

# The Use of Negative Pressure for the Sinus Lift Procedure: A Technical Note

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*The objective of the present report was to present a modification of the standard sinus lift procedure. The modification consists of the creation of a mechanism facilitating maxillary sinus mucosa lift by means of negative pressure and simplification of the instrumentation used for this procedure. With the change in technique, maintenance of the success and predictability rates observed in the literature is possible. (Technical Note/Case Report) INT J ORAL MAXILLOFAC IMPLANTS 2006;21:455-458*

**Key words:** bone transplantation, sinus augmentation

The posterior region of the edentulous maxilla frequently presents insufficient bone for rehabilitation by means of endosseous implants. Filling the maxillary sinus with a bone graft is a procedure first introduced by Boyne and James<sup>1</sup> and by Tatum.<sup>2</sup> This technique has been used to permit the placement of endosseous implants in edentulous or excessively pneumatized maxillae.

A group of experts participated in the organization of a conference<sup>3,4</sup> in which indications and contraindications of the technique, differences in the performance of various grafting materials, the ideal

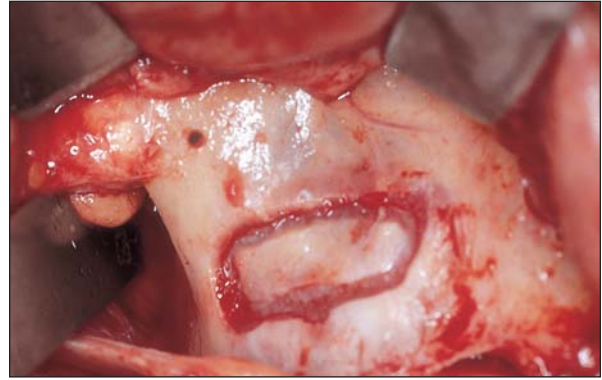
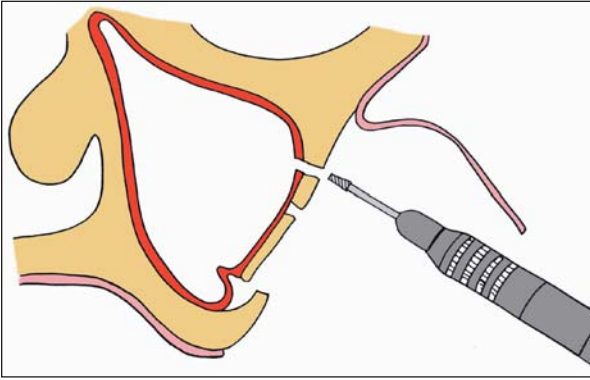
time for implant placement, and prosthetic indications were established. Despite wide variability in the opinions of attendees, there was unanimous agreement concerning the fact that filling the maxillary sinus with grafting material can be an effective procedure in the prosthetic rehabilitation of edentulous individuals. Thus, the placement of a graft inside the maxillary sinus ceased being considered an experimental procedure and has become a scientifically confirmed therapeutic method with a favorable prognosis.

According to Tatum,<sup>2</sup> the standard sinus lift technique consists of exposure of the anterolateral wall of the maxilla and U-shaped osteotomy followed by sinus membrane lift, fracture of the lateral wall, and placement of graft material inside the maxillary cavity. Several authors have proposed variations of the standard technique to avoid direct access to the maxillary sinus<sup>5</sup> or to minimize possible problems occurring during access to the sinus because of the presence of septa that segment and divide the inner part of this cavity. Problems may also occur during membrane lifting, since there is the possibility of dilaceration related to membrane fragility.<sup>6</sup> Other complications, such as graft contamination and infection, may also occur.<sup>7</sup>

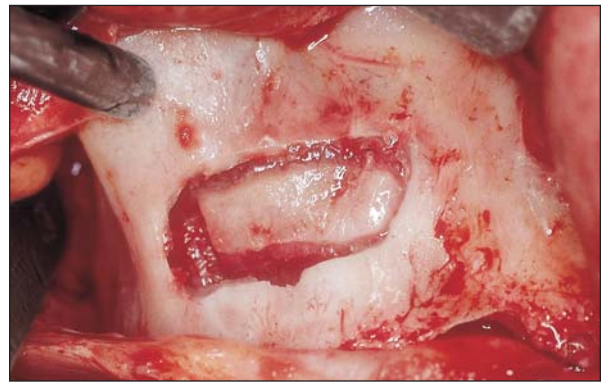
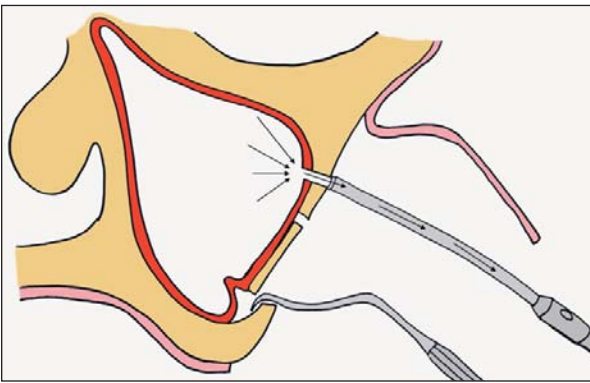
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**Figs 1a and 1b** A flap was superiorly raised to expose the anterolateral wall of the maxilla. A bony window was prepared by rectangular osteotomy to enable visualization of the maxillary sinus mucosa. An opening was created with a 702 bur superiorly and distally to the window through the wall of the maxilla and the sinus mucosa.



**Figs 2a and 2b** A suction tube was positioned and kept functioning over the created opening to establish negative pressure inside the maxillary sinus.

To prevent some of these complications, a new technique developed in the Oral and Maxillofacial Surgery Sector of the Hospital for Rehabilitation of Craniofacial Anomalies, University of São Paulo, which uses negative pressure, is presented.

## DESCRIPTION OF THE METHOD

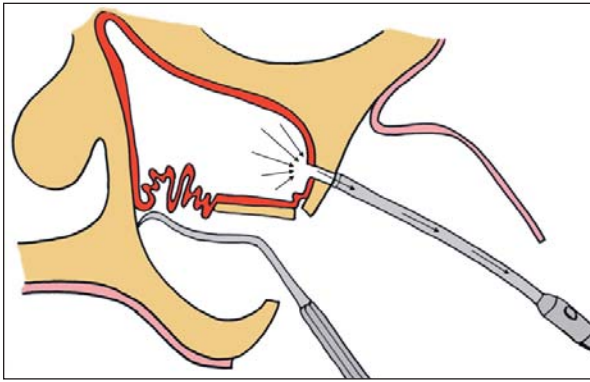
The sinus lift procedure is carried out under general anesthesia, since the donor area of choice is the iliac crest. Extension of the incision is directly related to the number of implants to be placed. A full-thickness mucoperiosteal flap is then elevated superiorly with a periosteal elevator until the anterolateral wall of the maxilla is fully exposed. A bony window is prepared by performing a rectangular osteotomy using a 2- to 3-mm diamond round bur. The maxillary sinus mucosa is then visualized. An opening is made with a 702 bur (Stryker Instruments, Kalamazoo, MI) superiorly and distally to this window through the maxillary bone wall and the sinus mucosa (Figs 1a and 1b).

A suction tube is positioned and kept functioning

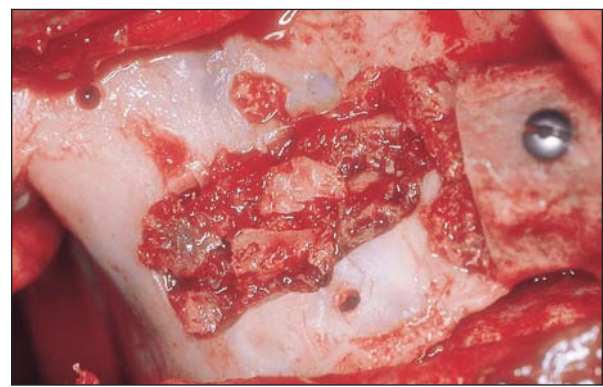
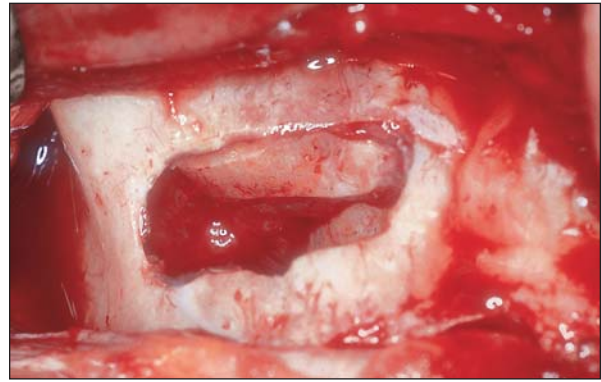
over this opening to establish negative pressure inside the maxillary sinus, which causes the sinus mucosa to lift while it is carefully dissected, starting from the lower limit of the cavity and progressing toward the lateral walls of the maxillary sinus (Figs 2a and 2b). The pressure established inside the maxillary sinus must permit the membrane to lift without being aspirated.

Dissection is performed with a Lucas curette modified so as to not damage the membrane and also to reach the lateral walls of the sinus cavity. The instrument is adapted manually by heating its tip to redness so that it can be molded until its outer portion acquires an angulation that will cause the cutting part of the instrument to be separated from the sinus mucosa at the time of dissection and the blunt part to be in intimate contact with it.

The fully elevated membrane is then positioned superiorly. The bony window is articulated in such a way that the membrane is maintained in position so as to permit graft to be placed inside the sinus cavity (Figs 3a and 3b). In this way, the maxillary sinus will be ready to receive the bone graft (Fig 4).



**Figs 3a and 3b** The articulated bony window in position to accommodate the graft inside the sinus cavity.



**Fig 4** Graft inside the sinus cavity.

## DISCUSSION

Although sinus augmentation using allogenic grafting materials is a clinical procedure with a high rate of success,<sup>8-10</sup> autogenous bone still is the gold standard because of its osteogenic potential. This osteogenic potential is related to the great number of surviving osteoblasts in autogenous graft material. Furthermore, autogenous bone is valued for its osteoinductive capacity, which is a consequence of the release of bone morphogenetic proteins and other growth factors.<sup>11</sup>

Among the various bone graft donor areas such as the tibia, calvaria, mandibular symphysis, mandibular ascending ramus, mandibular coronoid process, and iliac crest,<sup>12</sup> the latter is the one most frequently used. Because of the availability of abundant bone tissue, the technical facility for obtaining the graft,<sup>1</sup> and also because the histologic characteristics of iliac bone are quite compatible with those of maxillary alveolar bone, the occurrence of rapid transformation into alveolar bone<sup>13</sup> can be expected.

For the cases reported in the present study, only iliac crest bone graft was used because of the availability of ample bone tissue in this area. Because most of the operated patients were completely edentulous in the posterior region of the maxilla, a large amount of graft material was needed.

It is advisable to fill the sinus cavity immediately after obtaining the graft to prevent the bone tissue from being exposed to the environment, with the consequent occurrence of bone cell lysis, and to prevent the graft from being without irrigation for a prolonged period of time. This approach increases the chances of long-term success of the procedure. Particulate cancellous bone was used to fill the sinus because of the easy accommodation and condensation of this type of graft. An allogenic bone graft can be used in addition to autogenous bone when the thickness of the alveolar crest is not sufficient for implant placement.

According to the proceedings of the Sinus Consensus Conference,<sup>3,4</sup> the maxillary sinus mucosa is a structure bathed with mucin and lactoferrin, with antibodies that keep this environment sterile and free from infections. Patients who are smokers are known to be more susceptible to allergies and infectious diseases. Thus, smoking is considered a risk factor for the success of a bone graft in the maxillary sinus.

To date, 20 patients with a total of 30 maxillary sinuses have been treated using the proposed technique at the authors' institution. The healing time (ie, the interval before implant placement in the grafted area) adopted was 3 months. Of the 30 sinuses where the proposed technique was used, the membrane was perforated in only 1 case. The incidence of membrane perforation was low because the schneiderian membrane was firmly attached to the bordering septum as described by Vlassis and Fugazzotto<sup>14</sup> and Van den Berg and associates.<sup>7</sup> However, the authors' experience has shown that the technique can be used for all types of sinuses, ie, septated and nonseptated, small and large, thin and thick. Other complications, such as postoperative sinusitis,<sup>15</sup> have not been encountered.

## CONCLUSIONS

The use of negative pressure inside the maxillary sinus can permit a safer sinus lift procedure by facilitating visualization of the membrane-bone plate junction and the extension of sinus membrane elevation as far as the window level. Increasing the graft area reduces the risks of membrane rupture and dilaceration during lifting and reduces the risks of complication and infection during postoperative recovery.

Simplification of the instrumentation used for this procedure permitted the execution of this type of surgery at institutions with limited financial resources with the same success rates and predictability as observed in the literature. No cases of infection or sinusitis occurred after the grafting procedure in this limited patient population.

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