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SINUS LIFT AND RIDGE AUGMENTATION-AN OVERVIEW

Maxillofacial Surgery

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ABSTRACT

As far back as the eighteenth century, successful sinus surgeries were performed using calcium sulfate as the graft material.9 In 1893, an American physician George Caldwell and French laryngologist Henry Luc accessed the maxillary sinus by creating a lateral window, providing access to lift the sinus membrane. Hilt Tatum in 1975 introduced a technique to increase alveolar bone height that placed graft material under the maxillary sinus membrane before placing implants.10 In 1980, Boyne and James, using the Caldwell-Luc procedure, grafted autogenous bone between the sinus membrane and antral floor.11 This article explains need of ridge augmentation in sinus lift procedures.

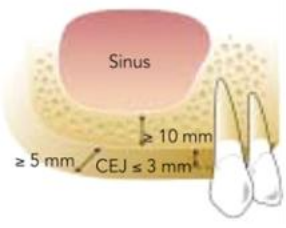
KEYWORDS

Sinus Lift,ridge Augmentation,balloon Elevation,trephine Core Elevation

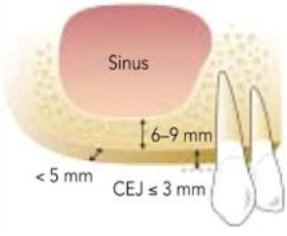
INTRODUCTION

The atrophic edentulous posterior maxilla often poses problems for implant placement. Following loss of teeth, there is a gradual loss of alveolar bone, and in many patients the sinus floor dips close to the alveolar ridge, leaving less than optimal bone height or width for placing implants. In some patients, the loss of alveolar bone coupled with increased antral pneumatization may result in only 2 to 3 mm thickness of alveolar bone height. The result is insufficient bone to place implants.1 It is for these patients that the sinus-lift procedures represent a treatment of choice. Sinus-lift subantral augmentation has produced excellent results with few complications.2,3 Autogenous bone alone or in combination with particulate allografts, xenografts, or alloplasts have provided excellent results.4 More recently, to reduce donor site morbidity, increased blood loss, operative time, and postoperative complications allografts, xenografts, and/or alloplasts alone, or in combinations, are used as the graft of choice and without the addition of autogenous bone.5 The grafts are combined with the patient's blood, plateletrich plasma, bone marrow aspirate, aqueous antibiotics, or sterile saline.6 In some cases, depending on the volume of alveolar bone, simultaneous sinus-lift subantral augmentation and implant placement can be accomplished for the patient.7,8 .

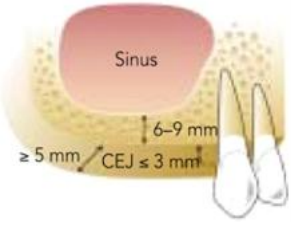
ABC sinus augmentation classification. 47



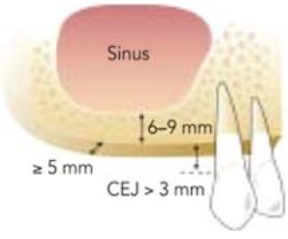
Sinus Class A



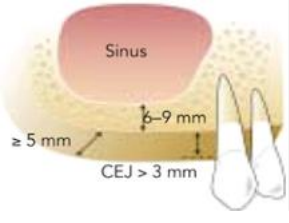
Sinus Class B



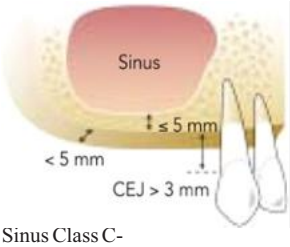
Sinus Class B-h



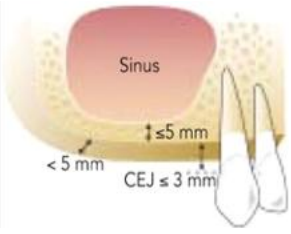
Sinus Class B-v



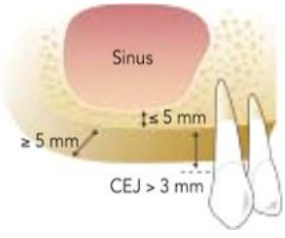
Sinus Class B-c



Sinus Class C-v



Sinus Class C-



Sinus Class C-c

Sinus lift surgery indications 12
Indications of sinus lift surgery include

- Oro-antral fistula treatment
- Reconstruction of palate clefts
- Interpositional graft with Le Fort I fractures
- Less than 10 mm alveolar residual bone height
- Less than 4 mm residual bone width
- No history of any pathology
- In the past, a major sinus disease has not been passed.

Sinus lift surgery contraindications
Local contraindications of sinus lift surgery

- Maxillary sinus infections and pathological lesions
- Chronic sinusitis
- Alveolar scar possibility
- Odontogenic infections
- Allergic rhinitis
- The presence of an irregular alveolar crest

General contraindications of sinus lift surgery:

- High doses of radiation in the head and neck region
- Sepsis
- Advanced medical conditions
- Uncontrolled systemic disturbances
- Excessive smoking, alcohol or substance consumption
- Psychological problems.

Sinus lift surgery procedure
Sinus lift surgery can be entered from four different regions to the sinus area
1. Superior-lateral wall (Caldwell-Luc): Entry from the anterior of the zygomatic arch.

2. Mid-lateral wall: Entered between alveolar crest and zygomatic arch.
3. Inferior-lateral wall: It is entered from alveolar crest level (Lateral window technique/external lifting)
4. Krestal osteotomy (closed technique/internal lifting

COMPLICATIONS OF SINUS LIFT SURGERY.20,14-17,19-21
DEHISCENCE OF THE INCISION
A vestibular horizontal buccolabial incision should be avoided. The blood supply in the vestibule is diminished when compared with alveolar crest–attached keratinized tissue. Suturing in this area is also more diffi cult.25 In addition, flanges of an appliance must be reduced because they impinge on the vestibule and push the incision apart.26

DELAYED HEALING—SMOKING Smokers are at greater risk for postoperative infection and wound breakdown.27-31

SWELLING AND ECCHYMOSIS Tearing of the periosteum will increase postoperative swelling and ecchymosis. Further, rents in the periosteum permit fibrovascular invasion into the graft.

SMALL MEMBRANE TEARS
Small membrane tears can be repaired with coverage of a resorbable collagen wound dressing. The membrane can be soaked with an aqueous antibiotic solution or platelet-rich plasma. Excess fluid is squeezed out of the membrane, and it is shaped to fit under the tear. It is important to elevate the schneiderian membrane to expose the bony medial wall of the antrum before placing the collagen membrane.

LARGER MEMBRANE TEARS
At times the membrane is very fragile and easily torn, exposing the entire antral cavity. The surgery proceeds with elevating the membrane and exposing the medial wall of the sinus. A GBR collagen membrane of sufficient size to cover the defect is soaked with an aqueous antibiotic and/or plateletrich plasma. It is then secured to the facial aspect of the buccal wall with transosseous sutures or bone tacks. The membrane is pressed inward with its margin against the medial wall. A collagen wound dressing is prepared and placed under the GBR membrane. Caution is observed when placing the graft material to neither overpack the cavity nor overly compress the graft material in a superior direction.

ANTRAL SEPTUM
Bony septum may be part of normal sinus anatomy.32 One option is to view the sinus as two compartments. A vertical bone cut is made through buccal bone over the septum . The membrane is elevated as described, but with two compartments . Another alternative is to cut the septum at its base, tearing the membrane. Continued elevation of the membrane exposes the medial wall. The tear is patched with either a collagen wound dressing or GBR membrane.

INFECTIONS
A subperiosteal infection at the incision or under the mucoperiosteum is first treated with antibiotics, and incision and drainage. Persistent infection requires elevation of the mucoperiosteal flap, débridement, curettage, and copious irrigation. If the graft material is not infected, a 7- to 10-day course of antibiotics is prescribed. When the graft material shows signs and symptoms of infection, purulent exudate, a high temperature, and/or fetid oris, the graft material must be removed. The exudate is sent for culture and sensitivity. Following complete removal of the graft, the cavity is copiously irrigated. Antibiotics are prescribed for 2 to 3 weeks, and the patient is kept under observation.

TREPHINE CORE MEMBRANE ELEVATION.32
The trephine bone core sinus elevation technique can be done at multiple sites to add 4 to 8 mm of bone height in preparation for placing implants. It is especially indicated when teeth are adjacent to the edentulous site.33 A minimum of 6 mm of alveolar bone is necessary for this technique. When less than 6 mm of bone remains between the alveolar crest and the floor of the sinus, the patient is best treated with the buccal quadrilateral osteotomy approach or the balloon sinus membrane elevation technique. The incision is made on the palatal aspect between adjacent teeth . The mucoperiosteal flap is reflected over crestal bone. Rarely a buccal vertical relaxing incision is needed for exposure. A trephine drill of appropriate diameter (Ace Surgical Supply, G. Hartzell & Son, and Salvin Instrument Supply) is positioned on the alveolar crest. A minimum of 2 mm of bone must remain circumferentially between the trephine and buccal-palatal bone and between adjacent teeth.

The trephine is drilled with copious irrigation through the alveolar crest to the floor of the sinus . This separates the bone core from the alveolus. The trephine is removed, and the bone core is intruded into the sinus, lifting the membrane. A minimum of one-half to one-third of the bone core must remain in contact with alveolar bone. This distance can be measured with a periodontal probe. When the bone core remains within the trephine, it is removed and placed into the osteotomy site. The surgically produced crestal five-wall defect is grafted with only enough allogeneic, xenograft, or alloplast material to loosely fill the defect. The intact mucoperiosteal flap covers the graft site and is sutured. Overpacking the defect pushes the bone core into the sinus. When this occurs, it cannot be retrieved and remains until it is resorbed. The resultant oral-antral defect is treated by placing a collagen hemostatic wound dressing into the defect and grafting the oral-antral osseous defect before repositioning the mucoperiosteal flap and suturing. After 4 to 6months of healing, the site can be treated with a conventional sinus-lift elevation technique. Postoperative healing is uneventful, and only mild analgesics are needed for relief of discomfort. After 4 to 6 months of healing, the site can be prepared for implant placement.

BALLOON ELEVATION.33
The antral membrane balloon elevation (AMBE) technique, introduced by Soltan and Smiler,34 is especially useful when teeth are adjacent to the edentulous region. There is limited reflection of the mucoperiosteal flap, and this procedure elevates the membrane to the medial wall of the antrum. The AMBE technique is indicated when there is moderate to severe resorption of the posteriormaxilla and deficient bone height for implant placement. Local anesthesia is obtained with infiltration of the buccal and palatal tissues. The incision can be midcrestal or more palatal. The mucoperiosteal flap is reflected to expose the buccal wall of the edentulous region. A vertical relaxing incision extending into the vestibule may be necessary for sufficient exposure.

A limited buccal osteotomy begins slightly above the sinus floor. The osteotomy is performed with copious irrigation with a large round bur, trephine drill, or piezosurgery saws. The integrity of the sinus membrane is preserved, and dissection begins at the bottom of the osteotomy. Freer elevators or large spoon elevators lift the membrane slightly from the sinus floor, and dissection progresses toward the medial wall of the sinus. The balloon is checked for leaks by inflation with 3 to 4 cc of sterile saline. The empty balloon is placed against the sinus floor midway between the lateral and medial walls. The balloon is slowly expanded with 1.5 to 2.0 cc of sterile saline, and the membrane is elevated.The balloon is emptied and withdrawn, leaving a cavity bordered by the reflected membrane and attached buccal bone, the medial wall of the sinus, and the nonreflected membrane. With loose compaction, the bone graft material is placed under the membrane . The mucoperiosteal flap is repositioned and sutured.

An alternative approach is developing the buccal osteotomy to the step of slight elevation of the membrane from the sinus floor. Sequential drilling prepares the final implant diameter and perforates through the bony sinus floor, but does not perforate the sinus membraneThe balloon is inserted through the implant receptor site and inflated. Graft material is placed through the implant receptor site and is observed from the buccal window . The implant is placed, and the mucoperiosteal flap is repositioned and sutured . Alternatively, before placing the balloon, the implant receptor site diameter is prepared to the floor of the sinus via the flapless surgical approach. If there is concern about a perforation of the sinus membrane, a resorbable collagen dressing or collagen capsule is positioned through the crestal implant receptor site under the membrane before depositing the graft and placing the implant. The balloon is inserted through the implant receptor site and inflated. The graft material is placed through the implant receptor site, and the implant is placed .

GRAFT MATERIALS
Graft materials to reconstitute the antral floor before placing implants may or may not include autogenous bone.35,36,37 However, the graft scaffold should mimic the extracellular. matrix of autogenous bone.38 It must be nontoxic, biocompatible, and biodegradable at a rate that is compatible with bone remodeling without lowering the pH of surrounding tissues; have a microporous structure of a geometry that promotes angiogenesis and capillary ingrowth; and be easily integrated into new bone.39,40 The ultimate success of the bone graft depends on the presence of cells and in particular osteoblasts.41

Osteoblasts and other precursor stem cells found within bone marrow promote osteogenesis.42-45 Bone graft success can be increased when marrow is incorporated into the graft scaffold.46

BONE MARROW ASPIRATE.11,34,40-42,44

Bone marrow aspiration from the anterior iliac crest is virtually free of complications. Smiler and Soltan describe the rationale and technique of combining extracted bone marrow with the graft matrix.The technique is an outpatient procedure with local anesthesia, with or without intravenous sedation or general anesthesia. The procedure continues with the insertion of the aspirating needle. With a twisting motion, the needle is through the skin, subcutaneous tissue, and down to and through the cortical bone into the marrow cavity. After removing the obturator and/or stylet, 2 to 4 cc of bone marrow is aspirated. After pressure over the site continues for about 5 minutes , an adhesive bandage is placed.

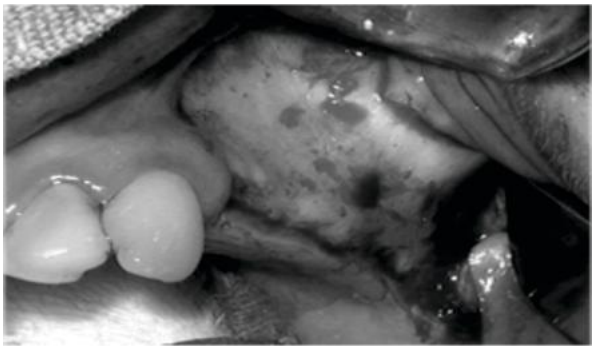


Figure 1:Incision and mucoperiosteal flap reflection

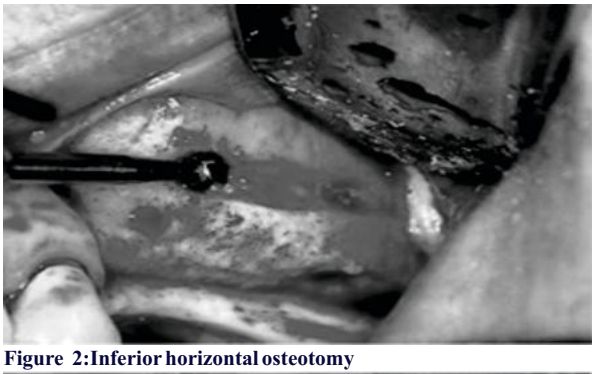


Figure 2:Inferior horizontal osteotomy

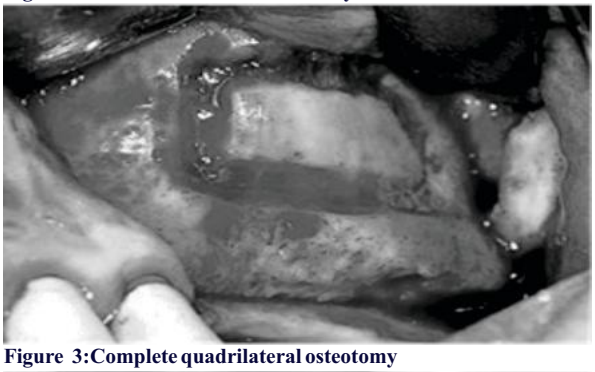


Figure 3:Complete quadrilateral osteotomy

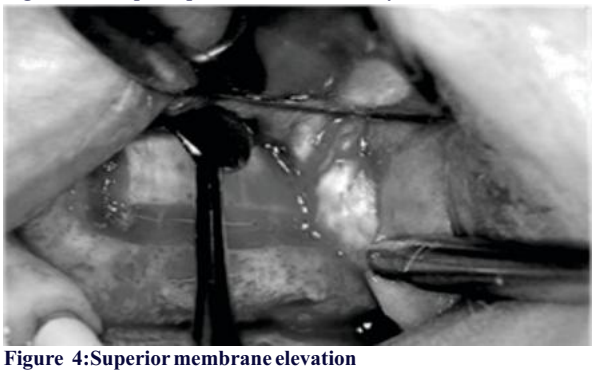


Figure 4:Superior membrane elevation

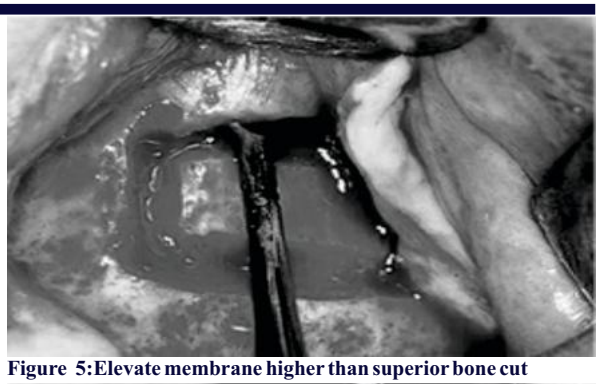


Figure 5:Elevate membrane higher than superior bone cut

Figure 6:Sharp border of elevator on bone.

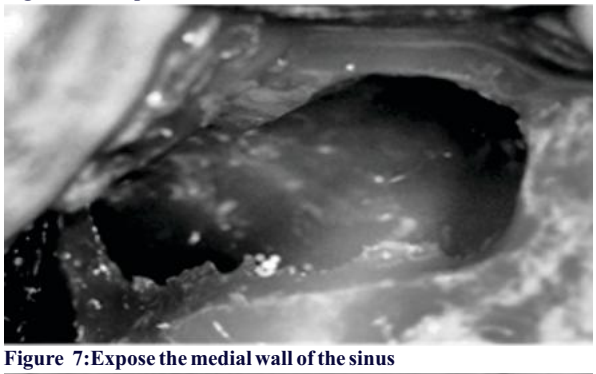


Figure 7:Expose the medial wall of the sinus

Figure 8:Smooth foot insert for piezosurgery to lift membrane

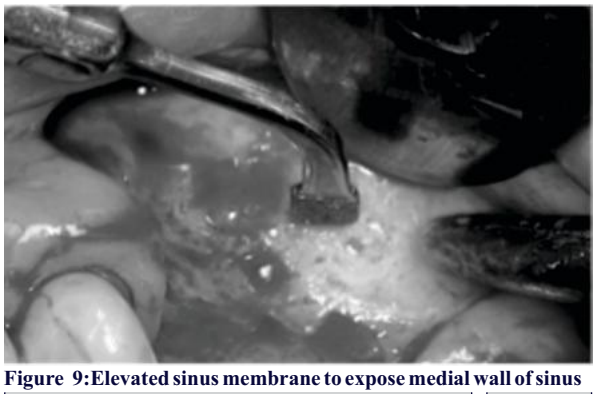


Figure 9:Elevated sinus membrane to expose medial wall of sinus

Figure 10:Graft placed under sinus membrane

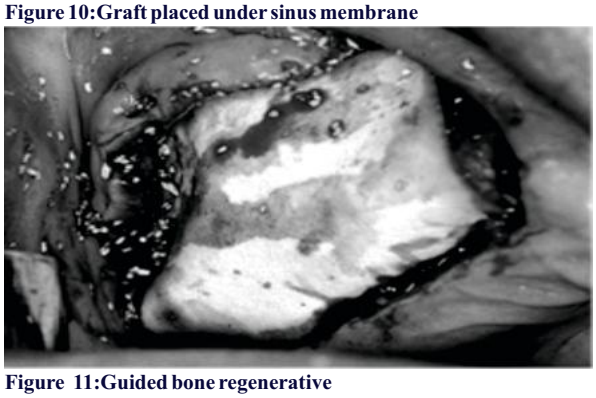


Figure 11:Guided bone regenerative

Figure 12:Small tear of the sinus membrane membrane over buccal window

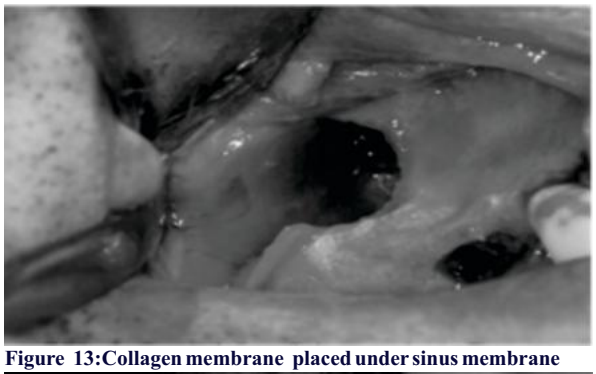


Figure 13:Collagen membrane placed under sinus membrane

Figure 14:Bone tacks stabilize membrane

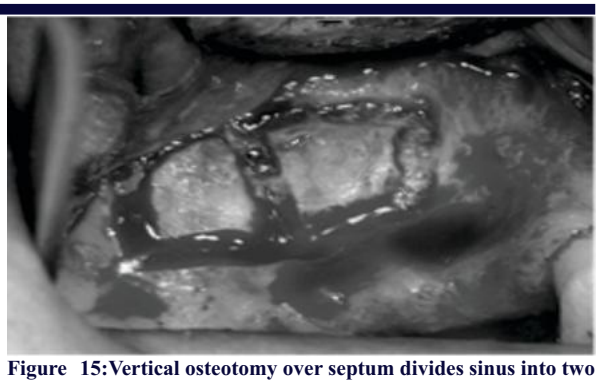


Figure 15:Vertical osteotomy over septum divides sinus into two cavities.

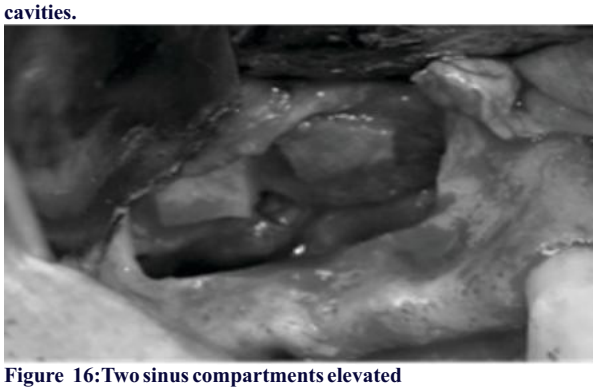


Figure 16:Two sinus compartments elevated

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