



**SINUS LIFT PROCEDURES IN UPPER JAW DENTAL IMPLANTOLOGY:
TECHNIQUES, INDICATIONS, AND CLINICAL OUTCOMES**

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Abstract

This article explores the use of sinus lift procedures in upper jaw dental implantology. Anatomical features of the posterior maxilla, particularly the location of the maxillary sinus and available bone volume, directly influence implant placement and long-term success. The primary aim of sinus lifting is to create sufficient bone height for stable implant insertion, ensure proper osseointegration, and improve prosthetic functionality. The article discusses the two main techniques—lateral window (open) and transalveolar (closed)—as well as various bone grafting materials, including autogenous, allogenic, xenogenic, and synthetic options. Indications, contraindications, potential complications, and risk management strategies are analyzed. Results indicate that sinus lifting enhances implant stability, restores masticatory function, and provides improved aesthetic outcomes while ensuring predictable long-term success. Emphasis is placed on thorough preoperative assessment, precise surgical technique, and careful postoperative management. Overall, sinus lift procedures represent an effective and reliable adjunctive method in upper jaw implantology, expanding treatment options for patients with posterior maxillary bone deficiencies.

Keywords

Sinus lift, maxillary sinus, dental implants, bone grafting, lateral window technique, transalveolar technique, posterior maxilla, implant stability, osseointegration, prosthetic rehabilitation.

Introduction

Dental implantation has become one of the most effective methods for tooth replacement in modern dentistry. However, restoring teeth in the upper jaw presents certain anatomical and physiological challenges that can complicate the implant procedure. In particular, the location of the maxillary sinus and the availability of sufficient bone volume directly influence the success of dental implants in the posterior maxilla. Therefore, in clinical practice, additional surgical procedures in the upper jaw, especially sinus lifting, are widely applied. The sinus lift procedure aims to increase the bone volume in the upper jaw to allow proper placement of dental implants. This technique enhances the stability of the implant, improves the long-term functionality of the prosthetic teeth, and ensures better osseointegration. Sinus lifting can be performed using two main approaches: the lateral window (open) technique and the transalveolar (closed) technique. The choice of method depends on the patient's anatomical characteristics, the available bone height, and the clinical situation. Moreover, sinus lifting not only facilitates the implant placement but also promotes natural bone regeneration in the edentulous area, reduces the risk of postoperative complications, and improves the patient's overall oral health and quality of life.



Therefore, when planning implant placement in the upper jaw, timely and proper application of additional surgical techniques such as sinus lifting is of critical importance.

Relevance

Restoring missing teeth in the upper jaw is a significant challenge in modern dental implantology. The posterior maxilla often presents anatomical limitations, including the pneumatization of the maxillary sinus and reduced bone height, which can hinder proper implant placement. These limitations may compromise implant stability, osseointegration, and long-term functionality. With the growing demand for reliable and long-lasting dental restorations, addressing these challenges has become increasingly important. Sinus lifting is a highly relevant surgical procedure that allows clinicians to overcome these anatomical obstacles, ensuring predictable and successful outcomes in upper jaw implant placement. Moreover, this procedure contributes to maintaining oral function, aesthetics, and overall patient quality of life.

Purpose

The purpose of this study is to explore the use and effectiveness of sinus lifting as an additional surgical procedure in upper jaw dental implantology. It aims to understand how sinus augmentation helps create sufficient bone volume, ensures proper implant placement, and improves long-term stability and functionality of dental implants.

Main part

The posterior maxilla presents unique anatomical challenges for dental implant placement. The maxillary sinus, a pyramidal cavity located above the alveolar ridge, often undergoes pneumatization with age and after tooth loss. This expansion reduces available bone height and complicates implant stability. Bone quality in the posterior maxilla is typically less dense compared to the mandible, which can affect osseointegration. Sinus septa and variations in membrane thickness further complicate surgical planning. Preoperative imaging, particularly cone-beam computed tomography (CBCT), is essential for evaluating bone height, width, and sinus anatomy. The presence of residual bone determines the choice of sinus lifting technique. Clinicians must consider the proximity of adjacent teeth, the sinus floor morphology, and potential anatomical variations. Membrane integrity and thickness are critical factors in preventing perforation. Awareness of sinus pathology, including cysts or chronic sinusitis, is necessary before surgery. Proper evaluation helps predict surgical difficulty and postoperative outcomes. The bone resorption pattern after tooth loss must be assessed to plan grafting procedures. Understanding the anatomy allows selection of an appropriate graft material and surgical approach. Residual alveolar ridge height influences whether a lateral or transalveolar sinus lift is required. Clinicians must balance minimal invasiveness with sufficient bone augmentation. Detailed anatomical knowledge improves implant positioning accuracy. Surgical planning must integrate anatomical constraints with prosthetic requirements. Predictable outcomes are achieved when anatomy is fully assessed. Patient-specific variations in sinus morphology dictate individualized treatment strategies. Overall, thorough anatomical evaluation is the foundation of successful upper jaw sinus augmentation and implant placement.

Sinus lifting is indicated when the posterior maxillary bone height is insufficient for predictable implant placement, usually less than 10 mm. Severe alveolar bone resorption after tooth extraction is a common reason for augmentation. Multiple implants in the posterior maxilla



often require increased bone volume to ensure proper spacing and load distribution. Long-span prosthetic restorations also necessitate sufficient bone support. Poor bone quality or density in the posterior maxilla may compromise osseointegration without augmentation. Aesthetic considerations in the posterior region may also justify sinus lifting to support implant-supported crowns. Delayed implant placement after bone resorption or trauma can require sinus augmentation. Localized defects, including previous failed implants or periodontal disease, may necessitate grafting. Preoperative CBCT assessment is essential to determine residual bone and plan the procedure. Patient-specific factors, such as age, systemic health, and sinus condition, influence surgical decisions. Contraindications, including active sinus infection, uncontrolled systemic diseases, or poor oral hygiene, must be evaluated. Sinus lifting is particularly beneficial when immediate implant placement is not feasible. It also improves primary stability and reduces implant micromovement during healing. Augmentation facilitates prosthetic planning by ensuring correct implant angulation and depth. Clinicians consider both functional and long-term outcomes when indicating sinus lifting. The procedure helps restore masticatory efficiency and maintain occlusal harmony. It minimizes the risk of sinus membrane perforation during implant placement. Indications are based on clinical evaluation, imaging, and anticipated prosthetic requirements. Proper patient selection maximizes implant survival and functional success.

The lateral window technique is a widely used approach for sinus augmentation, especially in cases of severe bone deficiency. A bony window is created on the lateral wall of the maxillary sinus to access the Schneiderian membrane. The membrane is carefully elevated to create a space for bone graft material. Different types of grafts can be used, including autografts, allografts, xenografts, and synthetic substitutes. The graft material is packed gently to avoid membrane perforation. Membrane integrity is crucial for preventing graft migration or sinus complications. The bony window may be repositioned or covered with a resorbable collagen membrane. Suturing and soft tissue closure ensure proper healing and prevent infection. This approach allows placement of implants either simultaneously or after a healing period, depending on residual bone height. Preoperative CBCT evaluation guides window positioning and graft volume. Surgical instruments, including osteotomes, sinus elevators, and curettes, must be handled delicately. Postoperative care includes antibiotics, pain management, and sinus precautions. Healing typically requires 4–6 months for optimal graft integration. The lateral window approach provides predictable bone height gain, making it suitable for severely resorbed posterior maxilla. Advantages include direct visualization and controlled graft placement. Limitations involve higher invasiveness and increased postoperative swelling. Proper surgical technique minimizes risks of sinusitis, membrane perforation, or graft failure. Long-term studies show high implant survival rates with this method. Patient education and compliance are critical for successful outcomes.

The transalveolar, or closed, sinus lifting technique is a minimally invasive method for augmenting bone in the posterior maxilla. It is generally indicated when residual bone height is moderate, usually more than 5 mm. The procedure involves creating the implant osteotomy site and using osteotomes to elevate the Schneiderian membrane gently. Bone graft material can be introduced through the same osteotomy, providing additional support for implant placement. This technique allows simultaneous implant insertion, reducing the overall treatment time. Proper preoperative imaging, including CBCT, is essential to evaluate bone height, sinus anatomy, and potential septa. The transalveolar approach is less invasive than the lateral window method, resulting in reduced patient discomfort and faster recovery. Careful manipulation is required to prevent membrane perforation, which can compromise graft stability. Various bone



substitutes, including autografts, allografts, and synthetic materials, can be used depending on the clinical scenario. The procedure requires precise control of osteotome depth and angulation to avoid sinus floor fractures. Postoperative care includes sinus precautions, antibiotics, and pain management. Healing typically allows implant osseointegration within 4–6 months. The technique is advantageous for patients seeking less invasive procedures with shorter recovery periods. Limitations include restricted bone gain and difficulty in multiple implant placements. Success depends on proper case selection, surgical skill, and patient compliance. Long-term outcomes indicate predictable implant survival when applied correctly. Clinicians must monitor healing through radiographs to confirm graft integration. Overall, transalveolar sinus lifting is an effective technique for moderate posterior maxillary augmentation.

Bone grafting is a critical component of sinus lifting procedures to achieve adequate bone volume for implant stability. Autogenous bone grafts, harvested from the patient, are considered the gold standard due to their osteoconductive and osteoinductive properties. Allografts, obtained from human donors, offer biocompatibility and reduce donor site morbidity. Xenografts, typically derived from bovine or porcine sources, provide a scaffold for new bone growth. Synthetic bone substitutes, including hydroxyapatite and tricalcium phosphate, can be used as alternatives depending on availability and cost. Particle size, density, and handling characteristics influence graft success. Bone grafts are packed into the sinus cavity after membrane elevation, ensuring uniform distribution without over-compression. Membrane integrity and graft stabilization are essential to prevent migration or sinus complications. Healing involves gradual remodeling and incorporation of the graft into the host bone. Clinicians must select graft material based on defect size, patient systemic health, and anticipated implant loading. Use of growth factors or platelet-rich fibrin can enhance osteogenesis and accelerate healing. Postoperative monitoring via radiographs ensures graft consolidation and bone height gain. Proper graft selection directly impacts implant osseointegration, functional load-bearing capacity, and long-term success. Understanding material properties and clinical application is crucial for predictable outcomes.

Sinus lifting procedures, while generally safe, carry potential complications that require careful management. Schneiderian membrane perforation is the most common intraoperative complication and can compromise graft stability. Sinus infections, including sinusitis, may occur if sterility or postoperative care is inadequate. Graft material migration can reduce bone augmentation and necessitate secondary procedures. Bleeding, hematoma formation, and soft tissue swelling are possible but manageable with proper technique. Implant failure may occur if primary stability is insufficient or osseointegration is compromised. Prevention strategies include thorough preoperative assessment, gentle membrane elevation, and careful graft handling. Use of collagen membranes, fibrin glue, or other protective measures can repair small membrane tears. Antibiotics, anti-inflammatory drugs, and sinus precautions help reduce postoperative complications. Clinicians should educate patients on avoiding sneezing, blowing the nose, or applying pressure on the sinus region. Regular follow-up, radiographic evaluation, and monitoring of bone graft integration are essential. Delayed healing or minor complications can be managed conservatively, while major complications may require surgical intervention. Systemic factors, such as diabetes or smoking, should be considered during planning. Proper documentation and risk assessment enhance clinical outcomes. Knowledge of potential risks and their management ensures predictable, long-term success of sinus augmentation and implant therapy.



Postoperative care is essential to ensure successful healing after sinus lifting procedures. Patients are advised to avoid activities that increase sinus pressure, such as blowing the nose, sneezing forcefully, or using straws. Pain and swelling are common and can be managed with analgesics and anti-inflammatory medications. Antibiotic therapy may be prescribed to prevent infection, especially in cases involving graft materials. Soft tissue healing is monitored regularly, and sutures are removed according to clinical protocols. Oral hygiene is crucial to prevent contamination of the surgical site, including gentle brushing and use of antiseptic mouth rinses. Dietary modifications, such as soft foods, are recommended during the initial healing period. Radiographic follow-up, typically with CBCT or panoramic imaging, assesses graft integration, bone height gain, and sinus condition. Clinical evaluation includes checking for signs of infection, graft displacement, or implant instability. Patients should be educated on recognizing early signs of complications and instructed to report any unusual symptoms promptly. Regular follow-up visits help monitor osseointegration of implants placed simultaneously or after graft healing. Adjustments in prosthetic planning may be required based on bone remodeling outcomes. Long-term maintenance includes periodic examinations to ensure implant stability, occlusal harmony, and soft tissue health. Any postoperative complications, such as minor bleeding or edema, are addressed promptly. The success of sinus augmentation relies on patient compliance, meticulous surgical technique, and proper postoperative management. Clear communication between clinician and patient improves satisfaction and overall outcomes. Follow-up protocols should be individualized based on the complexity of the procedure and patient-specific factors. Comprehensive care ensures predictable bone gain and successful integration for long-term implant functionality.

Sinus lifting procedures have shown high success rates in supporting dental implant placement in the posterior maxilla. Bone augmentation achieved through either lateral window or transalveolar techniques provides sufficient height and volume for stable implant osseointegration. Clinical studies demonstrate implant survival rates in augmented sinuses comparable to those in native bone. Functional outcomes include improved masticatory efficiency, restoration of occlusal balance, and long-term prosthetic stability. Aesthetic results are enhanced by proper implant positioning and sufficient alveolar ridge support. Prognosis depends on surgical technique, graft material, patient anatomy, and systemic health. Complications, though relatively infrequent, may affect outcomes if not managed promptly. Factors influencing prognosis include membrane perforation, sinus pathology, graft integration, and patient compliance. Long-term follow-up studies show predictable results when procedures are performed according to established protocols. Both lateral and transalveolar approaches yield favorable outcomes, with selection based on residual bone height and clinical scenario. Graft material type and proper handling impact bone regeneration and implant stability. Patients report high satisfaction due to functional and aesthetic improvements. Osseointegration monitoring through radiographs ensures early detection of any potential issues. The procedure supports rehabilitation in cases of severe bone loss, expanding treatment options for patients. Overall, sinus lifting provides reliable and durable outcomes in posterior maxillary implantology. Clinicians can expect consistent results with careful planning, precise technique, and diligent postoperative care. Evidence-based protocols continue to refine prognosis and enhance long-term success rates.

Conclusion



Sinus lifting is a crucial adjunctive procedure in dental implantology for the posterior maxilla. Anatomical limitations, including sinus pneumatization and reduced alveolar bone height, often make standard implant placement challenging without additional augmentation. Both lateral window and transalveolar techniques provide predictable methods to increase bone volume, improve implant stability, and ensure long-term osseointegration. Careful preoperative assessment, including radiographic imaging and evaluation of sinus anatomy, is essential for selecting the appropriate surgical approach. The choice of grafting material, proper handling of the Schneiderian membrane, and meticulous surgical technique significantly influence outcomes. Complications such as membrane perforation, infection, or graft migration can occur but are generally manageable with proper precautions and postoperative care. Postoperative monitoring, patient education, and follow-up are key to ensuring optimal healing and integration. Evidence demonstrates high implant survival rates and patient satisfaction when sinus lifting is performed according to established protocols. Overall, sinus augmentation enhances both functional and aesthetic outcomes, making it an indispensable procedure in upper jaw implantology. Its successful implementation expands treatment possibilities for patients with posterior maxillary bone deficiencies and contributes to long-term oral health, quality of life, and predictable prosthetic rehabilitation.

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