Summers' Technique Modification for Sinus Floor Elevation Using a Connective Tissue Graft. A Case Report.

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Abstract

The sinus floor elevation technique with Summers' osteotome is simpler and less invasive than access through the lateral wall of the sinus; however, it is susceptible to a higher level of sinusal membrane rupture. The objective of the present study was to display a modification of the osteotomy technique by connective tissue interposition in order to weaken the impact of sinus cortical fracture, and therefore prevent perforations in the sinusal membrane. A case is reported in which a patient presented with an absent tooth #4 for osseointegrated implant rehabilitation. Maxillary sinus elevation was required to perform the procedure. Initially, the flap was raised and the receptor site was prepared with a sequence of burs, without disrupting cortical bone. In order to weaken the fracture impact with the osteotome, a connective tissue graft was interposed to allow access to the sinus. Clinically, a satisfactory primary locking was obtained with torque greater than 50 Ncm. Through radiographic evaluation, good bone filling was observed immediately after surgery, with maxillary sinus wall elevation without membrane rupture. Two years after the initial procedure, a 5.3 mm increase in bone extension formed in contact with implant distal surface was observed. Thus, the osteotomy technique modification with connective tissue interposition was successful, both clinically and radiographically, showing an image suggesting long-term osseous formation.

Key words: Dental implants, connective tissue, autograft, maxillary sinus, lifting

Introduction

Before setting an osseointegrated implant there is often the need for bone reconstructive procedures because of an inadequate amount of bone for implant fixation and appropriate positioning. Osseous resorption that affects edentulous ridges is mainly associated with the presence of previous periodontal or endodontic lesions, accidents that occurred during either a dental extraction procedure or implant setting, trauma, pressure exerted by mucous-supported prostheses, or even by alveolar bone atrophy due to hypofunction (Borghetti and Glise, 2002).

The severity, height and width of ridge resorption vary as a function of the individual's systemic and anatomic conditions (Seibert, 1993). In the maxillary posterior region, besides alveolar resorption there is also a pneumatization of the maxillary sinus, which corresponds to the displacement of the sinus floor towards the ridge crest. Thus, there is a consequent decrease in the available bone height, which disfavors prognosis and prevents implant setting (Isaksson, 1994).

In order to overcome this limitation and improve the prognosis of posterior maxilla rehabilitation, the use of implants along with surface treatment, sinus floor elevation techniques, bone grafts, and zygomatic or maxillary tuberosity implants have been recommended; nevertheless, each technique shows advantages and disadvantages. A lateral access window shows more consolidated outcomes in the literature; however, it is a very traumatic and complex technique to perform. Contrarily, the osteotomy technique described by Summers (1994a) is simpler and less invasive, although it requires at least 5 mm of residual bone for initial stability and long-term success. Nevertheless, there is a higher risk of sinusal membrane rupture from the osteotome pressure (Bruschi *et al.*, 1998; Rosen *et al.*, 1999; Brägger *et al.*, 2004; Toffler *et al.*, 2004; Ferrigno *et al.*, 2006).

Considering such statements, the objective of the present study was to display a modification of the osteotomy technique by connective tissue interposition in order to weaken the impact of sinus cortical fracture, and therefore prevent perforations in the sinusal membrane.

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Clinical Case

A 37-year-old male patient presented to Implantology Clinics of the São Paulo State University in Araraquara (UNESP) for implant rehabilitation in the region of tooth #4. At the radiographic examination, maxillary sinus pneumatization was observed, with remaining bone height of approximately 7 mm (*Figure 1a*). The patient was in good systemic health and did not smoke. Appropriate oral hygiene was evident, and there were no signs of periodontal disease.

On the day of surgery, after local anesthesia injection with 2% mepivacaine HCl and epinephrine 1:100,000, an incision on the alveolar bone crest and two other releasing incisions were performed, after which a total-thickness flap was raised beyond the mucogingival junction. The sequence of burs suggested by the manufacturer was used under saline solution irrigation to carry out the initial preparation of the receptor site, which was prepared up to the bounds of the sinus floor bone plate (6.5 mm of depth), with burs up to 3 mm in diameter.

Afterwards, a small fragment of connective tissue was removed from the inner part of the palatal incision and inserted into the prepared receptor site, functioning as a cushion to avoid sinus floor fracture. This procedure was performed with the use of a Summers #2 elevator (*Figures 2-4*). The connective tissue graft was left in the sinus. Next, bone from the buccal osseous plate was harvested, blended in a 1:1 ratio with an osteoconductive bone substitute (Bio-Oss®, Osteohealth, Shirley, NY, EUA), and inserted in small portions into the sinus with the use of a Summers elevator. A 3.5 - 15 mm implant (Conect Cônico, Conexão Sistemas de Próteses, São Paulo, Brasil) was then positioned (*Figure 5*), and an initial lock greater than 50 N was obtained. The flap was repositioned and sutured with 4.0 nylon suture.

Amoxicillin 500 mg, 3 times a day for 7 days, beginning one hour before surgery, was prescribed to the patient along with 0.12% chlorhexidine digluconate solution mouthrinse to be used for 1 minute twice a day, until normal cleansing of the operated area could be resumed. Sutures were removed 7 days after the surgical procedure, and there was no report of pain or post-operative discomfort. The provisional prosthetic crown was cemented in place five months later, and the permanent crown positioned three months afterwards.

Appropriate software was used to analyze the radiographs (ImageJ 1.34, National Institutes of Health, Bethesda, MA, USA). The measure was performed in triplicate, considering the real size of the implant as 15 mm and evaluating its distal aspect, because the mesial aspect was not visible in all periods. Mean values were representative of the period. One examiner performed all measurements, and intraexaminer reliability was determined by calculating the Spearman rank correlation coefficient between the first and second measure ($r = 0.998$, $p = 0.0000$), the second and third measure ($r = 0.998$, $p = 0.0000$), and the first and third measure ($r = 0.998$, $p = 0.0000$).

Good bone filling was observed immediately after surgery, with maxillary sinus wall elevation without membrane rupture (*Figure 1b*). Two years after the initial procedure, a 5.3 mm increase was observed in the extension of bone formed in contact with the implant distal surface. (*Figure 1c*).

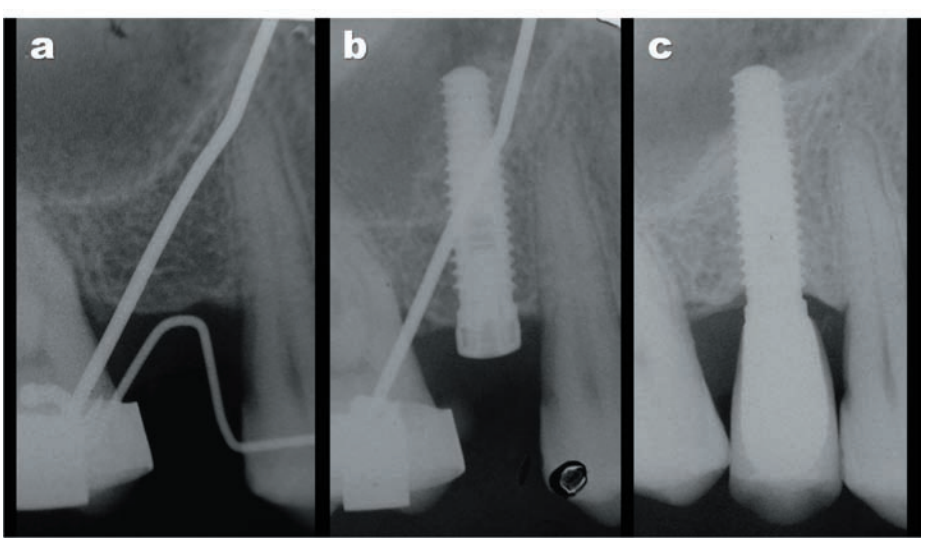

Figure 1. Radiographic aspect of the surgical area (a) previously, (b) immediately after, and (c) 2 years after the surgical procedure. The images suggest that there was bone remodeling between the surgery session and 2 years later.

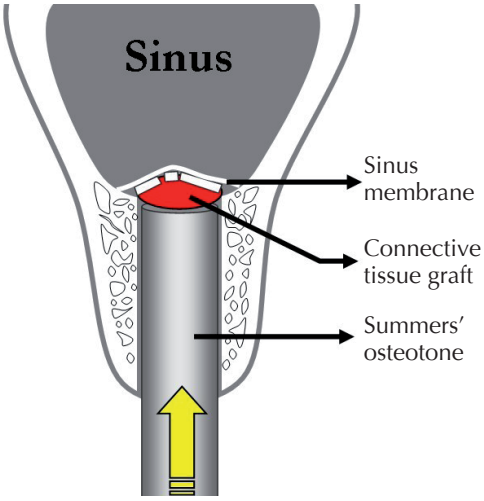

Figure 2. The osteotomy technique was modified through the interposition of connective tissue to function as a cushion to help cortical fracture.

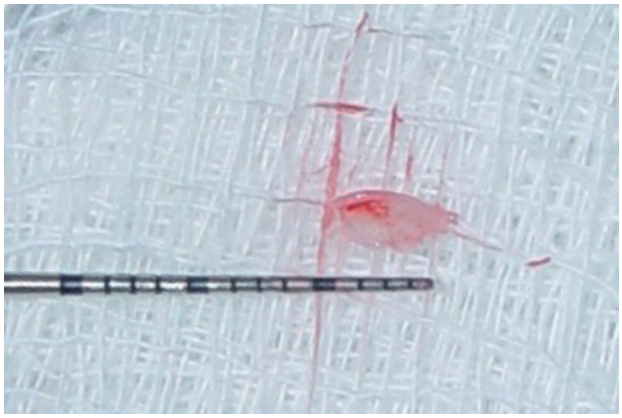

Figure 3. A connective tissue graft was removed from the inner border of the palatal flap.

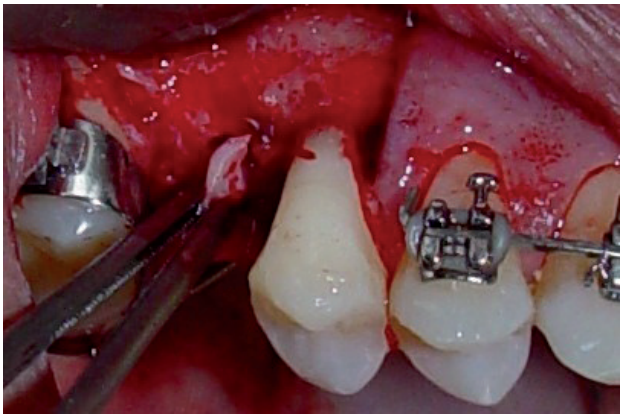

Figure 4. The graft was inserted into the receptor site that had been prepared with burs prior to implant positioning.

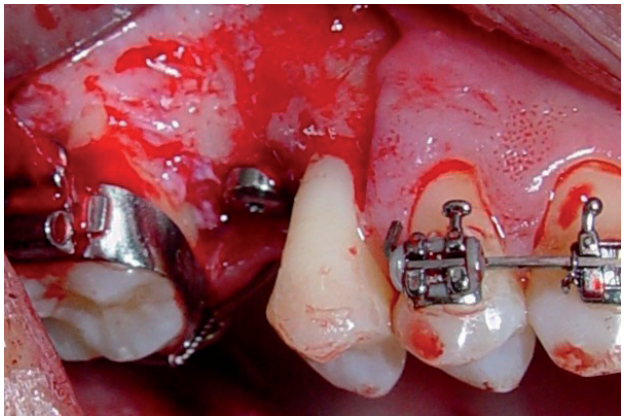

Figure 5. The implant was positioned after sinus elevation.

Membrane perforations using the conventional osteotomy technique were reported in studies by Toffler (2004) and Ferrigno *et al.* (2006), with percentages of 4.7% and 2.2%, respectively. The proposal for using a material to weaken the impact of the sinus floor rupture and to protect the sinusal membrane from perforations was suggested by Lazarra *et al.* (1998); however, the type of material was not specified. Therefore, in the present clinical case the choice was to use a connective tissue fragment, mainly because of its biocompatibility, resilience and availability.

Since the connective tissue is left in the space of the sinus, one might question the risk of infection. In the present case, no signs or symptoms of infection were observed during the two-year follow-ups. On the other hand, it is known that not only autogenous material such as bone, but also allografts and alloplasts, may be subject to infection (Misch *et al.*, 2007), and it seems that the occurrence of sinusitis would be more related to predisposing factors of the patient and aseptic conditions during surgery than to the kind of graft used. Although clinical and radiographic analysis revealed that this modification of the Summers' technique may be successfully used, an additional study with histological evaluation of the area should be conducted in an animal model to clarify the postoperative aspect inside the sinus.

It is important to emphasize that the remaining bone height was verified to be 7 mm. The residual bone height is a relevant factor for an appropriate response to the treatment, as high success rates (ranging from 90 to 100%) have been reported when there is an appropriate initial bone height (Bruschi *et al.*, 1998; Komarnyckyj and London, 1998; Zitzmann and Scharer, 1998; Rosen *et al.*, 1999; Deporter *et al.*, 2000; Toffler, 2004; Leblebicioglu *et al.*, 2005; Ferrigno *et al.*, 2006).

Several studies have demonstrated that the failure rate is higher when the bone crest height is inferior to 5 mm (Rosen *et al*., 1999; Kahnberg *et al*., 2001; Tofler, 2004). Nevertheless, according to Li (2005), the osteotomy technique can be used even in residual ridges with heights of 3 to 4 mm, if primary stability has been achieved. In the present clinical case, the height of bone remaining was adequate, favoring implant primary stability with a torque greater than 50 Ncm.

Therefore, the osteotomy technique modification with interposition of connective tissue was both clinically and radiographically successful, showing an image of long-term bone formation.

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