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Surgical approaches in successful maxillary sinus lift implant-a step by step detailed guided intervention

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Introduction

Implant dentistry has become an excellent treatment modality since its inception into the modern era of dentistry. It not only allows for a conservative and esthetic alternative to treating partial edentulism, but it also provides a stable foundation for treating complete edentulism. Dental implants can be a viable treatment option when there are sufficient quantity and quality of bone. However, when patients present with deficient alveolar ridges, it could jeopardize the application of implant dentistry. This problem is especially magnified in the posterior maxilla where ridge resorption and sinus pneumatization, compounded with a poor quality of bone, are often encountered. The procedure of choice to restore this anatomic deficiency is maxillary sinus floor elevation (sinus lift). [(1).]

The maxilla itself is different in its function, physiology, and bone density than the mandible. These differences, in combination with the unique and varied anatomy of the maxilla, pose a challenge to the surgeon in creating bone height and width sufficient for implant placement in harmony with planned prosthetic rehabilitation. However, a thorough knowledge of contemporary augmentation procedures mitigated by proper patient selection can lead to effective long-term solutions in the management of the deficient posterior maxilla [(2).]

Implants can either be inserted simultaneously, when there is sufficient bone height for primary Stability (>4 mm), or can be inserted in a second procedure when bone-remodelling of the graft has taken place. This two-stage procedure is indicated when no good primary stability can be expected (bone height< 4 mm). [(3]

Conditions such as sinus floor convolutions, sinus septum, and transient mucosa swelling and narrow sinus may form a (usually relative) contraindication for sinus floor elevation. Absolute contraindications are maxillary sinus diseases (tumours) and destructive former sinus surgery (like the Caldwell-Luc operation). [(3).]

Surgical techniques in sinus lift

Currently, there are mainly two approaches to the maxillary sinus floor elevation procedure, according to the literature. The first approach is lateral antrostomy, which is the classical technique and more commonly operated technique that was originally described by Tatum. More recently, summers advocated a second approach known as the crestal approach, using an osteotome. This crestal approach is considered to be a more conservative method for sinus floor elevation.

Lateral Antrostomy: Lateral antrostomy is started with a crestal incision made on the alveolar ridgeMostly, the incision is performed slightly palatal to the crest to preserve a wider band of keratinized attached gingiva for more solid wound closure and to avoid wound dehiscence. A Maxillary full-thickness flap is then raised to allow access to the lateral antral wall. Once the flap has been raised to the desired level, antrostomy is usually performed with a round bur to create a U-shaped trapdoor on the lateral buttress of the maxilla. Precaution must be taken so that the height of this trapdoor should not exceed the width of the sinus (it can be measured in a computerized tomogram) to allow for a final horizontal position of the new floor. The sinus membrane is then gently lifted from the bony floor by means of an antral curette. Marx and Garg suggested using a cottonoid soaked with a carpule of 2% lidocaine with 1:100,000 epinephrine and left in the space created for 5 minutes so as to limit bleeding and allow for better visualization for further dissection. It is important to free up the sinus membrane in all directions (Anteriorly, posteriorly, and medially) before attempting to intrude the trapdoor medially. Space is created after the sinus membrane has been elevated by the intruded trapdoor. This space is then grafted with different materials to provide the platform for implant placement; numerous research projects have been published to evaluate the prognosis of implants under different grafting materials. Autogenous bone remains the gold standard in bone grafting. Iliac crest, chin, anterior ramus, and tuberosity have all been mentioned as common Autogenous donor sites in maxillary sinus lift. Hydroxyapatite mixed with Autogenous bone or used alone has also been shown to be viable alternatives. Care should be taken not to overfill the recipient site because it will cause membrane necrosis.

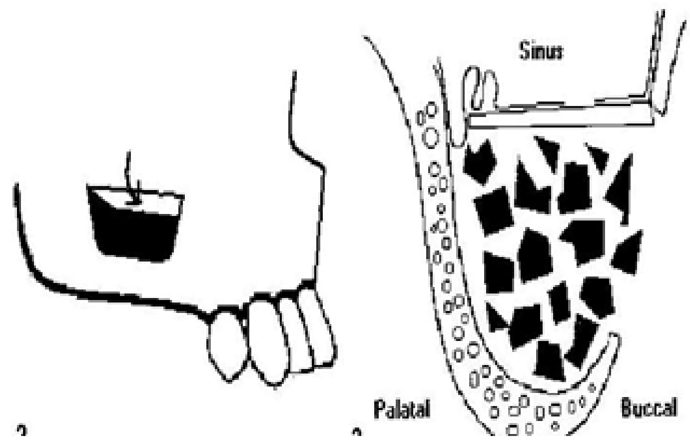


Fig. 1: Intruding the U-Shaped trapdoor. Corners of the trapdoor should be rounded.

Implants are placed either simultaneously with the graft (1-stage lateral antrostomy) or after a delayed period of up to 12 months to allow for graft maturation (2-stage lateral antrostomy). The initial bone thickness at the alveolar ridge seems to be a reliable indicator in deciding between these 2 methods. If the bone thickness is 4 mm or less, initial implant stability would be jeopardized. Therefore, a 2-stage lateral antrostomy should be carried out. The reverse holds true for a 1-stage procedure. A 1-stage procedure is less time-consuming for both the clinician and the patient. However, it is more technique-sensitive, and its success relies heavily on the amount of residual bone. Crestal Approach: One of the drawbacks of lateral antrostomy is that it requires the raising of a large flap for surgical access. Summers proposed a conservative crestal approach using osteotome for maxillary sinus floor elevation in 1994. This technique begins with a crestal Incision. A full-thickness flap is raised to expose the alveolar ridge. An osteotome of the smallest size is then tapped into place by a mallet or drill into the bone. Preoperative bone height underneath the sinus is measured to determine the desired depth for osteotome extension. Osteotomes of increasing sizes are introduced sequentially to expand the alveolus. With each insertion of a larger osteotome, bone is compressed, pushed laterally and apically.

Techniques of maxillary sinus lift

The sinus lift surgical technique has developed over time, and several minor variations now exist like "Antral membrane balloon elevation" by Smiler, "Distraction osteogenesis" by Boyne etc.

Maxillary sinus augmentation techniques

Direct sinus lift or lateral window technique.	Indirect sinus lift
Piezoelectric bony window osteotomy: 2001.	Summers osteotomy technique: 1994.
Subantroscopic laterobasal sinus floor augmentation:2002	Boyne's distraction
Sinus/alveolar crest tenting (SACT) technique: 2003.	Elevation of maxillary sinus floor with hydraulic pressure: Sotirakis 2005.

Summer's osteotome technique: 1994

As osteotomy preparation progresses toward the posterior, the surgeon usually notices a softer bone texture. The ability to drill accurately in the posterior maxilla diminishes with the loss of tactile sensitivity in the soft bone when using rotary instruments. Also, inadvertent sinus penetration and over the preparation of soft bone is common with drills. Other factors, such as torqueing of the handpiece and reproducing a consistent angle of penetration, become more demanding as bone density decreases in the posterior maxilla. Because of the problems of drilling in the maxilla summers developed a means of osteotomy preparation in which the bone is not removed. The objective of this technique is to maintain, if possible, all of the existing maxillary bone by pushing the bone aside with minimal trauma while developing an accurately shaped osteotomy.

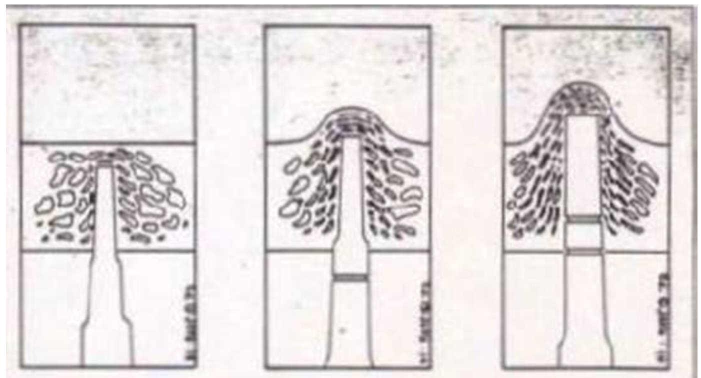


Figure 2: Lateral Antrostomy intruded with trap door grafting material.

At the osteotome sinus floor elevation,bone piles up in front of the penetrating osteotome, allowing the sinus floor to be displaced upwards.

The osteotome technique attempts to retain all of the bone that is present and to take advantage of the softer bone quality by relocating the bone to suit the needs of the surgery. In contrast to drilling, the osteotome technique improves maxillary anatomy by widening the ridge as the instruments are inserted. The osteotomes, developed by the author (Summers Osteotome Kit), are shaped so that the next larger osteotome tip fits into the opening created by the previous instrument. Bone buccal and palatal to the osteotomy is pushed laterally with successive penetrations of the larger osteotome. In a narrow ridge, expansion of the buccopalatal dimension of the site is an inherent beneficial characteristic of the osteotome technique. This is called a ridge expansion osteotomy (REO), in contrast to a drilled site, in which the buccopalatal bone width is not changed.

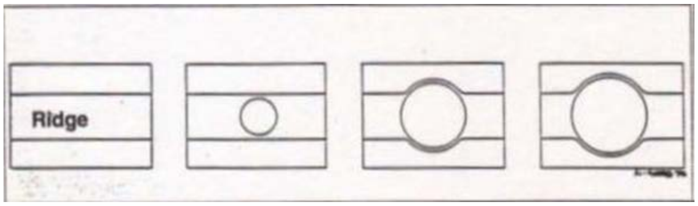


Figure 3

Ridge expansion osteotomy can be attempted at any location wider than 3mm.

Buccal and lingual bone moves laterally as the osteotome are inserted.

Other potential benefits of the osteotome technique include

1. Alteration of the anterior or posterior sinus boundary during a routine osteotomy.
2. More upright (less flared) positioning of implants. The osteotome technique provides greater flexibility for the surgeon to match opposing landmarks because of the REO feature.
3. Development of future implants sites.
4. Addition of bone into the osteotomy as the site is developed. [(17).]

Crestal core elevation (CCE) first described by summers in 1995, is a modification of the osteotome sinus floor elevation (OSFE) and the bone-added OSFE (BAOSFE) approaches, which are suitable for immediate implant insertion but require ≥6 mm of bone between the sinus floor and the crest of bone. CCE may be a simple alternative to LWT (lateral window technique) when the quantity of bone does not permit immediate implant placement. Performing CCE involves vertical crestal drilling using a wide trephine bur up to the sinus cortex followed by displacement of the bony plug inward and raising the sinus floor with a wide concave osteotome. The technique may be implemented in patients with residual bone height measuring 3 to 6 mm. A further modification of the summer's technique was suggested by Fugazzotto and De Paoli who used it concomitantly with extractions of the upper molars. The placement of deproteinized bovine bone mineral covered with an absorbable membrane or non-absorbable expanded polytetrafluoroethylene membrane minimized the loss of alveolar bone height and width after tooth removal and permitted implant placement after 4 to 8 months. (4). The osteotome sinus floor elevation procedure without grafting material, and immediate placement of tapered implants, might be applied in situations for which previously only the lateral approach was considered. (5). The osteotome technique can be recommended when more than 6 mm of residual bone height is present, and an increase of about 3 to 4 mm is expected. (6). The study consisted of 26 patients treated with 39 Brånemark implants (Nobel Biocare) placed Using the simplified osteotome technique between September 1997 and November 2004 (87 months). Implant length ranged from 10 to 15 mm, while the loading time . Ranged from 5 to 74 months (mean: 35.2 months). The success rate was 97.4%, according to Albrektsson's criteria. These preliminary data indicate that the simplified osteotome technique is an effective and safe technique. (7). Performing sinus elevations with osteotomes is a predictable technique that enables achieving an increase in bone height and successful results, similar to those of other techniques used in the placement of implants. (8).

The piezoelectric bony window osteotomy and sinus membrane elevation (Pbwo and Psme): 2001.

The most commonly used procedures, such as lateral bony window osteotomy technique and osteotome sinus elevation, have a problem of perforating the sinus membrane either with the burs during the osteotomy or with the manual elevators during the separation of the membrane. If the bone graft is carried out in the case of a membrane lesion, it is very likely that parts of the bone graft will go to an ectopic site, usually on the surface of the respiratory mucous epithelium; this would entail the necrosis of the graft, followed by a suppurative process in the sinus cavity, generally visible in the Orosinus antral fistula. In 2001 Vercellotti et al. introduced a new technique for simplification of the sinus augmentation procedure, the piezoelectric bony window osteotomy and sinus membrane elevation (PBWO and PSME). This new technique uses a specifically engineered device, the Mectron Piezosurgery system, to perform the osteotomy.

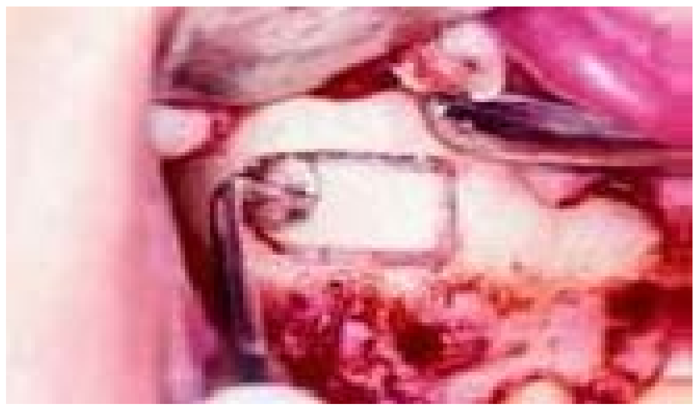
Surgical procedure

With the blade of the 15 scalpels, a horizontal crestal incision is made at the top of the ridge from the distal aspect of the maxilla, continuing mesially until it reaches one or two of the anterior teeth, where a vertical releasing incision is made. Another releasing incision is made in the distal aspect under the Stenson's duct. A flap of the total vestibular thickness is raised. It is characterized by a broad vascular supply mesially and distally. The most apical parts of the two incisions are united by a horizontal periosteal incision to give greater elasticity to the mucous flap in the suturing phase.

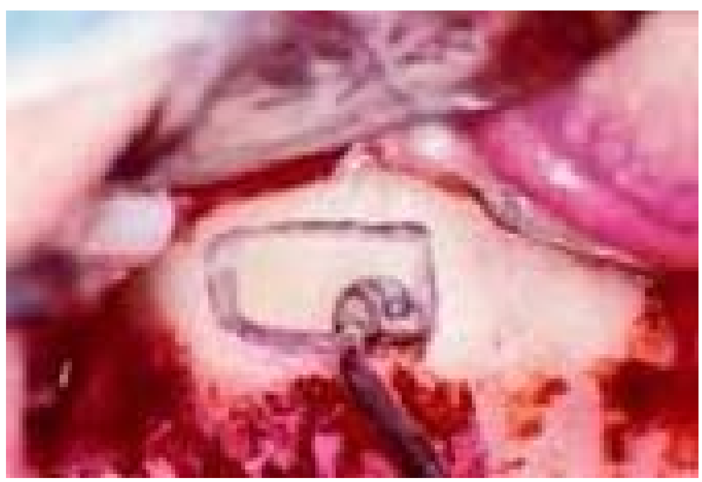
Piezoelectric bony window osteotomy

To open the sinus window, the following surgical procedure is carried out. With the No. 1 scalpel from the Sinus Lift system by Mectron Piezosurgery, an outline is drawn. It begins with the most coronal horizontal incision, with a length of approximately 14 mm positioned approximately 3 mm apical to the residual crestal bone. Two vertical incisions of 6 to 7 mm are made and united at the top by another horizontal incision. The bony window is performed in the area of the second premolar–first molar. The outline is drawn in about 3 minutes, and the average thickness of the cut is approximately 1 mm. This produces a bony window in which the frame is represented by the Schneiderian membrane (sometimes red in colour, sometimes blue). At this point, the osteotomy is completed by rounding the angles of the window.

PBWO made by No. 1 Piezoelectric scalpel. It is possible to observe the Schneiderian membrane, which appears as the frame of the bony window.



Different clinical case. The initial phase of PSME uses the overturned cone compressor.

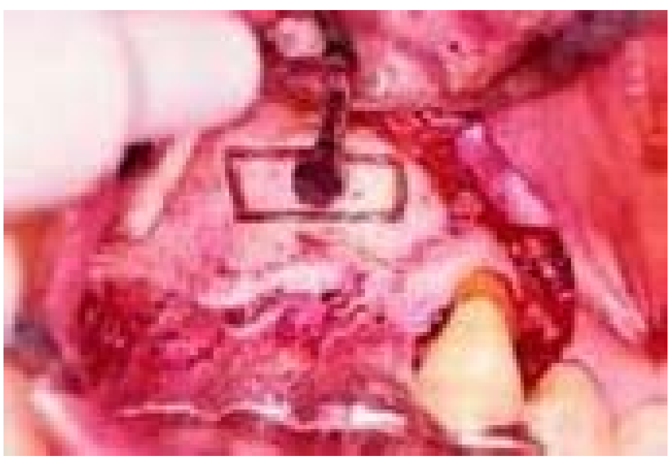


Compressor is inserted into the frame of the window, separating the borders approximately 2 mm

Piezoelectric sinus membrane elevation

The No. 2 insert, a compressor in the shape of an overturned cone, is inserted into the edge of the frame of the membrane exposed by the osteotomy. It separates the borders approximately 2 mm with ease. At this point, the No. 3 insert (an angled periosteal elevator with rounded edges) or the No. 4 (a straight periosteal elevator), depending on the anatomic situation, is used in the following order. The first stage of the membrane elevation begins in the apical position.

PSME phase two: the elevator in position, ready to work.

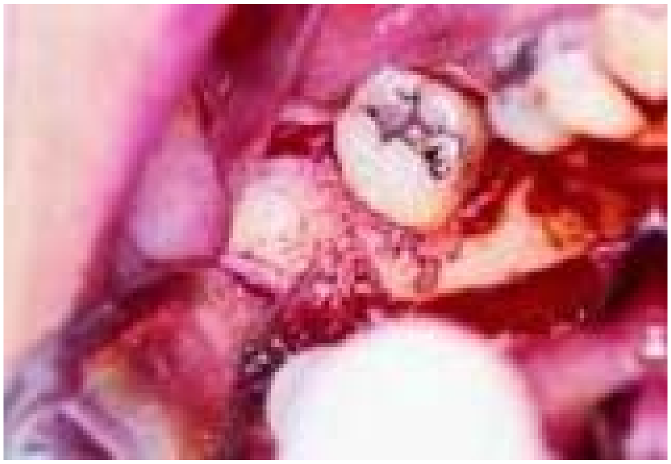


First stage of the membrane elevation begins in the apical position, then in the mesial and distal aspects.

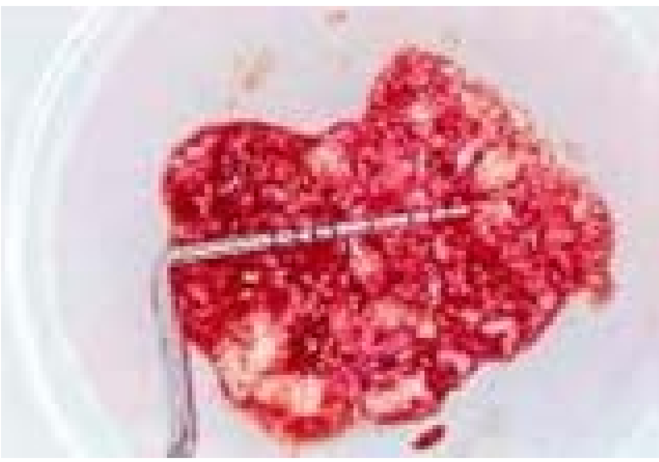
Once the membrane is elevated on three sides, it is possible to separate it from the floor of the sinus, where adhesions are very common, Therefore avoiding the risk of perforation.

The membrane separation in the apical direction depends on the length of the implants that will be placed in the second surgery. The insert is directed toward the mesial surface, separating the membrane until it meets the anterior walls of the sinus. The insert is then directed toward the distal walls, separating the membrane to obtain the volume required for the graft to build the future implant site. Finally, the insert is directed toward the crestal position, where it is possible to meet adhesions, particularly in the depths of the molar depressions. This maneuver is carried out last in a way that allows the separation of the membrane floor without tension, having already separated the membrane from the other sides of the window.

The sinus augmentation procedure is performed using an Autogenous bone graft mixed with Autogenous platelet-rich plasma gel. After the bone graft is performed, and the bioabsorbable membrane is positioned to cover the bony window and fixed to the bone with screws, horizontal mattress sutures are placed. [9]

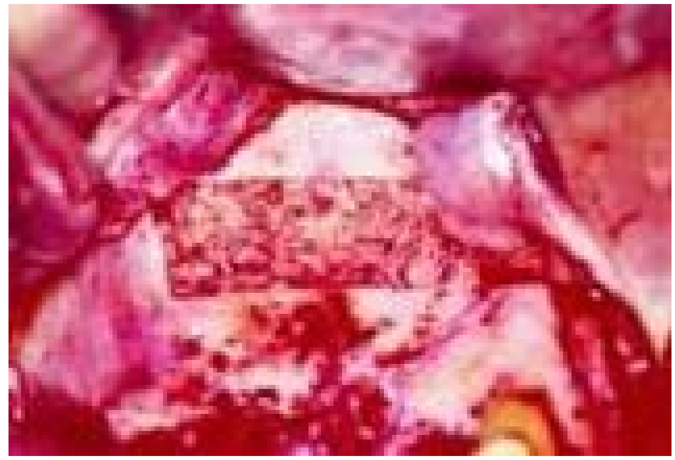


(Left) piezoelectric bone harvesting technique in the Mandible.



(Right) Volume of bone chips is on average 2.5 to 3cm of cortex and Medullary bone.

(Left) Donor site after the completion of the bone harvesting.



(Right) An autologous bone graft mixed with autologous platelet gel fills the sinus cavity.

A simple inexpensive method for precisely locating the floor of the maxillary sinus, as well as the presence of any septa, at the time of sinus augmentation surgery. Using an anaesthesia light wand placed transnasally to illuminate the sinus, the surgeon can reliably elevate the lateral maxillary wall overlying the sinus with relative ease without fear of placing the osteotomy cuts too far from the sinus floor. The same procedure can be used postoperatively to evaluate the density of the bone graft placed into the sinus prior to closure. (10)

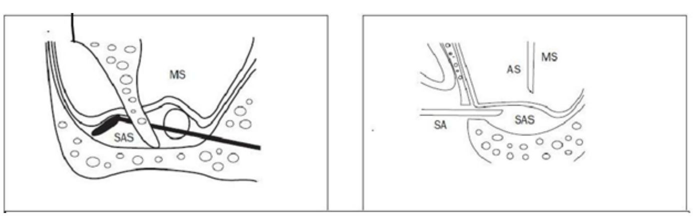
Subantroscopic Laterobasal Sinus Floor Augmentation (Salsa) Technique: 2002

Engelke and Deckwer described a new endoscopically controlled technique for sinus floor augmentation. This technique involves trans alveolar mobilization of the sinus membrane controlled by sinoscopy, trans alveolar augmentation, and simultaneous implant placement and has been indicated for moderately reduced alveolar sites. Engelke and coworkers reported on a modified endoscopic technique, the laterodorsal tunnel technique, which allowed augmentation of multiple maxillary sites via 1 small laterobasal trepanation (unpublished data). Through this approach, a “tenting” of the complete sinus membrane from the premolar to the second molar site could be performed, thus allowing for large augmentations in case of primary and secondary implantation. Both procedures are controlled with the endoscope placed in the lumen of the maxillary sinus via a puncture of the canine fossa.

Surgical procedure

The flap design depends on the number and location of implants planned. Typically, a crestal incision is made with a vestibular relief incision in the first premolar region. A full-thickness mucoperiosteal flap is then elevated, exposing the anterobasal aspect of the sinus wall, including the inferior third of the zygomatic buttress and the alveolar crest with the planned implant sites.

Microsurgical Access: A 5-mm-diameter laterobasal osteotomy is made directly anterior to the zygomatic buttress at the inferior aspect of the anterior sinus wall. The osteotomy is performed with a 4-mm diamond round bur under magnification with the support video endoscope technique.The osseous margin of the trepanation is then identified. The sinus membrane is displaced with the help of microsurgical elevators of 2 to 4 mm in diameter around the trepanation. The bony access is opened just enough to allow the introduction of 4-mm-diameter angulated mucosal elevators into the subantral space. The circular dissection of the sinus membrane is performed under continuous micro – endoscopic observation on a monitor.



Schematic representation of the SALSA technique. (Left) Preparation of the subantral space through the keyhole approach (Panoramic view). (Right) Endoscopic control during SALSA (Cross-sectional view). MS=Maxillary sinus, SAS= Subantral space, AS= Antroscopy, SA=Subantroscopy.

The 2.7-mm endoscope tip and SPS working end

Endoscope with SPS Mounted.

Microsurgical sinus Elevators : type O “dish-knives” for opening.

Microsurgical elevators: type T for tunnel preparation

After circular detachment, the access hole is rounded and extended to a diameter of 5 mm. Its position is always located at the most inferior aspect of the alveolar recess to facilitate the laterobasal tunnelling.

Creation of the SAS: The SAS is created by tunnelling the sinus membrane with elevators of 0-, 45-, and 90-degree angulation under tactile control with the osseous basal floor. Primarily the membrane at the laterobasal angle of the sinus floor is detached in an anteroposterior direction. The detachment ended 5 mm dorsal to the projected most distal implant site. If necessary, the complete sinus floor is tunnelled this way. The tunnel then is extended at its medial and superior aspects.

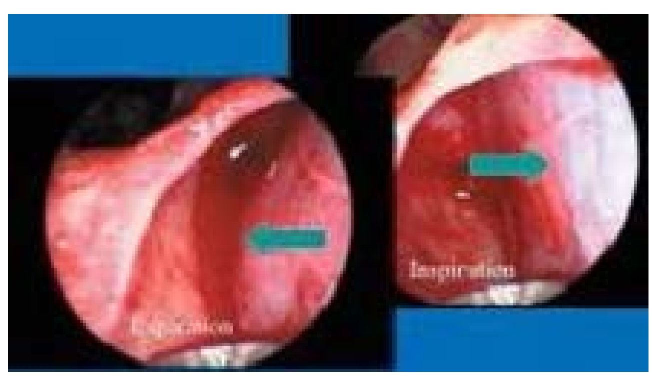
The instruments have to be guided continuously in close contact with the bone to avoid tension or perforation of the sinus membrane, particularly if irregularities of the sinus floor or difficult anatomy are present. In case of septa or irregular shape of the sinus floor, endoscopic exploration helps to lead the elevators along the basal limits of the bony maxillary wall. The tunnel size depends on the height and volume planned for the augmentation and implants. Enough space has to be provided to place the graft material without tension on the sinus membrane.

Endoscopic Control of the SAS

After detachment of the sinus membrane, the subantral space is examined via the access trepanation using the 70- degree and30-degree endoscopes. The examination includes circular identification of the boundaries of the SAS and inspection of the entire sinus membrane forming the roof of the SAS for perforations or tears.

Microsurgical access to the subantral space**.**

Subantroscopic examination of the subantral space. (Left) Normal appearance of the sinus membrane representing the roof of the artificial subantral **space.** (Right) Twist drill (Oraltronics, Bremen, Germany) entering the subantral space.



Sinus membrane examination. During respiration, alternating movement of the sinus membrane is observed, giving evidence of the absence of perforations

Stepwise augmentation. Augmentation material is placed first at the distal and proximal ends of the subantral space and is controlled endoscopically before the periapical Spaces around the implants are filled.

If a perforation of the sinus membrane is detected, immediate repair is performed using polyglactine mesh (Vicryl, Ethicon). Finally, the length, height, and width of the subantral space are measured.

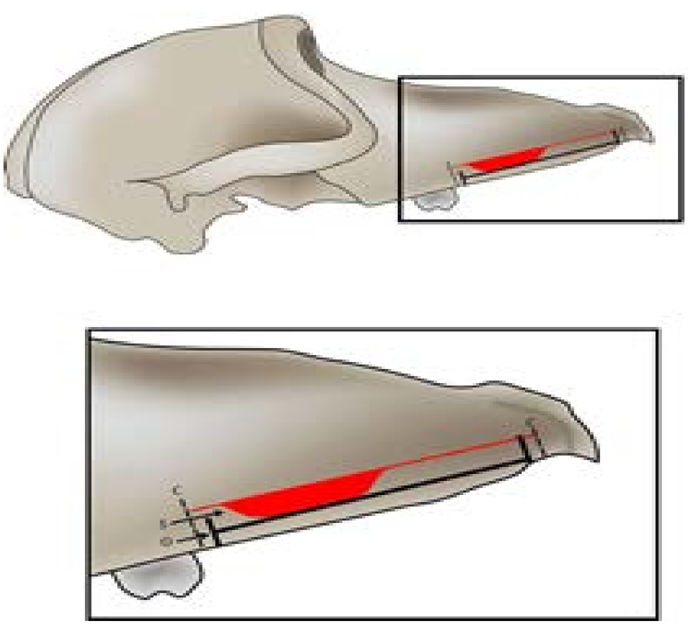
Preparation of Implant Cavities: Primary implant cavity preparation is carried out if primary Stability of the implants could be achieved. Within the subantral space, the sinus membrane is protected with elevators, while the basal bone is perforated with the implant burs. The implant cavity has to be surrounded by at least 5 mm of SAS to allow the membrane to tent up adequately during augmentation.

Endoscopically Controlled Stepwise Augmentation: The first portion of the augmentation is placed at the most distal part of the SAS. The desired “tenting up” of the membrane is checked endoscopically before covering the mesial aspect of the most distal implant with augmentation material. Proceeding from the distal extreme toward the entrance access hole, the inter implant spaces and periapical spaces around the implants are subsequently covered, with intermittent endoscopic control. Before the implant is placed adjacent to the access trepanation, the most mesial (anterior) aspect of the SAS is filled with augmentation material. The entrance keyhole is then covered with a mucoperiosteal flap.

Primary or Secondary Implant Placement: Implants are placed primarily, if primary Stability could be achieved. In the absence of primary Stability or if the bone structure is obviously insufficient, secondary placement is carried out after at least 6 months of healing time. (11). From October 1999 to December 2000, of 92 sinus floor elevations, 18 were carried out endoscopically controlled with an osteotome technique. As augmentation material, -tricalcium phosphate (-TCP) or autogenous bone was used; 22 implants were placed. With the ECOSFE, (Endoscopically controlled osteotome sinus floor elevation) perforations of the sinus membrane can be visualized; however, they cannot be avoided. Although this technique is less invasive than the lateral window technique, it cannot be recommended as a standard procedure in the posterior maxilla because of the large amount of additional equipment needed and the technically demanding procedure. (12). Sinus floor augmentation has become a routine procedure with predictable results. Flapless implant placement is recommended for a series of indications with sufficient bone volume. Flapless surgery in the atrophic maxilla is presented as a refinement of the endoscopic Subantroscopic laterobasal sinus floor augmentation (SALSA) technique. Subantral space is augmented using the SALSA technique without raising a mucoperiosteal flap. Implants are placed transgingivally without raising a mucoperiosteal flap, with endoscopic control of the cover screw at the bone level. In a case series of 6 patients, 21 implants were placed and augmented simultaneously. The mean augmentation height was 10.7 mm (range, 5.7 to 16.6 mm); the mean residual bone height was 5.1 mm (range, 1.9 to 12.1 mm). Complications such as insufficient primary Stability and sinus membrane perforation were treated without changing to an open surgical approach. (13).

Boyne's distraction osteogenesis technique

2004 Distraction osteogenesis is a biomechanical process of bone tissue formation, where the distraction forces which act between the bone segments affect the biological potential of the bone by forming a callus of determined length and height. Distraction osteogenesis is preceded by Corticortomy or sub-periosteal osteotomy and followed by fixation of the distractor on the segments and their gradual lengthening. Codvilla, in 1905 was the first to perform extremity lengthening by the application of external traction. The credit for popularizing the technique worldwide goes to Gavril Ilizarov, a Russian orthopaedic surgeon. In the late 1980s he published in America for the first time his research and clinical results on the bone distraction, causing a wave of developments in the bone distraction technique worldwide. Snyder et al., 1973 were the first to apply the Ilizarov principles of distraction osteogenesis is for the regeneration of the osteotomized mandible. (17).



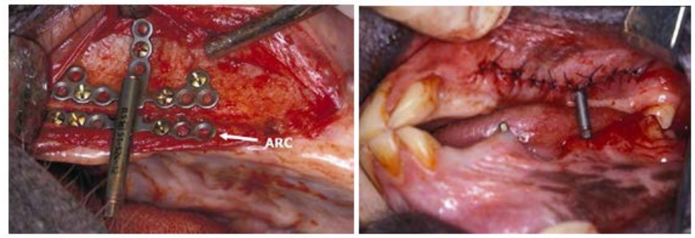
A diagrammatic representation of a Papio anubis dry specimen skull outlining the area of the osteotomy (O) for the DO in the maxillary canine, molar, and premolar region. (The outline of the maxillary sinus is shown) (S). (C) indicates areas of vertical cuts made to obtain biopsies for control maxillary alveolar bone to compare with the DO regenerated area. (Bottom) A higher power view of the surgical site is shown.

In 2004 Boyne PJ et al have applied this distraction osteogenesis technique to increase height of the maxillary sinus floor. In this animal study the posterior maxilla's of 3 adult Papio Anubis baboons are rendered edentulous from the lateral incisors anteriorly, to the third molars posteriorly; and alveolectomies are performed to simulate post-extraction alveolar ridge atrophy. After 12 weeks of uneventful healing, osteotomies are performed bilaterally in the edentulous areas with the horizontal section extending from the lateral incisor area to within 5 mm of the mesial surface of the retained and fully erupted third molar tooth. The superior extent of the osteotomy section is located at the level of the sinus and nasal floors in the midposterior portion of the bony section. The location of the horizontal osteotomy for the DO is calibrated by making a small 3 mm osteotomy opening in the lateral wall of the nose and sinus. A periodontal probe is inserted between the nasal-antral membrane and the bony wall of the nasal sinus and extended down to the osseous floor. By this method of measurement, it is possible to determine how much bone remained between the sinus floor and the alveolar crest so that the osteotomy cut could be made according to the design of the study. The osteotomy cut is made to leave anteriorly and posteriorly approximately 1 to 1.5 mm of alveolar bone height to accept the screws for the distractor plate. The midposterior portion of the osteotomy is fashioned to actually interdict the floor of the antrum for a distance of approximately 8 to 10 mm in antral floor.

Intraoperative view of the Surgical site

A view of a small osteotomy (SO) made in the lateral wall of the maxilla and the insertion of a measuring probe by which it is possible to determine the height of the nasal and antral osseous floor remaining in the maxilla. By this method, it is possible to direct the periapical maxillary osteotomy section (arrow) to interdict the floor of the antrum in the mid posterior portion of the osteotomy cut. The nasal and antral mucosa was elevated from the inferior portion of the sinuses by a small curette placed Through this osteotomy opening. Note the thin Alveolar ridge crest (ARC).

Fixation of the base plate portion of the DO device is obtained by placing the screws superior to the sinus floor into the lateral antral-nasal wall. The transport segment of the device containing the residual crest of the alveolar ridge is only 1 to 1.5 mm in height, which is minimally sufficient to accept the screws of the transport portion of the DO device. After a latency period of 7 days, the distractor (12 mm; KLS Martin, Jacksonville, FL) is activated at the rate of 1mm per day for 10 days. The postoperative course is uneventful. [18].



A view of the positioning of the distractor which is being guided by the marking probe in the sinus wall. The screws securing the inferior transport segment are engaging the thin alveolar crest which measures only 1 to 2 mm in height below the osteotomy. The thinness of the alveolar crest (transport segment) (ARC) and the attachment of the base plate at the lateral maxillary wall are visualized.

Complications

Complications may be encountered during and after maxillary sinus elevation procedures. Surgical procedures involving bone grafting and implants in the maxillary sinus have potential complications that can be specific or non-specific for these procedures. For the sinus graft, perforations of the Schneiderian membrane are the main intraoperative complication, which occurs in 7% to 35% of the procedures. Postoperative complications are less common and consist mostly of acute or chronic sinus infection, bleeding, wound dehiscence, exposure of barrier membrane and graft loss. Intraoperative complications may lead to post-operative complications. Surgical complications did not significantly influence implant survival. When performing sinus augmentation, bone substitute materials are just as effective as autologous bone, whether used alone or in combination with autologous bone. Implant surface treatments can have an important effect on implant survival, and it would appear that roughened surfaces are the best option. When implants are inserted simultaneously to grafting, a higher failure rate can be expected. In 100% of cases, the AAA (Alveolar antral artery) was found to be partially intra-osseous, that is, between the Schneiderian membrane and the lateral bony wall of the sinus, in the area selected for sinus antrostomy. Hence a sound knowledge of the maxillary sinus vascular anatomy and its careful analysis by CT scan is essential to prevent complications during surgical interventions involving this region.

Conclusion

An inadequate bone quantity and quality have been considered for many years as absolute contraindications for implant-supported rehabilitation. The risk of implant failure in the posterior maxilla is generally high because of the low bone density and the progressive ridge resorption caused by edentulism. Implant treatment in the atrophic posterior maxilla must be carefully planned and may require a pre-prosthetic surgical intervention of bone grafting. Maxillary sinus floor augmentation is often performed to create conditions adequate for implant placement. The implant success rate and the predictability of the maxillary sinus augmentation procedure depend on numerous factors. However, because of the improvement of surgical techniques and the progress of research in the field of biomaterials, excellent outcomes have been reported in the last years. Recent systematic reviews of the literature have demonstrated that sinus floor augmentation procedure is well documented with an overall implant survival rate well beyond 90%.

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