Review Article

Evaluation of Maxillary Sinus Augmentation, Review Article

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Abstract

Insufficient bone height resulting from a low-lying maxillary sinus or atrophy of the alveoli after extraction is a frequent clinical finding that confronts the implant surgeon when preparing for implant placement in the posterior maxilla. A transrectal sinus lift or a lateral technique can be used to augment the site. The maxillary sinus, vital in dental and surgical contexts, relates to dental structures, inflammation susceptibility, growth, and functions. Surgical methods, like maxillary sinus lifts for dental implants, are detailed along with patient evaluation and precautions. Osteotome-mediated sinus elevation aids oral rehabilitation. To learn more about the causes, modes, and treatments of implant infections, searches were conducted using the databases of Medline, Pubmed, Embase, NCBI, and Cochrane. Studies that provided information on the kinds of antibiotics and surgical techniques used to treat the infection were given special attention. Osteotome-based sinus membrane elevation is dependable for restoring atrophic posterior maxilla yet lacks long-term data. Short implants (<6mm) lower survival. It's suitable with >6mm vertical bone. Additional grafting aids if more intra-sinus bone is required for the desired implant length.

Keywords: Alveolar ridge augmentation, Oral surgical procedures, Crestal approach, Sinus

Introduction

Out of the four paranasal sinuses, the maxillary sinus is the biggest and sometimes more susceptible to inflammation due to its close proximity to the teeth underneath it. With a birth volume of around 1 cm, it develops between days 65 and 75 of pregnancy. Till the area occupied by tooth germs is released after their eruption, the maxillary sinus is still being pneumatized [1]. In the later developmental phases, it pneumatizes inferiorly under the direction of the permanent dentition's eruption pathway. The major purpose of the maxillary sinus is to humidify and warm the inspired air, as well as to inhibit microbe entrance by mucociliary activity. A putative evolutionary role could be to act as a 'crumple zone' following trauma, shielding the brain.

With a volume of around 15 cm and a form like a rectangular pyramid, the adult maxillary sinus's base is located adjacent to the nasal cavity, and its top extends towards the zygomatic process. The orbital floor constitutes the sinus ceiling, across which passes the infraorbital neurovascular bundle [2]. The maxillary sinus's anterior wall is the weakest of its walls, and the canine fossa arises from the thinnest part above the canine. It is perforated by the larger palatine nerve and the infraorbital nerve, which supply the maxillary sinus. The maxillary molar anatomical root structures, the hard palate, and the maxillary alveolar bone are among the invaginations that correlate to the inferior wall's most diverse form.

The quantity of bone separating the dental roots can range from complete absence to thicknesses of up to 12 mm [2]. Maxillary sinus augmentation (sinus floor elevation) operations are becoming increasingly popular before implant implantation in posterior maxillae that have sustained considerable bone loss owing to sinus pneumatization, alveolar bone atrophy, or trauma. Hilt Tatum exploited the maxillary sinus cavity in the 1970s to augment accessible bone with graft material, allowing for increased implant-to-bone contact area once the bone graft developed [3]. This is not the same as the maxillary sinus lift grafting procedure described and designed by Boyne and James [4]. Other publications on various grafting materials and adjustments to their technique were published [5].

Results and Discussion

The architecture of the respiratory epithelium is composed of ciliated columnar, basal, and goblet cells found in the maxillary

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sinus. Compared to the rest of the respiratory system, the sinuses have fewer ciliated and goblet cells, friable epithelium, and seromucous cells, which leaves them susceptible to pathogenic microorganism infiltration and related disorders. The sinuses' secretions are cleaned by a mix of ciliary and mucous activity. Ninety-six percent of the water released by the goblet cells is made up of immunoglobulins, glycoproteins, histamines, lactoferrin, prostaglandins, and lysozymes [6]. Capturing foreign bodies and preventing bacterial invasion are the two goals of sinus secretions. Additionally, ciliary motion is added, which works against gravity by promoting a spiral action of mucous flow by actively transporting from the sinus base to the natural ostium in the supero-posterior region of the medial sinus wall.

A complex biofilm of sterile aerobic and anaerobic organisms, including bacteria, makes up the typical flora of the maxillary sinus. This biofilm is located inside the sinus mucus layer. The most prevalent ones are staphylococci, Haemophilus species, and aerobic B-hemolytic streptococci [7].

Low bone quality, maxillary sinus pneumatization, and alveolar procedure atrophy sometimes make implant placement in the posterior maxilla challenging or impossible. Therefore, it is often necessary to do vertical alveolar ridge augmentation prior to or concurrently with implant insertion. A number of surgical techniques have been suggested to accomplish the required vertical height of the alveolar procedure for the insertion of implants long enough. These techniques include maxillary sinus floor augmentation using the lateral window method, osteotome-mediated sinus floor elevation, and sinus membrane elevation without the need for a graft. However, the best surgical method for oral rehabilitation of the atrophic posterior maxillary ridge with implants depends on a variety of factors, including the vertical height of the remaining alveolar bone, the local intrasinus architecture, and the number of teeth to be changed [8].

Autograft, allograft, xenograft, alloplastic, and growth factors have all been applied for maxillary sinus floor augmentation, and the choice of the optimum graft material has been a topic of controversy over the years. An autogenous bone graft is regarded as the gold standard in augmentation procedures due to its osteoinductive, osteogenic, and osteoconductive characteristics [9]. Conversely, the use of autogenous bone transplants carries a risk of graft resorption that is unexpected and donor site morbidity [10, 11]. Because of this, a variety of synthetic or biological bone replacements are being utilized more often to streamline surgical operations by minimizing the need for bone harvesting [12].

Individuals who need augmentation greater than 3 mm are often good candidates for a sinus lift performed through the lateral maxillary window [13]. The lateral window sinus lift is favored over the transrectal sinüs lift when a significant amount of bone is required for implant insertion. To reach the desired implant osteotomy position, an incision is made across the alveolar crest from the maxillary midline. To allow for closure on sound bones, the incision should be made further than the osteotomy site. Keep surgical access guidelines and clear imagery in mind while performing the osteotomy.

A dental bur or a piezoelectric tool is used to construct an oval or rectangular osteotomy across the wall of the lateral maxillary sinus [13]. Avoiding puncturing the sinus membrane while performing this surgery is crucial. After the lateral window is formed, the sinus membrane is peeled from the sinus floor and the surrounding walls. After that, the bone graft is placed under the sinus membrane.

With the implant being at least 10 mm long, the surgeon should aim for 12 mm of bone following the sinus lift. Throughout the healing process, bone resorption is taken into consideration by the few millimeters of extra bone. Resorbable sutures are used to largely seal the wound after the bone graft is placed. Healing after a maxillary sinus augmentation treatment requires about six months.

Platelet Concentrates

Since the 1980s, platelet concentrates have been employed in dentistry to improve clinical outcomes. To produce platelet-rich fibrin (PRF), the patient's blood is centrifuged without any anticoagulant [14]. The patient benefits from improved bone and wound healing capability. The disadvantages may include patient discomfort during blood sampling, additional financial charges, and a lengthier surgery period. According to Ortega-Mejia and colleagues' comprehensive evaluation, using PRF in sinus augmentation procedures did not substantially increase bone growth. According to the review, using PRF may improve the healing duration and bone development after sinus augmentation.

Complication and Its Management

Examining the patient's medical history is essential, as it has a direct bearing on issues that arise after surgery. The practitioner is looking for particular data, including whether the patient has uncontrolled diabetes mellitus and other probable immunodeficient illnesses, as these health issues may interfere with wound healing and decrease the likelihood of the dental implant's ultimate osseointegration [14]. In addition, it is recommended that patients who have been using denosumab or bisphosphonates see their doctor. Two further conditions that would require a doctor's advice are radiation treatments to the head and neck area and chronic liver disease [14]. The patient's use of cocaine and alcohol raises additional critical medical concerns. While cocaine users are more likely to get sinus and nasal pathway injuries, persistent alcohol drinkers are more likely to experience postoperative bleeding. Lastly, it is advised that patients who smoke give up a week prior to treatment and refrain from smoking for eight weeks following the one-stage procedure that includes the placement of a dental implant. This will help to increase the likelihood that the osseointegration will be successful.

Conclusion

With a high implant survival rate, osteotome-mediated sinus membrane elevation provides a predictable and dependable technique for oral rehabilitation of the atrophic posterior maxilla. However, there are few long-term investigations, and installing short implants (6 mm) drastically reduces implant survival. As a result, osteotome-mediated sinus membrane elevation is typically indicated when there is a residual vertical alveolar bone height of more than 6 mm. If greater intra-sinus bone growth is required for implant insertion with a desired length, an autogenous bone graft or bone substitute can be used.

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