Lateral window for major sinus lift bone grafting: Technical note

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Abstract

Introduction
After the loss of teeth in the posterior maxilla, the thickness or vertical height between the alveolar crest and maxillary sinus may be insufficient to place dental implants. At present, maxillary sinus lifting has become a widely used technique for augmenting bone tissue volume in the maxilla. Various surgical techniques can be applied to achieve a sufficient bone volume in order to place implants. Among the techniques used for lateral surgical access to the antral cavity, the technique of complete removal of the bony window through rotary instruments, and the technique of partial conservation of the window with the over-turning inside the sinus (trap door) are widely known. In this article the authors present an alternative to surgical access, using a technique with a minor invasive approach with a high biological value. This method provides a lateral access to the maxillary sinus with a minimally invasive osteotomy. The osteometric incision, of very reduced dimensions, must be performed with perfectly regular lines to delimit a rectangular shape, and convergent incisions in the cavity direction, realizing a true chamfer and preserving the integrity of the Schneiderian membrane.

Case report
A 54-year-old female presented in our dental clinic to replace the right superior premolars. Implants were placed after performing an antrostomy and maxillary sinus lift with a new technique. In order to guarantee greater stability to bone plug a membrane of PRF (Platelet Rich Fibrin) was placed according to the Choukroun Technique and the flap was sutured. Finally prosthetic rehabilitation was completed after six month.

Conclusion
The technique of sinus lift with side access, with purposes of implant prosthetic rehabilitation, is characterized by high predictability of success. Among the techniques of lateral surgical access to the antral cavity, the technique of complete removal of the bony window through rotary instruments and the technique of partial conservation of the window with the over-turning inside the sinus (trap door) are widely known. In this paper we have described a new surgical technique less invasive, infact, in any case it is essential, irrespective of the technique used, preserving the integrity of the Schneiderian membrane.

Introduction
After the loss of teeth in the posterior maxilla, the thickness or vertical height between the alveolar crest and maxillary sinus may be insufficient to place dental implants.² In the immediate period after maxillary posterior tooth extraction, initial decrease in alveolar width is due to resorption and/or loss of buccal bone. Continuous bone remodelling, absence of stimulation, loss of bone height and density, can lead to an increase in antral pneumatization. The maxillary sinus pneumatization is caused both by progressive resorption of alveolar processes, and by increase of intra-antral pressure. In such a situation, the residual vertical bone height progressively decreases, and standard implant placement becomes more and more difficult.³ It must be considered that, in these patients, grafting techniques before placing implants in the posterior edentulous area are required. At present, maxillary sinus lifting has become a widely used technique for augmenting bone tissue volume in the maxilla. Various surgical techniques can be applied to achieve a sufficient bone volume in order to apply implants. The lateral approach, first described by Tatum in 1976, provides surgical access through the zygomatic lateral wall of the maxilla, followed by elevation of the sinus membrane and placement of grafting material.⁵

This surgery creates an antrotomy access to the sinus, detachig Schneider's membrane from the sinus floor, and placing a grafting material into the sinus cavity to promote vertical bone augmentation.⁶ The long-term success of this technique has been reported even with the use of different types of grafting materials and implants.⁷ Sinus augmentation has a high percentage of success, but presents a number complications: intraoperative complication, such as membrane perforation, fracture of the residual alveolar ridge, obstruction of the maxillary ostium, haemorrhage, damage to adjacent dentition; early post-operative complications such as haemorrhage, wound dehiscences, acute infection, exposure of barrier membrane, graft infection, graft loss and dental implants failure, and late post-operative complications such as graft loss, implant loss or failure, implant migration, oroantral fistula, chronic pain, chronic sinus disease, chronic infection.⁸,⁹

The most frequent complication is surely the Schneiderian membrane perforation. Anatomic irregularities of the sinus floor, or residual sinus septa, and above all the window design, can increase the risk of perforation. Nowadays the use of piezoelectric osteotomy provides a good tactile...
sense, does not damage non mineralized structures, and prevents membrane perforation.10,11

Technical note
In this article the authors present an alternative to surgical access, using a technique with a minor invasive approach with a high biological value. This method provides a lateral access to the maxillary sinus with a minimally invasive osteotomy.

The osteotomic incision, of very reduced dimensions, must be performed with perfectly regular lines to delimit a rectangular shape, and convergent incisions in the cavity direction, realizing a true chamfer.

Case report
A 54-year-old female presented in our dental clinic to replace the right superior premolars (Figure 1). An x-ray panoramic was performed and, due to a lack of bone (Figure 2), we underwent the patient to a maxillary sinus lift.

An x-ray study was performed with a tridimensional method (TC, Cone Beam, Siemens, Medical Sistem, Italy) (Figure 3 and Figure 4), to define sinus anatomy details:

- height of the residual bone ridge.
- location of seven cavities (seven of Underwood), present in at least 30% of cases.
- vertical and mesio-distal extension of the maxillary sinus.
- health conditions of the Schneiderian membrane.
- thickness of the lateral bone wall.

The height of the residual bone ridge allows us to establish two important parameters:

- lower limit of osteotomy.
- planning the immediate or delayed insertion of the implants.

It’s important, during surgical planning, to identify the presence of a septum that could hamper the correct detachment of the membrane. The septum, originating from the floor, sometimes develops considerably in a vertical sense. In this case, the solution is to create two independent windows, one mesial and the other distal to the septum. The greater the thickness of the lateral wall, the more difficult both osteotomic access and membrane detachment. In any case, our new technique proposes an anthrostomic access of limited dimensions, with the maximum

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conservation of the lateral wall of the sinus (Figure 5).

The risk of membrane perforation is related to the angle between the vestibular wall of the sinus and the medial one: the more acute the angle, the more difficult the membrane detachment. An angle greater than 60 degrees presents no risk of perforation; when the angle is between 30 and 60 degrees, the risk of perforation increases approximately 30%. If the angle is less than 30 degrees, the risk increases to 60% (Figure 6).

After x-ray study the gingival flap is designed (Figure 7). Osteotomy is performed with the use of sonic instruments (Airson®, TeKne Dental srl, Calenzano (FI), Italy). This technique allows to perform thin, very precise osteotomies, between 0.18 and 0.25 millimetres, greatly reducing the risk of damaging soft tissues and with an increased saving of bone tissue. The bone plug resulting from the above-mentioned osteotomy is delicately detached from the membrane, removed and conserved in a physiological solution (Figure 8).

Once anthrostomic window is performed, we proceed to membrane detachment from the apical part to mesial portion, then distal, finishing with the most coronal (Figure 9). This surgery must be performed always maintaining the sharp part of the detacher constantly on the bone floor, verifying membrane integrity with Valsava manoeuvre (Figure 10).

Implants (Megagen srl, Como, Italy) are placed before filling the cavity with grafting material (Figure 11). Finally anthrostomy is closed repositioning the bone plug (Figure 12).

In order to guarantee greater stability to bone plug a membrane of PRF (Platelet Rich Fibrin) is placed according to the Choukroun Technique (Figure 13).

Then the flap is sutured and an x-ray is performed to control implants position (Figure 14 and Figure 15). Finally prosthetic rehabilitation is completed after six month (Figure 16).

Discussion
Dental implant placement is often restricted by sinus enlargement in the posterior maxilla. Various sinus augmentation techniques have been introduced so far to overcome the
problem. The conventional method for sinus augmentation is the lateral window technique. Membranes prevent graft migration and soft tissue invasion of the sinus12, favouring a greater amount of bone regeneration in the sinus13. Several studies assessed survival rates of implants with sinus floor lifting14, however, very few controlled clinical trials have evaluated the need of placing a membrane over the antrostomy defect in terms of implant survival, and most of them have conflicting results. Therefore, the debate on the necessity of barrier membranes in sinus augmentation still persists.

However, because of limitations in bone regeneration, attention has focused on biological mediators to enhance the clinical benefits of bone grafts and improve wound healing15. Purified and recombinant growth factors, including platelet-derived growth factor (PDGF) and insulin-like growth factor I (IGF1), have demonstrated significant therapeutic potential in preclinical and clinical studies16,17.

Platelets produce and release multiple growth and differentiation factors critical for regulation of wound healing. Refinements in haematological instrumentation now enable the efficient collection of platelets in high concentrations, such as platelet-rich plasma (PRP)17. In other medical specialties, platelet-rich plasma (PRP) is known to support wound healing in the therapy of sulcus-crurus, and in ophthalmology PRP has been applied in the treatment of macular defects18.

An in vitro study has shown that proliferation of human osteoblast-like cells can be stimulated by concentration dependent platelet concentrates and supports the assumption that the clinical use of PRP might increase bone regeneration. In addition to single case reports about the topical use of PRP in oral surgery, other studies have investigated its effects in animal experiments. Furthermore, some reports have discussed different combinations of autologous bone or bovine collagen with PRP19,20.

Lenharo and Cosso21 claimed that using the technique of obtaining platelet-rich plasma, in order to produce a high concentration of growth factors derived from platelets, appears to be a significant addition to surgical techniques for tissue regeneration. They mentioned that bone regeneration is predictable when considering viable cells (osteocompetents), growth factors and organic or synthetic matrices.

They also concluded that the regeneration in bone areas treated with growth factors seems to have better epithelial repair compared with control areas, as well as bone regeneration is improved. In contrast Gürbüz et al.22 concluded that the application of PRP alone into soft tissue impacted mandibular third molar extraction sockets failed to increase the osteoblastic activity in postsurgical weeks.

They investigated the early effect of platelet-rich plasma (PRP) on osteoblastic activity during the healing process of soft tissue impacted mandibular third molar extraction sockets by means of bone scintigraphy. Scintigraphic findings did not show significantly increased osteoblastic activity.

Conclusion
The technique of sinus lift with side access, with purposes of implant prosthetic rehabilitation, is characterized by high predictability of success.

Numerous studies have shown that the method of filling the antral cavity with autologous bone or allograft, does not influence on outcome in terms of successful implant surgery, tissue healing and complications. Instead, the use of a barrier on the access window, compared to no use of any barrier, really influences the implant success, limiting any complications.

A systematic review, published by Tarnow in 2000, showed a 91.5% implant success especially when the bone window is closed with the placement of a membrane of resorbable material23. Among the techniques of lateral surgical access to the antral cavity, the technique of complete removal of the bony window through rotary instruments and the technique of partial conservation of the window with the overturning inside the sinus (trap door) are widely known.

In this paper we have described a new surgical technique less invasive, infact, in any case it is essential, irrespective of the technique used, preserving the integrity of the Schneiderian membrane.

Consent
Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

References


Case report