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Maxillary Sinus Floor Elevation for Dental Implants: A Literature Review on Techniques, Complications and Management

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ABSTRACT
Maxillary sinus floor elevation is a successful technique for augmentation of posterior edentulous maxilla. However, Due to maxillary sinus pneumatization, placing implants in posterior edentulous maxilla is often a difficult procedure in implant dentistry. This literature search enumerates on several quality publications that provide evidence for the available treatments and the expected rise in bone height following sinus lift surgery. This literature review explains sinus lift techniques, their complications and management.
KEYWORDS: Sinus lift, implant, osteotome, Schneiderian membrane

I. INTRODUCTION

The largest paranasal sinus is the maxillary sinus, also called the Antrum of Highmore. It is pyramidal in shape with dimensions of approximately 2.5 cm in width, 3.75 cm in height, and 3 cm depth.[1]With fixed prostheses in edentulous posterior maxilla, dental implants have completely changed oral rehabilitation.[2]When teeth are extracted in posterior maxilla it can lead to progressive resorption of alveolar bone,as a result of natural bone remodelling that occurs after tooth loss and also due to sinus cavity pneumatization towards the alveolar crest.[3] These two factors are the key challenge for the implant placement leading to the development of technique known as “sinus lift procedure”.Different terms, including "sinus lift," "sinus augmentation," "sinus floor elevation," and "augmentation of an atrophic maxillary sinus," have been used to describe the technique in the literature. This classic technique was first proposed in 1970s by Tatum.[4]In maxillary sinus lifting procedures, a variety of different biomaterials have been utilised as bone replacement grafts, ranging from autologous bone taken from the iliac crest, mandibular ramus, or other intraoral sites to the use of synthetic bone substitutes, synthetic biomaterials, or combinations of these.[5] This purpose of this article is to enumerate various clinical presentations, its clinical techniques, complications and their management.To resolve the difficulty in designing a sinus lift operation for dental implants, a literature search was conducted across several databases with an emphasis on clinical trials, meta-analysis and systematic reviews.

SURGICAL TECHNIQUES

A successful and reliable method for augmenting the posterior maxilla with insufficient crestal bone is the maxillary sinus lift procedure.Depending on the patient's anatomy and the physician's own preferences, a surgeon may choose to elevate and enhance the maxillary sinuses of a particular patient. Remaining bone height and desired lift are two anatomical considerations specific to the patient.[6]There are two main techniques for sinus floor elevation: lateral window and crestal osteotome technique. However, modifications and advancements in this clinical procedure has been published by several authors.[7]

Lateral window /direct technique

When residual alveolar bone height is 5mm or below, this technique is considered.

Instrumentation

The osteotomy through which the sinus floor is accessible is most frequently made using these instruments.

- Typically, round burs (1.4-2.3 mm) are used to delineate the lateral window's contour.
- Large diameter diamond burs (fi ne grit) would carry a lower risk of membrane perforation
- An antrostomy could be made by carving into the anterior sinus wall using bone scrapers.

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- Sinus lift curettes are frequently employed to elevate, detach, and reflect the Schneiderian membrane from the maxillary bone.

Procedure in lateral window technique

Subperiosteal, posterior superior alveolar and greater palatine nerve block are used in combination to provide adequate local anaesthesia.[8]Typically, a local anaesthetic with epinephrine (lidocaine, articaine) is administered.The flap design depends on various factors which includes edentulous ridge, whether complete or partial, Adjacent crown restorations, the maxillary sinus shape and size, the need for simultaneous or delayed implant placement, are all factors to consider. Soft-tissue incisions must allow enough space for the lateral window to be created.The anterior vertical incision should be at least 10-15 mm anterior to the sinus wall. A crestal incision with 15C blade along with a vertical mesial and distal releasing incision should be placed, which allows the elevation of flaps to visualise the lateral bone wall of sinus.[9]In order to avoid the infraorbital plexus, the releasing incision is frequently done immediately posterior to the canine tooth, which in most dentated cases was the posterior surviving tooth. To access the canine fossa, buttress of the zygomatic arch, and posterior lateral maxillary wall, a full-thickness flap is reflected.The dimensions and position of the maxillary sinus decide where the antrostomy should be placed. The height of the graft, length of the implant to be used, and position of the posterior superior alveolar artery will all affect the window's coronal outline.The osteotomy is created in the lateral wall using high speed handpiece to access the Schneiderian membrane.The window is usually oval in shape with no sharp edges. The chance of perforating the membrane will be significantly decreased by utilising a piezoelectric tip during preparation of the bony window.[10] For direct access to the various sinus walls, blunt instruments, broad-based freers, and curettes with various angulations are used to elevate the sinus membrane.With a short curette, membrane elevation is typically started at the edges, increased gradually from the superior border of the osteotomy, and then moved about 2-3 mm mesially, towards the mesio-superior line angle and along the mesial part of the window, causing a portion of the sinus membrane to separate from the alveolar bone.The sinus membrane is detached and elevated till the medial wall to create adequate space for the graft material to be placed.By asking the patient to take a deep breath in and seeing the membrane lift, the integrity of the sinus membrane may be checked.After that, the previously acquired graft material is positioned and packed.With the aid of instruments like pluggers, periosteal elevators, or even osteotomes, the grafting material should be forced through the window in all directions, mesially and distally. The opening of the sinus should be covered with a collagen membrane.[11]Numerous researchers reported success with the application of barrier membranes over lateral walls, and they found a tendency for better bone formation and fewer implant failures.To maintain hemostasis and stop bone exposure due to primary intention healing, suturing method should ensure appropriate flap closure without strain. Horizontal mattress method and monofilament material is used to suture the flap.The main disadvantage of lateral antrostomy is that it necessitates the elevation of a substantial flap for surgical access.

Comparison of One-Stage Versus Two-Stage sinus lift

Regarding the timing of dental implant placement, two general procedures in sinus lift techniques could be taken into account.A “two-stage” technique using a lateral window approach, followed by implant placement after a healing period of 4–10 months and a “one-stage” technique with a simultaneous implant placement which was suggested by Tatum[4]. Two-staged technique is required when basal bone is not enough to provide primary stability for implant and should only be inserted after the space under the sinus lifting has been regenerated with mature bone. Hence, one-stage sinuslift is more technique-dependent, and the outcome of the procedure mostly depends on the quantity of residual bone height.Since the grafted site is well mineralized, a staged approach makes it simple to achieve the initial stability. But because it takes at least 5 months for the graft to heal before implants can be inserted, the procedure takes longer and the patients are displeased.

OTHER VARIATIONS

Torella's suggested ultrasonic ostectomy to get access and to minimise perforation of sinus.The surgical procedure entails elevating a full thickness flap, and access to the cavity is supplied by an ultrasonic ostectomy with the generator's tip situated perpendicular to the osseous level and withsterile irrigation.[44] Once ostectomy is completed, an instrument is used to dislocate sinus window.The osseous window and Schneiderian membrane are separated from the sinus floor, creating an empty region where an implant can be inserted and graft is placed.

As an alternative to the mechanical instruments used in traditional oral surgery, piezoelectric surgery is a hard tissue surgical application using a versatile high-end ultrasonic device that was originally created for the atraumatic cutting of bone by use of ultrasonic vibrations.In the past two decades, a growing body of research has demonstrated that piezoelectric devices have enormous benefitsas cutting-edge instruments for sinus elevation surgery.Vercelloti proposed piezoelectric osteotomy for sinus floor elevation surgery which was performed in 21 patients.Osteotomies was performed using mectron piezo surgery system.[45] First phase of procedure involves flap elevation, creating a bony window with scalpel and elevation done using cone shaped compressor tip. Second phase involves elevating the sinus membrane in apical, mesial and distal aspect. Platelet rich plasma with autogenous bone graft material was used. The main advantage of this technique is that the surgical instruments in piezoelectric surgery has power 3 times higher than normal instruments. Hence, can be used to cut highly mineralised bone.Reduced membrane perforation rate, enhanced intraoperative vision, less intraoperative haemorrhage, and decreased surgical trauma are the advantages of this technique.

One technique which is minimally invasive for sinus lift is by using a trephine which was described by emtiaz et al.[46] A crestal incision is made from the tuberosity area to anterior border of sinus in the alveolar ridge followed by a buccal vertical incision anterior to planned surgical site. After flap elevation, trephine which is perpendicular to lateral wall is used on an implant handpiece abundant irrigation to make a round bone cut 4 to 5 mm above the crest of alveolar ridge. The outer bony cortex is removed. The exposed membrane is lifted from the sinus floor. The bony window and mucoperiosteal flap are repositioned and sutured.The advantage is that, smaller or bigger preparations with different sized trephines are possible depending on the size and structure of the sinus.

Other variations apart from instruments which is used to perform surgery has also been described in literature. First technique is hinge osteotomy where the lateral wall of the maxilla has a hinge-shaped bony rectangle that close to the malar buttress.The Schneiderian membrane and this bony rectangle are punched inward so that they can function as a new sinus floor that is fortified with graft material. When there is distorted anatomy of lateral wall of maxilla, elevated osteotomy can be advocated.The hinge is replaced with an uninterrupted bone cut along the quadrilateral's superior horizontal side which leads to Schneiderian membrane elevation.

Crestal osteotome/indirect technique

This less invasive technique also known as trans alveolar approach was introduced by Tatum in 1976 and modified by summersin 1994, utilising tapered osteotomes with large diameters.[12] This technique is indicated when the residual alveolar bone height is equal to or >5mm.[13]The primary distinction between this procedure and the lateral window technique is the use of osteotomes to elevate the sinus membrane through the crestal bone, and the direct insertion of implants into the locations that these standardised instruments have previously prepared.

Procedure in crestal osteotome technique

Local anaesthesia is administered in the implant site and flap is raised to expose the osteotomy area. The crestal portion of the alveolar ridge is exposed by a midcrestal incision where buccal and palatal mucoperiosteal flaps are reflected in a full-thickness approach. The implant sites are marked with a 2.0 mm round drill and then prepared with a drill to a depth of 0.5–1.5 mm from the sinus floor. The preparation region is subsequently expanded using the osteotomes, leading to the first sinus up-fracture.Numerous concave-tipped tapered osteotomes of increasing diameters are inserted through the edentulous alveolar crest at the inferior border of the maxillary sinus floor to expand the osteotomy sites.Bone is compressed, pushed laterally and apically with each larger osteotome insertion, forcing the gathered bone apically behind the tented membrane.With the final osteotome, the cortical plate of the sinus floor is punched out along with the adherent sinus membrane to create the sinus floor fracture.

OTHER VARIATIONS

Summers modified the original Osteotome sinus lift operation with the addition of a bone graft material, known as theBone-Added Osteotome Sinus Floor elevation, since he believed it to be more conservative and minimally invasive than the lateral approach.[47]A blunt force is produced over an extended region that is bigger than the osteotome tip by pressure on the graft material and trapped fluids exerting hydraulic pressure on the sinus membrane.By avoiding the direct application of a hard surgical instrument, the sinus membrane is less likely to rip due to the fluid pressure's consistency.

The use of osteotomes in accordance with summers technique would be seen as hazardous for the patient if the sub-sinus bone quality was dense and there was no need to further improve it.For this purpose, in 1996, a new sequence of surgery based on the combined use of osteotomes, drills, and screw-type implants with a rough surface texture was proposed by Davarpanah.[48]While the site preparation begins with a 2 mm twist drill (pilot drill) and is maintained to a distance of only 2-3 mm, the positioning of the implants is done with a round bur.The 3 mm twist drill completes the preparation of the implant site for a standard-diameter implant. grafting material is introduced into the surgical site before using the first osteotome which serves as a shock absorber to fracture sinus floor. The fracture is performed at the end with the largest instrument that corresponds to the size of the implant to be placed.

Fugazzotto (2002) described a method in which an osteotome is used to implode a core of remaining alveolar bone prior to simultaneous implant insertion after a trephine with a 3.0 mm external diameter is used in place of a drill (or osteotome) as the initial step.[49] Calibrated trephine bur with 3.0 mm external diameter is used to prepare the site to within approximately 1–2 mm of the sinus membrane at a reduced cutting speed. A calibrated osteotome corresponding to the diameter of the trephine preparation is used under gentle malleting forces, to implode the trephine bone core to a depth approximately 1 mm less than that of the prepared site. The widest osteotome utilized will be one drill size narrower than the normal implant site preparation. Implant placement induces a lateral dispersion of the imploded alveolar core with gentle and controlled displacement. This procedure minimises patient trauma while also preserving the most alveolar bone possible at the specific location where an implant is planned to be placed.

Another modification of crestal approach is known as cosci technique which is aone-stage crestal Sinus floor elevation approach using a specific sequence of atraumatic drills of varying lengths.[50]If the residual bone height of 6-7mm, a dedicated trephine drill of 3 mm diameter is initially used for the first 2–4 mm. The dedicated 3 mm long and 2 mm diameter pilot drill is then used. Followed by the 3 mm long intermediate and 3.1 mm diameter drill and by one or more atraumatic lifting drills of the actual height of the ridge as measured on the radiograph.After using the first atraumatic lifting drill, the site is probed with a blunt instrument to feel the presence of the Schneiderian membrane. Then, the graft is gently pushed into the site using a particular instrument called “body lifting”; this step is repeated until the site is filled with the graft.

Antral membrane balloon elevationtechnique was given by Soltan and smilar in 2012.[43]A pilot drill pilot (2 mm diameter) is introduced in the center of the alveolar crest up to 1–2 mm below the sinus floor.The osteotomy is enlarged with the dedicated osteotomes.Bone substitute is injected into the site, and subsequently, the sinus floor is gently fractured.The membrane integrity is assessed. Bone substitute is injected again and a screw tap is tapped into the prepared site 2 mm beyond the sinus floor.After screw-tap removal and evaluation of sinus membrane integrity, the metal sleeve of the balloon-harbouring device is inserted into the osteotomy 1 mm beyond the sinus floor.The balloon is inflated slowly with the barometric inflator up to 2 atm. Once the balloon emerged from the metal sleeve underneath the sinus membrane, the pressure dropped down to 0.5 atm.Subsequently, the balloon is inflated with progressively higher volume of contrast fluid. Sequential periapical X-rays evaluate the balloon inflation and membrane elevation. Once the desired elevation (usually 10 mm) is obtained, the balloon should be left inflated 5 min to reduce the sinus membrane recoil.Then, the balloon is deflated and removed. The membrane integrity is assessed by direct visualization and examination with the suction syringe and respiratory movement of blood within the osteotomy site This procedure causes minimum trauma to the epithelium and also can be completed within 30 minutes. The main disadvantage is that, the antral lining might be ruptured as a result of the balloon burst if it is inflated too rapidly or with more saline solution than 4ml.

The elevation of the maxillary sinus floor by hydraulic pressure was proposed by Sotirakis and Gonshor[41,42]. Osteotomes are used in a specific order to widen and deepen the osteotomy site and to fracture the sinus floor. To raise the sinus floor, apply hydraulic pressure to a syringe that is properly fitted and inject normal saline beneath the Schneiderian membrane. Finally, sinus membrane is both detached and elevated.Kher et al. in 2014 provided the minimally invasive trans alveolar sinus approach (MITSA) elevation method.Hydraulic sinus membrane elevation is accomplished in this process using calcium phosphosilicate putty.Osteotomy is finished up to the last drill, which is done 1 mm short of the sinus floor. Using a concave 3 mm osteotome, the sinus floor is fractured. Implant is placed when the sinus membrane lifts.

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Minimally invasive transcrestal guided sinus lift technique was proposed by pozzi and Moy. This is a novel treatment to elevate the maxillary sinus using computer-assisted planning and a guided surgical approach.This surgical approach is minimally invasive because it uses an expander-condensing osteotome and a surgical template created using computer-aided design and manufacturing technology.

GRAFT MATERIAL USED IN SINUS LIFT

Numerous types of biomaterials, such as autograft, xenograft, alloplast, and growth factors, have been employed for sinus augmentation, and the choice of the best graft material is still debatable.Autogenous graft known as the gold standard for sinus lift which can be obtained from both extraoral and intraoral sources.[51] Osteogenic capacity, biocompatibility and no chance of disease transmission are the advantages of this material. The main disadvantage is high resorption rate and survival of implants placed in this graft is compared to them placed in allogenic grafts. Allografts come from deceased individuals who belong to the same species as the recipient of the graft. It can also be used as they have both osteoconductive and osteoinductive property provided the mineralised portion of graft is removed. Xenograft are obtained from different species, which acts as osteoconductive graft with high radio opacity that helps to identify the material in sinus. Recent years have seen a rise in the usage of alloplastic grafting materials, which can be employed either alone or in conjunction with autogenous bone, demineralized bone, blood, or other substances.Hydroxyapatite, calcium phosphate ceramics, beta-tricalcium phosphate, calcium sulphate (Gypsum), bioactive glasses, and polymethylmethacrylate are some of the materials employed.[52] Several studies have shown that implant survival rate higher when alloplastic graft is used.An alternative to bone graft is tissue engineered materials. Bone morphogenic protein is obtained and created as a recombinant human protein. Currently, rhBMP-2 and rhBMP-7 is used. This comes in form of a powder that is mixed with sterile water and placed in carrier at the time of surgery which acts as a scaffold for bone formation.

PRE -OPERATIVE ASSESSMENT AND INFORMED CONSENT

Prior to contemplating performing a sinus augmentation operation, a rigorous clinical and radiological examination must be completed in order to reduce the likelihood of intraoperative and postoperative problems.The number of teeth to be restored, the residual alveolar height, the sinus anatomy and any prior sinus pathologies must all be taken into account when determining the best technique for maxillary sinus augmentation. For heavy smokers who consume more than 15 cigarettes daily, a smoking cessation plan is essential.An informed consent conversation must occur prior to the start of the procedure, as with any surgical treatments. The conversation should have discussion of benefits, risks and alternatives to the procedure. The risks of sinus lift include pain, swelling, bleeding from surgical site, paraesthesia and graft failure. The alternatives to the surgical procedure include shorter implants, angled implants, zygomaticus implants, bridges or even a partial denture.It is crucial to emphasise that it may take longer than a year from this treatment to a dental restoration and the cost with additional procedure. Hence it is patients final call to proceed with the procedure.

PROPHYLAXIS

- If Patient not allergic to penicillin - Amoxycillin/clavulanic acid 1 g twice a day (BID) per OS One hour before surgery should be given.
- If Patient allergic to penicillin - Clarithromycin 250 mg BID + metronidazole 500 TID per OS starting 24 h before surgery be given.
- Steroidsreduce the postoperative edema and enhance the patient's comfort
- Corticosteroids

– Tablet form: prednisolone (prednisone®, Medrol®): 1mg/Kg/day administrated 1 hour before surgery and for 2 or 3 days after.

– Intramuscular injectable suspension: Betamethasone (Diprofos®) usual adult dose 1 to 2 ml (single injection prior to surgery)

POST-OPERATIVE INTRUCTIONS AND MEDICATIONS

The patient instructed to bite gauze with pressure in the surgery site for at least 20 minutes, preferably for three to four hours.A verbal review of the surgeon's instructions with the patient should follow the provision of a printed set of postoperative instructions and medications. The following instructions are:

1) After surgery, head should be raised with two or more pillows the following night.
2) The patient is recommended to follow a liquid diet for two days, a soft diet for two weeks, and to maintain as much upright posture as possible.

3) There may be a little amount of white dust in the nose or mouth. maybe as a result of bone debris escaping from the nose or sutures
4) It is also advised to take calcium supplements, rinsing with chlorhexidine 1.2% three to four times day, and getting as much rest as possible.
5) Avoid smoking, blowing balloons, sucking liquid through a straw, diving or flying in pressurised aircraft, drinking carbonated beverages for at least three days, hard lifting, and playing instruments that require blowing for two weeks.
6) During the first week following surgery, the patient must refrain from performing any actions that result in negative pressure (such as blowing their noses or sucking through straws).
7) If the patient does sneeze, they must keep their mouths open so that the pressure can be directed away from sinus.
8) Some people may get mild to moderate bruising on their cheekbones, neck, or even close to their shoulders and swelling in face, which would progressively disappear.
9) Medications – If patient is not allergic to penicillin -Amoxycillin/clavulanic acid 1 g thrice a day (TID) per OS For 7 days. If patient is allergic to penicillin Clarithromycin 250 mg BID + metronidazole 500 TID per OS for 7 days should be given.

COMPLICATIONS AND MANAGEMENT

Perforation of Schneiderian membrane

The Schneiderian membrane perforating while being dissected and reflected off the sinus bone walls is the most common intraoperative complication of direct sinus lifting. The incidence varies between 7% - 40% which compromises the graft material survival.[15-18]The thickness of the sinus membrane as well as forceful instrumentation during elevation are factors that might cause sinus membrane perforation during osteotomy, with perforation risk higher (60%) when membrane reflected in anterior region.[19]There are also studies indicating that gingival thickness may be utilised as a predictor of sinus membrane thickness, as there was a positive and highly significant link between the two measures, demonstrating a strong correlation between thicker Schneiderian membrane and thicker gingival phenotypes and vice versa.[20]Another anatomical characteristic that has been strongly linked to the occurrence of membrane perforations during sinus lifting procedures is the existence of bony septa. The incidence of septa range between 15% - 60%.[21,22]Therefore to prevent perforation of the membrane, it is suggested to carefully examine anatomy and location of septa,thickness of membrane, residual ridge and the presence of disease in sinus by using computed tomography scan.[23]Also, Sinus membrane perforations are more likely when there is a residual alveolar bone height of less than 3.5 mm. Several treatment procedures have been proposed depending on the size and extend of perforation.A categorization of sinus membrane perforation and a range of therapeutic alternatives were provided by Vlassis and Fugazzotto.[24] When the perforation is minor, it will heal itself by membrane fold over or clot formation. If the perforation is more than 5mm, resorbable collagen membrane is placed that acts as barrier material between graft material and sinus.[2,15,25]

Bleeding

The infraorbital artery, posterior lateral nasal artery, and posterior superior alveolar artery are the maxillary artery's branches that provide blood supply to maxillary sinus, where several anastomoses occur between the arteries.[26]If any of these arteries are injured either during the window osteotomy or during the reflection of the Schneiderian membrane, there is a chance that bleeding might occur during sinus lifting.The risk of haemorrhage, according to some authors, increases by up to 55% when the sinus artery diameter is over 0.5 mm.[27]Haemostatic measures must be used rightto stop the bleeding when the sinus artery is unintentionally injured during surgery. Techniques such as suturing of vessel, by use of local vasoconstrictor, applying firm pressure or crushing bone until bleeding stops.[28,29]

Infection

Infection typically affects the grafted area beneath the sinus membrane and sometimes extends into the sinus. Based on the answers to clinical questions from the panel of specialists (periodontitis, implantologist, maxillofacial surgeons, ear, nose, and throat, and microbiology specialist), Testori Tziano had developed recommendations.According to clinical observations, common post-operative symptoms may include edema, ecchymosis, mild discomfort and a little amount of bleeding from the nose and resolves in 3 weeks.A multidisciplinary strategy must be used to treat symptoms that have persisted for longer than three weeks with accompanying pus discharge, fistulation, discharges from the throat and nose, flapdehiscence, and suppuration.The removal of bone graft and implant via the oral method can be recommended combined with

functional endoscopic sinus surgery. Hence, patient has to follow the prescribed post operative medication to prevent infection.

Implant displacement

Dislodgement of implant into the maxillary sinus can occur during surgery or even several days later.[16] This may be due to excessive pressure on implant during osteotomy or improper positioning of the implant without sinus lift. The implant has to be removed as soon as feasible if the displacement is identified and localised in an OPG or computed tomography scan. The displaced implant into the sinus can be retrieved by using endoscopic devices via transoral/transnasal approach.[30] Also,it is advised to carefully construct the implant bed in a cone-shaped configuration and to utilise tapered implants with a decreased diameter in the apical section, which will limit the displacement of the whole device into the sinus, in order to prevent implant migration to the sinus.

Chronic rhinosinusitis

Inflammation of the mucosa of the nose and paranasal sinuses, also known as rhinosinusitis or sinusitis, frequently caused by a viral, fungal, or bacterial infection and following an allergic reaction.[31]The symptoms include nasal congestion, cough, facial pain, ocular pruritis and purulence surrounding implants. Chronic rhinosinusitis may occur as a result of overfilled graft causing ostium blockage, bacterial contamination during surgery, mucosal activity being impaired due to mucosal laceration.[32,33]The first signs of chronic rhinosinusitis often show three months after the sinus operation, but they can appear up to a year later.[34] Hence, systemic antibiotics may be prescribed in single or many courses until the infection is under control, in addition to nasal steroid sprays, oral antihistamines, and nasal douching with saline solutions.Also, Caldwell- Luc osteotomy may be needed if pathology is present even after nonsurgical management.[35]

Benign paroxysmal positional vertigo

A common otoneurologic condition known as benign paroxysmal positional vertigo characterised by transient, sudden gyratory sensation with nystagmus.The position of the head in relation to gravity can cause symptoms, which can range in intensity from moderate vertigo to incapacitating bouts that can cause nausea and vomiting and seriously impair everyday functioning.The pathophysiology of it is thought to be caused by the otoliths' separation from the utricular macula and their displacement into the semi-circular canals.[36]A clinical study showed that 146 patients who had undergone sinus augmentation had benign paroxysmal positional vertigo with an incidence of 6%.[37]The treatment for repositioning the canalith is known as Epley manoeuvre, is a series of head motions that aid in the otoliths returning to their original location.[38]The surgical damage created by the osteotomes and the surgical hammer when malleting and condensing the bone is thought to be what causes the otoliths to separate during indirect sinus lift .A study comparing the incidence of benign paroxysmal positional vertigo between conventional malleting osteotomes and screwable ones, , showed 3% and 0%, respectively. This finding supports the idea that reducing surgical trauma during osteotomy may lower the incidence of benign paroxysmal positional vertigo.[39]As part of the informed consent process and since symptoms can be painful and incapacitating, causing the patient great stress, patients should be advised that they can experience temporal vertigo following surgery.[40]

II. CONCLUSION

Maxillary sinus floor elevation surgery provides best results to regenerate lost osseous structure in the posterior maxilla. Hence, an understanding of sinus anatomy, a correct preoperative assessment, a diagnosis, appropriate surgical procedures, regular recalls, and review are all necessary for the direct or indirect sinus lift technique.Also, these surgical procedures are associated with various complications, with Schneiderian membrane perforation being commonly reported. Hence, further study is required to create and evaluate patient-safe, minimally invasive technologies that would lower the frequency of problems related to sinus lifting treatments.

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