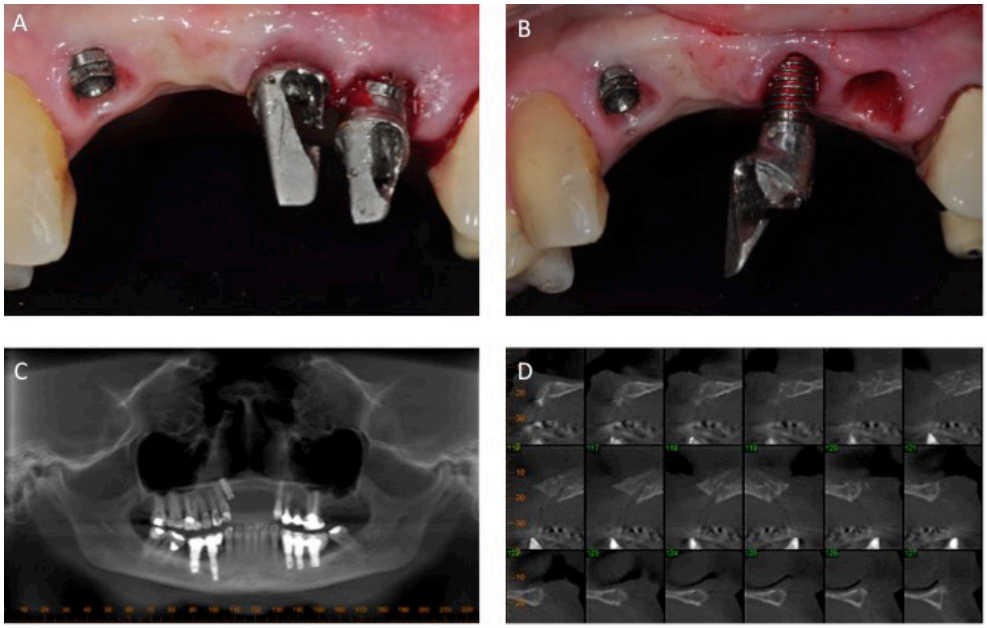

Figure 2. A) Implants view after prosthesis removal; B) Left upper central incisor and left upper lateral incisor implants were lost. At this stage, the right upper lateral incisor implant was maintained; C) Panoramic reconstruction from cone beam computed tomography (CBCT) scan after left upper incisors implant removal; D) CBCT slices revealed insufficient bone height for conventional length implant placement (5 mm residual bone height on average).

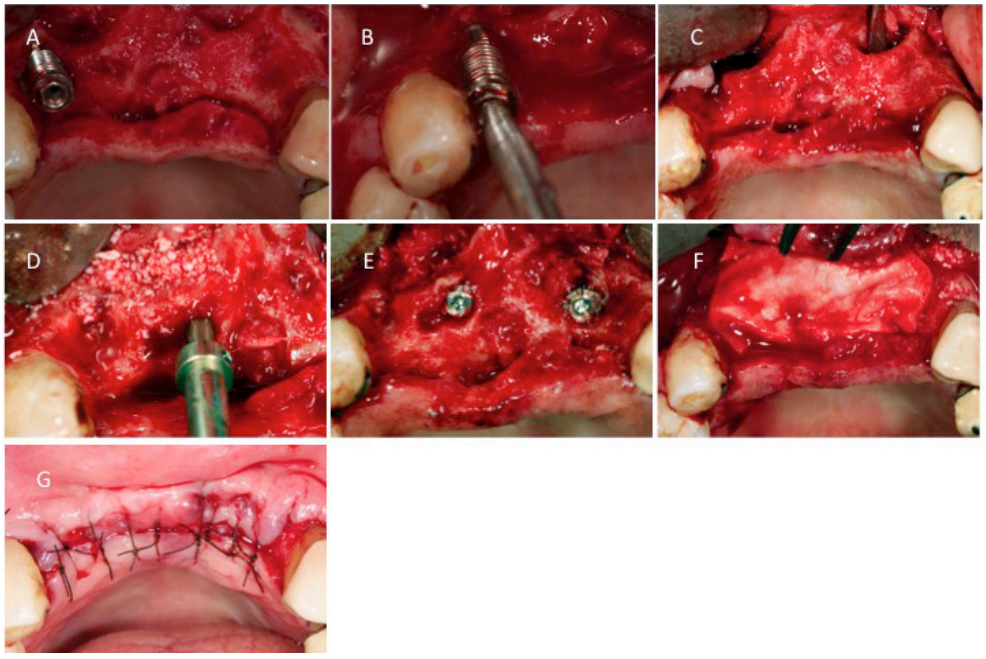

Figure 3. A) Flap elevation and anterior maxilla surgical area. Bone loss around the right upper lateral incisor implant and nasal floor exposure; B) Right upper lateral incisor implant removal with an implant retriever driver; C) Nasal floor elevation with a Freer elevator; D) Alignment pin position indicating parallelism for dental implant placement; E) Installation of two Morse taper conical implants 1 mm under the bone crest level on right upper central incisor and left upper lateral incisor positions; F) A porcine collagen membrane covered the implants and the grafted area; G) Flap repositioning and primary intention closure with sutures.

Two Morse taper conical implants (3.5 mm in diameter and 9 mm in length; Implacil DeBortoli®, São Paulo, Brazil) were placed 1 mm under the bone crest level on the right upper central incisor and left upper lateral incisor regions (*Figure 3d*, *3e*). The nasal floor and apical portion of the implants were then filled with particulate bovine bone material (Bio-Oss®; Geistlich Pharma, Wolhusen, Switzerland) and covered with porcine collagen membrane (Bio-Gide®; Geistlich Pharma, Wolhusen, Switzerland, *Figure 3f*). The flap was repositioned and simple sutures with 5-0 polyglactin 910 (Vicryl™; Ethicon Inc., Somerville, USA) were performed for primary intention healing (*Figure 3g*).

Postoperative treatment

A provisional removable prosthesis relined with resilient resin was then installed and kept during the healing period. Antibiotics (amoxicillin, 500 mg three times daily for 5 days), steroidal anti-inflammatory (dexamethasone, 4 mg; once 12 hours post-surgery) and anti-inflammatory analgesics (ketorolac tromethamine, 10 mg; three times daily for 3 days) were prescribed as postoperative medication protocol. Chlorhexidine mouthrinse was prescribed for 2 weeks post-surgically. The patient was instructed to follow a soft diet for the first week. Sutures were removed 7 days post-surgery.

After a healing period of 6 months, the patient underwent computed tomography in order to evaluate the bone formation around the implants and the amount of height improvement resultant from nasal floor elevation, in comparison with the first CBCT performed, avoiding distortions of conventional radiographs (*Figure 4*). A fixed implant-supported prosthesis was then manufactured (*Figure 5*).

Discussion

Following tooth removal, an unavoidable bony resorption is expected as consequence of the natural process of remodeling experienced by hard tissues in extraction sites (Cardaropoli *et al*., 2003; Araújo and Lindhe; 2005). In addition, peri-implantitis, biofilm-related disease characterized by inflammatory bony loss around dental implants (Albrektsson *et al*., 2012; De Souza *et al*., 2013, Dalago *et al*., 2016) can destroy bone tissue until there is complete implant loss, making insertion of new implants impossible without bone reconstruction. Combining those factors with the high aesthetic and functional demands of the anterior region, placing implants in this area represents a challenge for clinicians. For such cases, nasal floor elevation can provide a rapid and predictable solution (Mazor *et al*., 2012; Lorean *et al*., 2014). This technique can be performed under local anesthesia with reduced postoperative consequences. Possible complications might include bleeding, swelling, pain, hematoma, infection, implant displacement and rhinitis. Although possible, nasal mucosa perforation is very rare (Jensen *et al*., 1994; Mazor *et al*., 2012; Lorean *et al*., 2014).

Preliminary reports by Jensen *et al.* (1990; 1991; 1994) about the nasal floor augmentation technique propose an elevation of the nasal mucosa through an intraoral access, filling the nasal cavity with autologous bone. Lundgren *et al.* (1997) suggest a two-step technique, using bone augmentation with autologous bone in a first stage and dental implant placement in a second stage. Since those studies, there have been many changes in grafting materials, implant technology and surgical techniques. As seen from the case presented, the incorporation of these new concepts on the nasal floor elevation technique has given good survival and success rates for implants simultaneously placed.

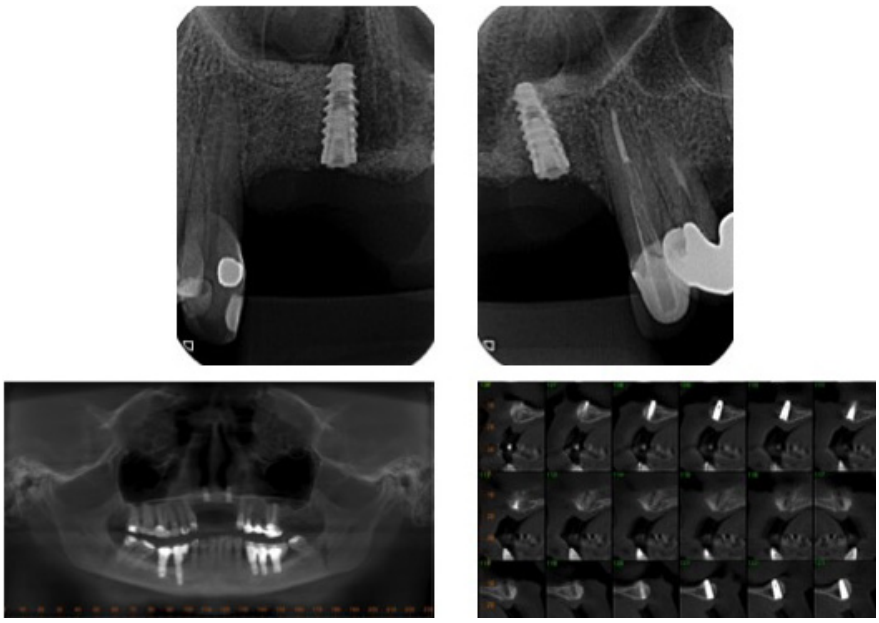

Figure 4. A, B) Periapical radiographs of post-operative control at 6 months. Nasal floor elevation and bone formation in the area can be observed; C, D) Panoramic reconstruction and cone beam computed tomography slices 6 months after the surgical procedure. Implants and newly formed bone seen in augmented nasal cavity.

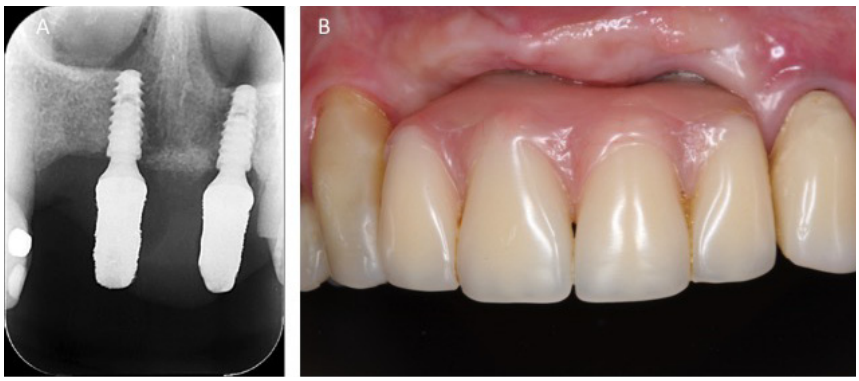

Figure 5. A) Post-operative follow-up of 1 year. New position of the nasal floor after bone maturation; B) Post-operative follow-up of 1 year. Fixed implant-supported prosthesis in a frontal view.

In a series of six cases, El-Ghareeb *et al.* (2012) exposed the nasal floor through an intraoral approach and osteoconductive bone substitutes were used for nasal floor augmentation. The conclusion of the authors was that the use of osteoconductive bone substitutes for nasal floor augmentation is a reliable method, even though they recommended more longitudinal studies. Lorean *et al.* (2014), including the study of Mazor *et al.* (2012), presented a large-scale follow-up of dental implants placed simultaneously with nasal floor augmentation using osteoconductive bovine bone substitutes. A total of 67 patients was assessed with an implant survival rate of 100%. The authors concluded that nasal floor augmentation might serve as a reliable method for reconstruction of the anterior atrophic maxilla when residual height is insufficient. According to them, one of the benefits that might explain the high survival rates of the implants in this method is the bicortical stabilization that is achieved when implants are placed through the alveolar bone, crossing the cortical bone of the crest as well as the cortical bone of the nasal floor.

Another technique in the present report is the use of anorganic osteoconductive bovine bone as graft material for nasal cavity augmentation. The use of bone substitutes for subnasal elevation is discussed by Misch (1999), demonstrating the possibilities of other graft materials. Despite the use of autologous bone in the first studies (Jensen *et al.*, 1990; Jensen and Sindet-Pedersen 1991; Jensen *et al.*, 1994; Lundgren *et al.*, 1997), the increase of post-surgical morbidity and the low acceptance by the patients of donor-site harvest surgery have given use of bone substitutes more opportunities with predictable results. Many authors (Misch; 1999; El-Ghareeb *et al.*, 2012; Mazor *et al.*, 2012; Ferreira *et al.*, 2013; Lorean *et al.*, 2014) have filled the nasal floor with non-autologous osteoconductive materials, providing the patients less invasive procedures with reliable methods and high success rates. Data from some studies of different materials used and the time necessary to perform the implant placement after the nasal floor augmentation are summarized in *Table 1*.

Table 1. Overview of studies and materials employed in nasal floor augmentation.

Study (year)	Technique (number of interventions)	Period between surgeries	Graft material employed
Jensen *et al.* (1990)	Two stages	4-5 months	Autologous bone (iliac crest)
Jensen and Sindet-Pedersen (1991)	Two stages	6 months	Autologous bone (mandibular symphysis)
Jensen *et al.* (1994)	Two stages	6 months	Autologous bone (various donor sites)
Lundgren *et al.* (1997)	Two stages	6 months	Autologous bone (iliac crest)
Misch (1999)	Two stages	6-9 months	Various
El-Ghareeb *et al.* (2012)	One or two stages	6 months (when two-stage technique was applied)	Coral-derived bone substitute and freeze-dried allogenic bone
Ferreira *et al.* (2013)	One stage	-	Anorganic bovine bone
Mazor *et al.* (2012) and Lorean *et al.* (2014)	One stage	-	Bovine bone

Conclusions

Within the limitations of the case, nasal floor elevation proved to be a reliable method of dental implant insertion on the anterior atrophic maxilla when bone height reconstruction is necessary. The use of bovine bone substitutes for nasal cavity augmentation showed predictable results as well as simultaneous implant placement.

Acknowledgments

The authors would like to thank the Coordination for the Improvement of Higher Education Personnel (CAPES) and the Brazilian National Council for Scientific and Technological Development (CNPq) for financial support, and declare no conflicts of interest.

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