

# Minimal invasive sinus elevation (MISE), a different approach for maxillary sinus lift surgery

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## Abstract

**Aim:** The maxillary sinus lift is a crucial surgical procedure performed to increase the vertical height of the remaining bone, often required before implant placement. Several techniques are used to approach the maxillary sinus, with varying results. Among them, it is possible to mention the minimal invasive sinus elevation (MISE) technique.

**Methods:** This paper provides a comprehensive review of the MISE technique, its materials, and surgical methods. It analyzes the outcomes compared to conventional methods and discusses its applicability in different clinical scenarios.

**Results:** The MISE technique has proven effective in increasing bone height with a lower risk of membrane perforation compared to traditional methods. It offers high implant success rates and minimal post-operative complications, with strong patient outcomes regarding bone regeneration and implant stability. This section will analyze these results with both quantitative and qualitative evaluations.

**Conclusions:** The MISE technique notably improves sinus lift procedures, providing a minimally invasive method with reliable clinical results. Its predictability and lower risk of membrane perforation make it well-suited for implant surgeries involving sinus elevation. Future studies should explore long-term results and refine the technique for broader clinical use.

**Keywords:** Maxillary sinus lift, MISE technique, Oral surgery.

## Introduction

The paired maxillary sinuses are air-filled spaces within the bilateral maxillae, lateral to the nasal cavity, superior to the maxillary teeth, inferior to the orbital floors, and anterior to the infratemporal fossa. These sinuses, the most extensive paranasal sinuses, have a pyramidal shape and an average volume of 12.5 mL. However, their size can vary between individuals depending on factors such as age, sex, and pathological conditions. Specifically, the volume of the maxillary sinuses can be affected by diseases such as chronic sinusitis or other inflammatory conditions, which may lead to an increase or decrease in the air space. Their primary function is to lighten the weight of the skull, enhance vocal resonance, and contribute to the humidification and warming of inhaled air.

The maxillary sinuses are lined with a thin bilaminar mucoperiosteal membrane, known as the Schneiderian membrane. This membrane is composed of ciliated pseudostratified columnar epithelium, which facilitates mucus movement towards the nasal cavity. The cilia on the epithelial surface are responsible for clearing mucus and other foreign particles, helping to keep the sinuses clean and preventing infections. Beneath the epithelium lies

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## How to Cite

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a layer of connective tissue rich in blood vessels, which nourishes the membrane and keeps it moist. The ostium, an opening connecting the maxillary sinus to the nasal cavity, allows mucus drainage. Conditions affecting the maxillary sinuses include infections such as sinusitis, which may be of bacterial, viral, or fungal origin, and lesions or tumors that can obstruct normal sinus drainage. Dental procedures, such as the extraction of maxillary teeth or the placement of implants, can also impact the integrity of the maxillary sinuses, as their proximity to the upper teeth may result in perforations or abnormal communications between the oral cavity and the sinuses (1).

The maxillary sinus lift is a critical surgical intervention employed to augment the vertical height of residual alveolar bone in the posterior maxillary region, an area commonly affected by significant bone resorption after tooth loss. This bone reduction, often due to the physiological expansion of the maxillary sinus into the edentulous ridge, severely compromises the ability to place dental implants of adequate length and stability. The procedure, initially developed to counter these anatomical limitations, has become an essential component of pre-implant surgery for patients with severe maxillary atrophy (2, 3).

Traditionally, sinus augmentation is performed using either the lateral window technique or the crestal approach, both of which have proven to be highly effective in increasing bone volume beneath the sinus cavity for implant placement (4).

The lateral window technique, pioneered by Tatum in the 1970s, involves creating a surgical window on the lateral aspect of the maxillary bone to elevate the Schneiderian membrane and introduce bone graft material into the sinus floor. While this technique allows for significant bone gain, it is often associated with higher rates of membrane perforation. This complication can lead to post-operative infections, delayed healing, and implant failure (2, 5).

The crestal approach, first described by Summers in 1994, represents a less invasive alternative, utilizing osteotomes to elevate the sinus membrane through the existing alveolar ridge. This technique reduces surgical trauma and recovery time, but its application is generally limited to cases with moderate bone loss (3).

In recent years, the focus has shifted toward developing minimally invasive sinus augmentation techniques that can reduce the risks and complications associated with these traditional methods. The Minimal Invasive

Sinus Elevation (MISE) technique has emerged as an innovation designed to minimize trauma to the sinus membrane and surrounding structures while still achieving sufficient bone height for implant placement. The MISE technique employs specialized drills and stops systems that allow for precise control of the sinus elevation, significantly lowering the risk of Schneiderian membrane perforation—a common complication in sinus lift surgeries (6, 7).

This method is particularly advantageous for patients with moderate bone resorption. It provides a reliable and less traumatic solution, resulting in shorter recovery times and increased patient comfort (8).

Moreover, the MISE technique aligns with the broader trend in modern implantology towards minimally invasive procedures, which aim to reduce patient morbidity while ensuring optimal clinical outcomes. As such, it has gained considerable attention in clinical practice as a viable alternative to more invasive sinus lift methods, especially in cases where traditional techniques may pose higher risks due to anatomical or systemic factors (9, 10).

Its ability to provide predictable results with fewer complications underscores its growing relevance in contemporary oral surgery (11).

### Materials and methods

The MISE (Minimal Invasive Sinus Elevation) technique significantly advances sinus augmentation procedures, offering a less invasive alternative to traditional methods. This technique involves the use of highly specialized surgical tools designed to provide precise and controlled elevation of the Schneiderian membrane, thereby minimizing the risk of complications such as membrane perforation (12, 13).

The MISE kit (Sweden & Martina, Padua, PD, Italy) includes calibrated drills of varying diameters, depth stoppers, and sinus membrane elevation instruments, all of which are specifically engineered to perform incremental sinus lifts in a controlled manner. Unlike traditional approaches, which may rely on osteotomes or lateral windows, the MISE technique enables a minimally traumatic intervention, improving patient outcomes and reducing recovery times (14, 15).

The procedure is primarily indicated in patients with a residual bone height between 2 to 6 mm, where traditional methods might pose a higher risk of complications due to insufficient bone volume (16).

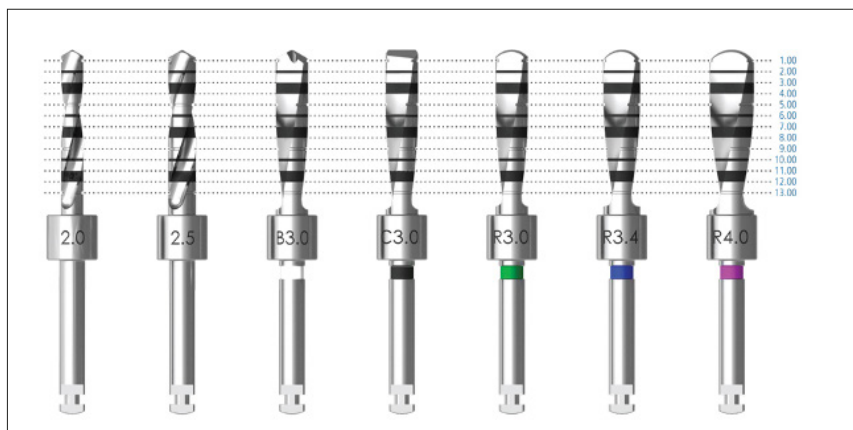


Figure 1. Drills of the MISE protocol.

In such cases, achieving vertical augmentation through conventional techniques may require extensive bone grafting or the creation of a lateral window, both of which increase the risk of membrane perforation and postoperative infections (17).

The MISE technique, by contrast, employs a series of progressive drills (Figure 1) guided by depth stoppers, ensuring a gradual elevation of the sinus floor without exerting undue force on the Schneiderian membrane. This controlled approach allows for membrane elevation in increments of 1 mm, thereby reducing the likelihood of perforation and the need for secondary corrective surgeries (18)

The specialized drills and stop systems used in the MISE procedure are designed to create a precise osteotomy without damaging the surrounding structures. The drills are equipped with rounded tips to minimize the risk of perforation, and the depth stoppers allow for accurate control over the drilling depth, ensuring that the membrane is lifted in a stepwise fashion.

Classic cylindrical drills are primarily used to create initial holes. The Chamfered drill, featuring a flat tip, can deform and break the sinus floor if sufficiently thin. As the name implies, the Break up drill is ideal for breaking through thicker or more rigid sinus floors. The three rounded drills, with their non-cutting, rounded tips, are designed to gradually widen the implant site, allowing the insertion of fixtures up to 5.00mm. These drills are distinguished by colored rings at the base of the shank, which follow a specific color-coding system to ensure proper use in sequence. In addition, the technique eliminates the need for forceful manipulation of the bone, as is often required in the lateral window technique, reducing both surgical time and patient discomfort (19-21).

Furthermore, using cone-beam computed tomography (CBCT) imaging to guide the procedure has enhanced the precision and predictability of MISE, making it a highly adaptable technique even in complex anatomical situations. By providing detailed three-dimensional images of the maxillary sinus and surrounding structures, CBCT allows clinicians to plan the exact location and depth of the osteotomy, significantly improving surgical outcomes (22).

This section will provide a step-by-step description of the MISE procedure, focusing on the surgical protocol, equipment used, and the conditions under which this method is most effective. The technique's ability to minimize trauma while achieving reliable bone augmentation has made it a valuable option in moderate to severe bone resorption cases, where other methods may pose more significant risks and challenges (10, 23, 24).

## **Results**

Clinical trials and case studies have convincingly demonstrated the efficacy of the MISE (Minimally Invasive Sinus Elevation) technique in enhancing bone height by up to 9 mm. This innovative approach increases bone volume and reduces the risk of membrane perforation, a common complication in sinus elevation procedures. Research shows that MISE has a significantly lower incidence of membrane perforation compared to conventional, more invasive techniques.

The MISE technique offers several advantages, including minimizing patient discomfort and reducing recovery

time, allowing for a quicker return to normal activities. Its precision leads to more predictable outcomes, essential for the success of dental implant procedures. Clinical data emphasizes both the safety and effectiveness of MISE in preserving surrounding tissues, which is crucial for bone grafting and implant placement, enhancing patient satisfaction and outcomes. As a result, the MISE technique represents a significant advancement in sinus elevation procedures, making it a preferred choice for clinicians aiming to achieve successful and predictable results in patients requiring sinus augmentation (15).

This reduced risk of complications solidifies MISE's status as a preferable option for many dental practitioners. The lower incidence of complications not only improves patient safety but also leads to better overall treatment outcomes. Studies show that practitioners using MISE report fewer post-operative issues such as infections, prolonged healing, and discomfort, primarily due to its minimally invasive nature, which promotes quicker recovery.

The favorable outcomes of MISE have increased confidence among dental surgeons, encouraging wider adoption of this method for sinus elevation procedures. As more professionals recognize its efficiency in achieving successful bone augmentation, MISE's use will likely continue growing. Patient feedback has been overwhelmingly positive, with many expressing satisfaction with their treatment experiences and results. This reinforces the technique's clinical benefits and contributes to its popularity, making it a leading option in sinus elevation, reflecting a shift toward more patient-centered care in dental practice (25, 26).

The success rates of implant placement following the MISE procedure are notably high, with minimal post-operative complications reported. This is especially important considering the higher risks of complications such as membrane perforation and extended healing times in traditional sinus elevation techniques. By mitigating these risks, MISE improves immediate outcomes and contributes to dental implants' long-term success.

Patient outcomes following MISE show promising results in bone regeneration and implant stability—two key factors for the long-term success of dental implants. The precision of the technique ensures effective sinus lift, promoting optimal conditions for bone grafting and bone growth. This, in turn, helps create sufficient bone density and volume to anchor dental implants, ensuring their stability and durability securely.

Patients undergoing the MISE procedure typically experience long-term implant success, with fewer complications related to implant failure or bone loss. High bone regeneration rates and secure implant integration contribute to dental professionals' confidence in recommending MISE, particularly for patients requiring complex sinus augmentation. Patients also report high satisfaction due to minimal discomfort and shorter recovery times. These positive outcomes and patient feedback further solidify MISE as a superior, reliable, patient-centered option for sinus elevation procedures (11).

This section will present a detailed analysis of these patient outcomes, including quantitative bone regeneration measures and qualitative implant stability assessments following the procedure (17).

## Discussion

The findings clearly demonstrate that the MISE (Minimally Invasive Sinus Elevation) technique is a highly reliable procedure and a groundbreaking alternative to more invasive, traditional sinus elevation methods. One of its standout advantages is its ability to dramatically minimize surgical trauma, a major consideration for patients and surgeons. Despite being less invasive, the MISE technique maintains exceptionally high success rates, offering a safe and effective solution for patients with moderate bone resorption. This is especially important because, unlike traditional approaches, which often require more complex and invasive surgical interventions, MISE reduces the risk of postoperative complications, such as infections, prolonged healing periods, and discomfort. Additionally, the reduced trauma makes it a more accessible option for patients who may be at higher risk due to age or medical conditions, further broadening its appeal as a preferred treatment method. Overall, MISE is a modern, patient-centered technique that combines effectiveness with a more comfortable, less risky patient experience (9, 27).

In addition to its proven effectiveness in minimizing surgical trauma, the MISE (Minimally Invasive Sinus Elevation) technique exhibits an impressive degree of adaptability across a wide range of clinical scenarios. One of the most remarkable aspects of this technique is its ability to deliver successful outcomes even in patients with severely limited residual bone height. This condition often poses significant challenges in the realm of implant dentistry. Traditional sinus elevation methods can be far less effective in such cases, usually requiring more complex and invasive interventions that increase the patient's discomfort and heighten the risk of complications. Conversely, MISE offers a more versatile and patient-friendly approach, allowing for predictable success even in complex anatomical situations. This adaptability makes MISE a desirable option for dental surgeons, enabling them to treat a broader range of patients without resorting to more aggressive surgical techniques. By maintaining high levels of clinical success while minimizing both invasiveness and recovery time, the MISE technique further establishes itself as a cutting-edge solution that can be tailored to meet the specific needs of individual patients, ultimately enhancing their overall treatment experience (28, 29).

The benefits of the MISE (Minimally Invasive Sinus Elevation) technique extend far beyond the realm of clinical outcomes, encompassing several practical advantages that significantly enhance the overall patient experience. One of the most noteworthy benefits is the reduction in surgery time, which contributes to increased patient comfort and leads to a more streamlined and efficient use of operating room resources. Shorter procedures mean less time under anesthesia for patients, reducing potential risks and promoting quicker recovery. This efficiency is a significant advantage for healthcare providers and patients, as it allows for higher patient turnover and optimal use of surgical facilities.

Additionally, MISE's lower rate of postoperative complications is critical in improving patient satisfaction. The minimally invasive technique results in less trauma to surrounding tissues, leading to fewer complications such as infections, swelling, or prolonged healing times. This translates into fewer follow-up visits, reducing the

need for additional treatments or corrections that can otherwise burden both the patient and the healthcare system. The combination of fewer complications and shorter recovery periods directly impacts healthcare costs, making MISE a clinically effective choice and a cost-efficient one. By minimizing the need for extended aftercare and follow-ups, patients experience smoother recoveries. At the same time, healthcare providers benefit from reduced resource consumption, making MISE a win-win solution from both medical and economic perspectives (30).

In summary, the MISE (Minimally Invasive Sinus Elevation) technique presents a range of distinct advantages compared to traditional sinus elevation methods. Key benefits include a substantial reduction in surgical trauma, making it less invasive and more comfortable for patients while maintaining high success rates even in challenging cases like those involving minimal residual bone height. Its adaptability to various clinical conditions further sets it apart, allowing for successful outcomes in situations where conventional techniques might be less effective or more invasive. Additionally, the procedure's reduced surgery time enhances patient comfort and the efficient utilization of operating room resources. This efficiency, coupled with the lower incidence of complications, directly contributes to improved patient satisfaction, fewer follow-up visits, and reduced healthcare costs.

This discussion will explore these advantages in greater depth, offering a detailed analysis of how the MISE technique is transforming the landscape of dental implantology and why it is becoming the preferred choice for modern practitioners. By examining the clinical, practical, and economic benefits, we will illustrate why MISE represents a significant advancement in sinus elevation procedures (31).

## Conclusion

The MISE (Minimally Invasive Sinus Elevation) technique significantly advances sinus lift procedures, providing a highly effective and minimally invasive approach that results in excellent clinical outcomes. This technique has been shown to enhance significantly predictability in surgical results, as evidenced by various studies that highlight its success rates and reliability. For instance, a survey conducted by Farina emphasizes that "the MISE technique offers predictable outcomes with minimal complications, demonstrating its effectiveness in challenging anatomical situations" (32).

One of the standout features of the MISE procedure is its ability to significantly reduce the risk of membrane perforation, a common complication associated with traditional sinus lift methods. Research by Stacchi indicates that "the risk of membrane perforation can be minimized through the use of minimally invasive techniques, allowing for safer sinus elevation in patients with limited bone availability. This reduction in complications makes MISE an ideal choice for implant surgeries requiring sinus elevation, as it not only promotes a higher rate of success but also contributes to enhanced patient comfort and satisfaction (33).

Furthermore, the minimally invasive nature of the MISE technique translates into reduced surgical trauma and faster recovery times, which are linked to improved patient experiences. According to a prospective study



by Rengo et al. (2021), “patients undergoing MISE procedures reported higher levels of satisfaction and quicker recovery compared to those who received traditional surgical interventions” (34).

Looking ahead, future research should prioritize the exploration of long-term outcomes associated with the MISE technique and its continued refinement to broaden its applicability across a wider range of clinical conditions. The ongoing development of this technique could enhance its versatility and efficacy, potentially expanding its use in patients with varying anatomical challenges. By investigating these areas, researchers can provide further evidence to support the adoption of MISE in clinical practice, ultimately improving outcomes for patients in need of sinus elevation procedures.

## Declarations

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## Conflicts of interest

The authors declare no conflicts of interest

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