Different Techniques For Sinus Floor Elevation: A Review Part II – Indirect Techniques

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Abstract

The bone available for implant placement may be limited by the presence of the maxillary sinus together with loss of alveolar bone height and it may be increased by augmentation. Minimally invasive sinus augmentation is an effective solution for this problem. This review explains indirect sinus augmentation procedures which are less invasive and highly successful if done using prescribed technique.

Key Words: *Sinus lift, indirect technique, schnedrian membrane.*

Introduction

The reduced vertical bone height in the posterior maxillary region is often a major obstacle to the placement of dental implants. Elevation of the maxillary sinus floor is an option to solve this problem. Various surgical techniques have been presented to access the sinus cavity and elevate the sinus membrane.

Two different techniques of sinus augmentation are described in the literature: direct and indirect. The indication for indirect sinus augmentation is a minimum bone thickness of 5 mm underneath the sinus; otherwise, the direct sinus floor augmentation or a 2-stage indirect augmentation technique must be implemented.[1] However, Misch[2] considered that 8 mm subantral bone height is the limit for the indirect sinus augmentation technique, 5–8 mm bone height is indicated for 1-stage direct augmentation with implants, and cases with less than 5 mm bone height are indicated for the 2-stage direct augmentation technique. The direct sinus floor augmentation technique has several disadvantages: the blood supply of the alveolar crest may be severely reduced,[3] and an increased possibility of sinus membrane perforation exists that compromises the grafting procedures. As a result of sinus membrane perforation and migration of the graft material, persistent chronic sinusitis may develop.[1]

On the other hand, the complications with the indirect sinus elevation technique are less than those of the direct method because it is less invasive.[4] However, the bone augmentation gained by this technique is usually less than that gained by the direct method.[13] The possibility of Schneiderian membrane tearing with subsequent sinusitis and risk of failure is also present.[12]

Osteotome mediated sinus floor elevation:

The bone-added osteotome sinus floor elevation (BAOSFE) technique[5] and its reported modifications[6] represent substantially less invasive and less costly alternatives for predictable implant installation in the moderately deficient posterior maxilla. Introduced by Summers [5] in 1994, the BAOSFE procedure uses tapered concave-tipped osteotomes and graft materials to facilitate sinus floor elevation (SFE) with concurrent implant placement.

Indirect osteotome maxillary sinus floor elevation (OMSFE) is generally employed when the residual bone height is equal to or greater than 6 mm; in cases with higher resorption, the direct sinus elevation technique is used.[7] The indirect osteotome technique offers a number of advantages: The surgery is more conservative, sinus augmentation is localized, there is a low rate of postoperative morbidity, a shorter time to implant loading is possible than with the direct technique, and high survival rates of around 90% are obtained.

The primary determinant in implant survival with OMSFE procedures is the residual subantral bone

height (RSBH).[6] Summers[5] claimed that a preoperative RSBH of at least 5 to 6 mm was needed for predictable implant success with the BAOSFE procedure, and this has been confirmed by other reports. Clinical studies on osteotome mediated SFE (OMSFE) with simultaneous implant placement show a success rate between 88.6% and 100%.[6]

Minimally invasive transalveolar technique:

A minimally invasive surgical procedure has been defined in general surgery as a procedure that is carried out with the least damage possible to the patient. The procedure is called "minimally invasive" when there is minimal damage to biological tissues at the point of entrance of the instrument.[8] There are some obvious advantages with a less invasive surgical approach for the patient, such as quicker recovery, less postoperative pain, and economic gain due to shorter recuperation.

The sinus elevation procedure has an integral invasive surgical procedure that could pose surgical morbidity as well as increase cost of treatment. The ISAT (indirect sinus augmentation) procedure performed with 5-8 mm thick RAB is less invasive and less costly for predictable implant placement.[9]

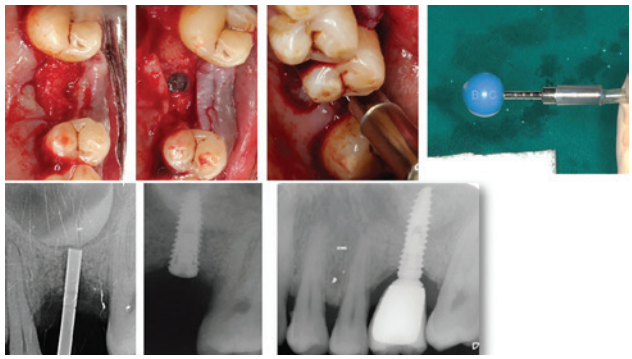
For ridges with 3-5 mm thick RAB, surgical modalities as those proposed by Summers[5] , Fugazzotto[25] and Toffler[24] provides less traumatic and less costlier alternatives especially in compromised single molar sites.

Antral membrane balloon technique:

The antral membrane balloon elevation (AMBE) technique [Figure 1] is another minimally invasive technique to elevate the sinus membrane. An inflatable balloon is used to elevate the sinus membrane. The AMBE technique was introduced by Soltan *et al.*[10] It is used to elevate the membrane easily and make the antral floor accessible for augmentation with grafting materials.

Minimally invasive antral membrane balloon elevation(MIAMBE) is a modification of the bone-added osteotome sinus floor elevation (BAOSFE) method as the antral membrane elevation is performed through the osteotomy site (3.5 mm) using a specially designed balloon. This technique has been used as an alternative to conventional procedures.[11] MIAMBE balloon-harboring device (MiambeLTD, Netanya, Israel) consists of a stainless steel tube, three mm in diameter, that connects on its proximal end to the dedicated inflation syringe, and its distal portion has an embedded single use silicone balloon. The balloon is inflated with diluted contrast fluid that pushes up the Schneiderian membrane, creating the desired height for implant placement. Under local anesthesia, a four mm diameter punch is to be used to remove the epithelium to expose the underlining bone crest at the precise future implant location.

Kfir *et al*. introduced a minimally invasive method of sinus lift using an upward-expanding balloon deployed via a 3 mm osteotomy.[12] This procedure has several advantages. It is brief (less than 60 min), performed under local anesthesia, and leaves the patient with very little operative and postoperative discomfort. MIAMBE is a minimally invasive, single-sitting procedure of maxillary bone augmentation, and implant placement.[11] Advantages of using a flapless approach for dental implant placement includes predictability, preservation of crestal bone and mucosal health surrounding the implants.[13]



(Figure 1)Transcrestal sinus floor elevation using antral membrane mini baloon

(Figure 2) Antral membrane balloon

Hydraulic sinus lift technique:

Hydraulic Pressure technique through crestal approach has been used recently for the elevation of sinus membrane. This method facilitates detachment of the Schneiderian membrane through injection of a liquid followed by its spontaneous expulsion or aspiration, to then pass on at the insertion of the graft material in the sub-Schneiderian space created this way.[11]

In 2010, Andreasi Bassi and Lopez[14] proposed a new method that takes advantage of the hydraulic pressure exercised on a graft material of a pasty consistency to detach the antral mucosa and simultaneously fill the sub-antral space created this way. The authors called the technique Hydraulic Sinus Lift (HySiLift).[14]

It takes advantage of the hydraulic pressure exercised on a graft material of a pasty consistency to detach the antral mucosa and simultaneously fill the sub-antral space.

The instruments made for this purpose consist of three components: a titanium syringe equipped with a micrometric piston to assemble single-use plastic syringes of various volumes, a dispenser in threaded surgical steel available in different forms and measurements and a needle in surgical steel. The single-use syringes can be pre-loaded with the desired amount of graft material, or it is possible to directly use the syringe containing the graft material as provided by the manufacturer.[14]

The HySiLift technique allows the hydraulic detachment of the maxillary sinus mucosa and, at the same time, the filling of the sub-schneiderian space with the graft material. This method, which can be used both with flap and flapless interventions, joins the most common techniques for preparation of the implant tunnel and discontinuation of the maxillary sinus floor, allowing conspicuous and harmonic increases in the three dimensions of the sub-antral space volume. The strong point of this method is researched in: a brief learning curve, reduced invasiveness, reduction of the operating times and greater precision.[11]

Nasal suction technique:

The nasal suction technique (NaSucT) is characterized by the insertion of a suction catheter attached to a high-flow vacuum regulator that incorporates a suction canister connected to a 10 kPa medical vacuum. As to the ultrasonic surgery approach, a voltage applied to a polarized piezoceramic causes it to expand in the direction of and contract perpendicular to polarity. Moreover, a frequency of 25 to 29 kHz is used to cut only mineralised tissue and not neurovascular tissue and other soft tissues. The suction device is to be attached to a high-flow vacuum regulator that incorporated a suction canister connected to a 10-kPA medical vacuum (-75 mm Hg).[15]

Suction tip is to be placed in the nostril (same side as the maxillary sinus lift being undertaken) with the tip directed toward the maxillary ostium and the assistant gently pinching the nose, it produces a mild intramaxillary negative pressure. This pulls the maxillary sinus lining inward once the bony window is in-fractured or removed from the lateral wall of the maxilla, and helps to atraumatically elevate the sinus lining without any perforations and increases the visual field The negative pressure produced is mild and does not cause any harm to either the nostril or the sinus membrane.[16]

Conclusions

The objective of an indirect sinus lift procedure is to increase the height of the vertical bone in the posterior maxilla and provide the opportunity for implant restoration in that area with adequate primary stability of the implant. Various indirect techniques like nasal suction technique(NaSucT), balloon antral elevation technique(BAOSFE), and Hydraulic Sinus Lift technique(HySiLift) are explained in this article which prove to be less invasive and more effective. The success of the dental implant with sinus augmentation mainly depends on the skill of the operator, adequate preoperative planning, technique used to place an implant and the type of graft material used.

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