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## Multiple window access antrostomy in maxillary sinus grafting. Presentation of a clinical serie of 10 cases and literature review

Rafael Martínez-Conde <sup>1</sup>, Asier Eguia <sup>2</sup>, Agurne Uribarri <sup>3</sup>, José López-Vicente <sup>3</sup>, José Manuel Aguirre <sup>4</sup>

<sup>1</sup> Professor. Oral and Maxillofacial Surgeon. Oral Medicine. Faculty of Medicine and Dentistry. University of the Basque Country. Spain.

<sup>2</sup> Associated Professor. Master of Oral Pathology. Oral Medicine. Faculty of Medicine and Dentistry. University of the Basque Country. Spain.

<sup>3</sup> Associated Professor. Oral Medicine. Faculty of Medicine and Dentistry. University of the Basque Country. Spain.

<sup>4</sup> Head Professor. Director. Master of Oral Pathology. Oral Medicine. Faculty of Medicine and Dentistry. University of the Basque Country. Spain.

### Correspondence:

Departamento Estomatología. Universidad del País Vasco.

Barrio Sarriena s/n

48940. Leioa (Vizcaya). Spain.

E-mail: aeguiadelvalle@yahoo.es

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eMail: <a href="mailto:jced@jced.es">jced@jced.es</a>	

### Abstract

**Objectives:** A variation on the usual maxillary sinus grafting technique and its results are presented, using a more conservative approach that provides better conditions for applying the graft in complicated situations.

**Material and Methods:** Ten case reports are presented in which the multiple access technique was used due to the existence of large maxillary sinuses, where a wide surgical approach was needed because several implants were to be installed or cases in which sinus bone graft was part of a more extensive reconstructive procedure.

**Results:** All the implants that were placed after using this technique were correctly integrated and it was possible to proceed to the prosthesis stage without any problems.

**Conclusions:** This modified technique of sinus floor bone grafting can have a beneficial effect with a lower risk of perforations, better preservation of vascularisation in the area and improved integration and stability of the implants and bone graft, specially where wider surgical access is required.

**Key words:** Antrostomy, maxillary sinus, bone grafting, dental implants.

## Introduction

Due to its versatility and the good results achieved with its use, oral implantology has become a commonly used therapeutic tool. Indications of these intraosseous fixation systems have become so widespread that they cover almost any type of edentulism. This widespread use, sometimes, face situations where there is an insufficient quantity and quality of bone for their installation.

The posterior area of the maxilla is often compromised, as the presence of the maxillary sinus limits the height of the remaining amount of available bone. Maxillary sinus grafting techniques have been developed to solve this problem. Since it was first described by Boyne et al. (1), this method has become a widely-used surgical technique with a reported success rate of more than 90 % (2). However, despite this, there is still controversy about certain aspects such as which graft material to use, whether to perform delayed or simultaneous placement of dental implants, how to close the antrostomy window or the type of surgical approach to employ (3-5).

Double window antrostomy approach to the maxillary sinus has been proposed in the presence of septa (6-9). Furthermore, this type of surgical access could present some advantages in another clinical situations where it is necessary to use a wide surgical approach such as: in hyperpneumatized maxillary sinuses, in cases that require a large surgical access due to the simultaneous installation of several implants, or in cases where the sinus graft is part of a more extensive procedure (3,6,7).

Ten cases of multiple antrostomy window surgical access for the maxillary sinus grafting procedure, where the indication was other than the presence of sinus septa, are presented in this paper.

## Material and Methods

### Patient Selection

Between January 2005 and November 2007, ten patients in which a wide approach to the maxillary sinus was needed because several implants were to be installed and the distance between them was very large, or cases of hyperpneumatized maxillary sinuses, were included in this study (Table1). Patients were fully informed about the surgical procedure and signed an appropriate consent form.

### Surgical Technique

A large buccal mucoperiosteal flap was raised exposing the lateral wall of the maxilla from its anterior region up to the area of the tuberosity. In the anterior wall of the maxilla, an oval-shaped ostectomy was performed using rotatory instruments. This ostectomy must large enough to facilitate handling of the sinus lift instruments and make it possible to detach the Schneirediam membrane from the anterior portion of sinus floor.

Following extensive detachment in this area, which must also include the palatal wall, the sinus lift instrument is

moved in a posterior direction, initially along the maxillary sinus floor. At this level it is common to find some kind of obstacle due to the presence of irregularities and septa, especially in the zygomatic-malar complex. It is not advisable to insist on detaching this area, as the Schneiderian membrane can easily be torn (6,10). However, it is easy to perform this posterior advance by detaching the membrane from the external lateral wall of the sinus, where it is safe to perform an extensive tunnelling in this buccal area. This tunnelling makes it easy to perform a second and even a third antrostomy distally in the bony wall, generally behind the zygomatic-malar complex, without any risk of tearing the membrane.

This secondary window is used to approach the detachment of the membrane in the posterior region of the sinus floor and the palatal wall, which is joined with the anterior area, thus releasing any osseous crests and irregularities that there might be at this level (Fig. 1).



Fig. 1.

After raising the sinus membrane it is possible to install the implant, in the case of immediate implantation (Fig. 2), or to fill the area with the graft material if a delayed technique is to be used. Implantation was delayed in three cases, either because the lifting procedure formed part of a more extensive reconstruction with buccal



Fig. 2.

Case	Age	Sex	Indication	N. of Access	Implant placing
1	44	M	Hyperpneumatized sinus	2	Immediate
2	50	M	Number of implantes	2	Immediate
3	43	M	Hyperpneumatized sinus +Extensive reconstructive procedure	3	Delayed
4	60	M	Number of implants	2	Immediate
5	51	M	Hyperpneumatized sinus	2	Delayed
6	56	F	Number of implants	2	Immediate
7	63	M	Number of implants	2	Immediate
8	46	F	Hyperpneumatized sinus +Extensive reconstructive procedure	3	Delayed
9	48	M	Number of implants	2	Immediate
10	46	M	Number of implants	2	Immediate

M (Male)

F (Female)

N (Number)

**Table 1.** Cases included in the study. Indications and treatment

“onlay” grafts, or because it was not possible to achieve good primary stability with the implants (Table 1).

A mixture of particulate bovine bone (BioOss®, Geistlich Pharma AG, Switzerland) with autologous bone harvested from the same area and platelet-rich plasma was used as the graft material (10). In two patients, in whom the sinus lift formed part of more extensive reconstructive procedures, cancellous bone chips taken from the anterior iliac crest mixed with bovine bone (BioOss®, Geistlich Pharma AG, Switzerland) were utilised. Antrostomies were closed by placing a collagen membrane (Bioguide®, Geistlich Pharma AG, Switzerland) to cover osseous defects protecting the graft and preventing its migration. After this the buccal flap was replaced and sutured in place.

**Results**

Perforation of the sinus membrane only occurred in one patient (Fig. 3) and it was treated by folding and collapsing it, then placing a collagen membrane (Bioguide®, Geistlich Pharma AG, Switzerland) in the area as an occlusion material (10,11) (Fig. 4).

After an osseointegration period of 4 to 6 months, sur-

gery was performed to expose the implants in the cases where they were left submerged, and placement of the implants was performed in those where a two-step procedure had been chosen. All the implants that were placed immediately, at the same time as the lift procedure, were correctly integrated and it was possible to proceed to the prosthesis stage after this period. In the three cases where placement of the implants was delayed, a sufficient quantity of bone was achieved to make their subsequent insertion possible without any problems.

**Discussion**

Maxillary sinus floor bone grafting technique has been in use for more than thirty years (1) and, since it was first described, numerous variations have been reported (5). Despite all these variations, the most common surgical access continues to be lateral antrostomy, this involves the use of the thinnest area of the buccal wall on the anterior face of the maxillary sinus. From this area, in a posterior direction, we find the zygomatic-malar complex, where the bone is thicker. In this buttress region it is more laborious and difficult to perform the osteotomy, requiring previous bone reduction, and the lifting of the



**Fig. 3.**



**Fig. 4.**

membrane is associated with a higher incidence of perforations (10). The thickness of the buccal bony wall of the maxillary sinus decreases again towards the distal region, in the direction of the tuberosity. By performing the osteotomy in this area after detaching the membrane it is easy to avoid accidental perforations.

Perforations or tears of the sinus membrane during the surgical procedure are the most common complication of the maxillary sinus lift technique. Although the importance of these perforations for the ultimate success of the implants is debatable (12-14), when they are very large they can make it necessary to abort the procedure (13,15,16). According to different authors, the prevalence of these perforations varies between 7% and 44% (13,16). Perforation of the sinus membrane only occurred in one patient in our study (case report No. 6), which coincided with the presence of a partial septum in the sinus floor). With multiple antrostomies the approach to the maxillary sinus is through the anterior wall, where the bone is thinner, the use of instruments is simpler and there is therefore a lower probability of perforating the membrane.

Masticatory forces are distributed to the cranium by means of four major buttresses, the outermost of which is the zygomatic-malar buttress, which forms the joint between the anterior and posterior walls of the maxillary sinus. This maxillary pillar is an important bone structure in terms of resistance to masticatory forces, so it is not advisable to sacrifice it during the surgical procedure. If kept, this pillar or the sections of bone that are preserved between the antrostomies provide extra support and help to retain the graft material and its contour, adapting the collagen membrane that is usually used as a closure for the osteotomy to that convex area in order to prevent migration of the graft and the possibility of invasion by cells of connective origin into the augmented area (4). Furthermore, these sections of bone that are preserved between the multiple osteotomies make it possible to achieve a larger contact area and osteosynthesis screw fixation if buccal bone grafts are used simultaneously.

Once the graft is packed into the maxillary sinus, its integration and ossification potential is determined by the presence of osteogenic cells in the area. To a large extent, these osteogenic cells migrate towards the graft from the remaining exposed bony walls that are in contact with the graft and from them the new bone progresses towards the augmented area (17,18). It can therefore be said that ossification of the graft takes place centripetally, with a gradient from the exposed maxillary bone inwards into the graft (18). By trying to conserve the buccal wall we will therefore improve the integration of the graft due to the greater contribution of the residual bone.

In the case reports described in this article, none of the implants were lost during the osseointegration period. After a healing period of 4 to 6 months all the implants

were successfully integrated. In every case, except where the sinus lift formed part of a more extensive procedure, we endeavoured to perform immediate implantation, despite the fact that in many of them there was less than 4 mm of residual alveolar bone remaining (10). It is necessary to achieve good initial primary stability in order to perform this simultaneous placement of the implants and sinus bone graft (19,20). Most studies show a success rate of almost 95% for implants after alveolar bone grafting, with a slight decrease in this rate in cases of immediate implantation (21), especially when there is less than 4 mm of residual bone (22). The stabilising effect of the residual buccal wall graft may be beneficial for its integration, isolating it from external lateral forces that produce micromovements (provisional prostheses, muscles, mastication, etc.). To achieve better primary stability Astra Tech ST implants were used, in which the conical coronal region with microthreads initially help to anchor them to the bone tissue (23). The preserved integrity of the buccal bony wall in turn prevents fractures from occurring in the residual alveolar bone during insertion of the implant, which would destabilise this anchorage.

Sinus floor bone grafting is a commonly used technique in oral implantology that has an established method and indications. However, there are some cases, such as hyperpneumatized maxillary sinuses, where wider surgical access is required due to the need to place several implants or when the sinus lift forms part of more extensive procedures, in which multiple antrostomies can have a beneficial effect with a lower risk of perforations, better preservation of vascularisation in the area and improved integration and stability of the implants and bone graft.

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