International Journal of Science and Research (IJSR)
ISSN: 2319-7064
Impact Factor 2024: 7.101

Sinus Augmentation in the Atrophic Posterior Maxilla: Combined Use of Magnetic Mallet and Hydraulic Lift Technique

Dr. Farrukh Faraz[1], Dr. Anshika Maheshwari[2], Dr. Arundeep Kaur Lamba[3], Dr. Shruti Tandon[4]

[1]Department of Periodontology and Implantology, Maulana Azad Institute of Dental Sciences, New Delhi, India

[2]Post Graduate Resident, Department of Periodontology and Implantology, Maulana Azad Institute of Dental Sciences, New Delhi, India
Corresponding Author Email: *anshika.maheshwari2407[at]gmail.com*

[3]Department of Periodontology and Implantology, Maulana Azad Institute of Dental Sciences, New Delhi, India

[4]Department of Periodontology and Implantology, Maulana Azad Institute of Dental Sciences, New Delhi, India

Abstract: ***Minimally invasive sinus lift techniques are increasingly preferred for their reduced morbidity and faster recovery. Implant placement in the posterior maxilla becomes challenging with limited residual bone height. Although direct sinus lift procedures are effective, their invasiveness restricts routine use. Advances such as the Magnetic Mallet and hydraulic sinus lift have introduced less invasive, predictable alternatives. This case report describes a minimally invasive sinus lift using a combination of Magnetic Mallet and hydraulic techniques in a patient with inadequate vertical bone height. The combined approach enabled precise sinus membrane elevation, minimized surgical trauma, and achieved successful implant placement with favourable postoperative healing, highlighting the synergistic benefits of these modern techniques.***

Keywords: Sinus Floor Augmentation, Maxilla, Dental Implantation, Endosseous

1. Introduction

Implant placement in the posterior maxilla is often complicated by sinus pneumatization and ridge resorption, leading to limited bone height [1]. While indirect sinus lift is less invasive than the lateral window technique, it still poses a risk of membrane perforation in atrophic maxillae [2]. The Magnetic Mallet (Osseotouch, Italy) uses magneto-dynamic technology to deliver controlled, high-precision impacts for crestal sinus lifts [3] [4]. The hydraulic sinus lift technique, introduced by Chen and Cha, utilizes hydraulic pressure for gentle membrane elevation [5] [6]. This case uniquely combines both approaches to achieve a minimally invasive, precise sinus lift with enhanced safety and predictability [7] [8].

2. Case Presentation

A 28-year-old male patient presented to the Department of Periodontics and Oral Implantology with missing teeth in the upper posterior region and sought dental implant replacement [Figure 1]. Clinical and radiographic evaluations, including CBCT, revealed insufficient vertical bone height of 3.1 mm [Figure 2]in the posterior maxilla due to sinus pneumatization, necessitating a sinus augmentation procedure. According to the classification given by Misch patient came under SA-4 category which required direct sinus augmentation which was otherwise a traumatic procedure.

Given the patient's preference for minimally invasive techniques and faster recovery, an indirect sinus lift using the Magnetic Mallet system [Figure 3] combined with a hydraulic sinus lift was planned. The patient's medical history was unremarkable, and after a thorough examination and treatment planning, he was informed about the procedure to allow implant placement. Potential complications, and postoperative instructions were explained to the patient. Informed written consent was obtained prior to the procedure. Standard aseptic protocols were followed throughout the treatment.

Figure 1: (a) Preoperative intraoral photograph – Lateral view, (b) Preoperative intraoral photograph – occlusal view

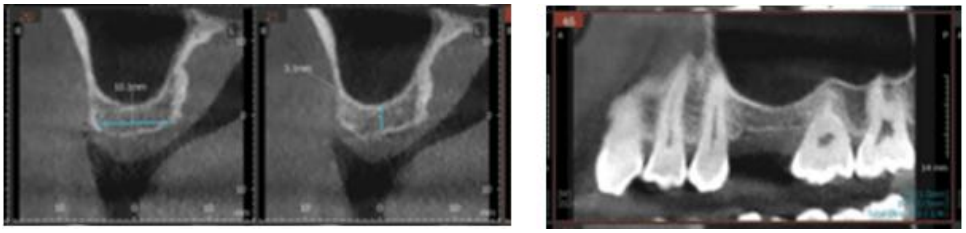

Figure 2: (a) CBCT revealed horizontal and vertical bone measurements, (b) CBCT revealed sinus pneumatization.

Surgical Method

1) Local anaesthesia was administered using 2% lignocaine with 1:100,000 epinephrine to ensure adequate anaesthesia and haemostasis in the maxillary posterior region.
2) A mid-crestal incision was made in the edentulous area. A full-thickness mucoperiosteal flap was reflected to expose the alveolar ridge.
3) Osteotomy was initiated with a pilot drill up to 2mm and sequentially enlarged to just 1mm short of the sinus floor under copious saline irrigation.
4) Upon reaching close proximity to the sinus floor, an indirect sinus lift was initiated using a combination of:
   Magnetic Mallet Technique- Magneto-dynamic osteotomes attached to the Magnetic Mallet were used to fracture the sinus floor osteotome with tip diameter of 2mm, at length 4mm and further sinus elevation was done using osteotome with tip diameter 3 at 6 mm, 3.4 at length 8mm, 3.6 at 10mm length elevate the sinus membrane in a controlled, atraumatic manner, reducing the risk of perforation.

Hydraulic Sinus Lift Technique

A sterile saline syringe was used to gently elevate the Schneiderian membrane from all sides by applying slow hydraulic pressure. Approximately 0.2–0.3 cc of saline was sufficient to lift the membrane by 3 mm.

1) The elevated sub antral space was grafted with a DFDBA bone graft material.
2) A dental implant (osstem) of size 4*10mm dimensions was placed with good primary stability.
3) The surgical area was irrigated with sterile saline and the flap was repositioned and sutured using 3-0 non-resorbable sutures.
4) The patient was given standard postoperative instructions and prescribed antibiotics, analgesics, and 0.12% chlorhexidine mouthwash.

Figure 3: (a) Armamentarium, (b) Magnetic Mallet, (c) Osteotomes

Figure 4: (a) Bone osteotomy prepared with magnetic mallet, (b) Sinus membrane elevation with hydraulic lift, (c) DFDBA was placed, (d) Implant placed, (e) Cover screw placed, (f) R/G image shows implant placement.

Figure 5: (a) Postoperative intraoral photograph – Lateral view, (b) Postoperative intraoral photograph – occlusal view

3. Discussion

The use of magneto-dynamic technology in sinus lift procedures marks a significant advancement in minimally invasive oral surgery. Utilized by the Magnetic Mallet, this technology employs rapid acceleration to reduce impact duration while maximizing force and efficiency [9]. By generating precise, repeatable force through magnetic fields, it minimizes tissue trauma and lowers the risk of complications like membrane perforation. Its controlled power allows safer handling of delicate structures, enhancing surgical precision [10]. In trans crestal sinus elevation, this results in a more predictable and atraumatic sinus floor elevation, improving both operator control and patient outcomes.

It consists of a handpiece connected to a power control unit, which delivers controlled forces based on precise timing. Different surgical inserts can be attached to the handpiece, transmitting shock waves at the tip according to the specific procedure. The device offers four selectable force settings—75, 90, 130, and 260 daN with each impact delivered over an extremely short duration of 80 microseconds [11].

Indirect sinus lift using hydraulic pressure technique has advantages over other methods of sinus lifting including predictable implant survival rates, acceptable bone healing, simultaneous implant placement possibility, lesser membrane rupture, and is a more conservative approach [12].

In our case, the pre-operative CBCT scan showed that the available bone height was only 3.1 mm, which would normally require a direct sinus lift. However, by using a combination of the Magnetic Mallet and the hydraulic technique, we were able to safely increase the bone height to 7 mm without damaging the sinus membrane. This allowed us to successfully place a 4×10 mm dental implant.

Felix et al. (2022) [13] demonstrated that using a hydraulic lift system with alloplastic phosphosilicate putty resulted in predictable implant placement with minimal membrane perforation and bone loss. In their clinical study, Gopi and Anup (2023) [14] reported that the Magnetic Mallet improved osseointegration and reduced sinus membrane rupture in indirect sinus lift procedures. Albassal et al. (2024) found that combining the Magnetic Mallet with piezo surgery led to stable implant integration and minimal discomfort in narrow mandibular ridges. This combination offers a less invasive, more controlled, and patient-friendly approach compared to traditional lateral window or osteotome techniques, particularly when bone height is insufficient but membrane integrity is preserved. However, limitations include the need for operator training, specialized equipment, and higher costs, which may limit its availability. Despite these challenges, the combination of the Magnetic Mallet and hydraulic sinus lift presents a promising, minimally invasive technique for implant placement in challenging posterior maxillary sites. Further studies with larger sample sizes and long-term follow-up are needed to validate its efficacy across diverse anatomical situations.

4. Conclusion

The combined use of Magnetic Mallet and hydraulic pressure technique represents a safe, minimally invasive, and effective approach for indirect sinus lift in cases with limited vertical bone height. This technique offers enhanced surgical control, reduced risk of membrane perforation, and allows for predictable implant placement with improved patient outcomes. While it requires operator expertise and specialized equipment, its clinical benefits make it a valuable alternative to traditional sinus lift methods, especially in anatomically challenging cases.

References

[1] Morand M, Irinakis T. The challenge of implant therapy in the posterior maxilla: providing a rationale for the use of short implants. J Oral Implantol. 2007;33(5):257-266.
[2] Summers RB. A new concept in maxillary implant surgery: the osteotome technique. Compend Contin Educ Dent. 1994 Feb;15(2):152-158. PMID: 8055503
[3] Bennardo F, Barone S, Vocaturo C, Nucci L, Antonelli A, Giudice A. Usefulness of Magnetic Mallet in Oral Surgery and Implantology: A Systematic Review. *J Pers Med.* 2022 Jan 14;12(1):108. doi: 10.3390/jpm12010108. PMID: 35055423; PMCID: PMC8781210.
[4] Visale K, Manimala V, Vidhyasankari N, Shanmugapriya SV. Magnetic mallets – A stroke of luck in implantology: A review. *J Acad Dent Educ.* 2021;7(1):6-9.
[5] Chen L, Cha J. An 8-year retrospective study: 1,100 patients receiving 1,557 implants using the minimally invasive hydraulic sinus condensing technique. *J Periodontol.* 2005 Mar;76(3):482-91. doi: 10.1902/jop.2005.76.3.482. PMID: 15857085.
[6] Manekar VS. Graftless crestal hydraulic sinus lift with simultaneous implant insertion. *Natl J Maxillofac Surg.* 2020 Jul–Dec;11(2):213-218. doi: 10.4103/njms.NJMS_38_19.

[7] Sotirakis EG, Gonshor A. Elevation of the maxillary sinus floor with hydraulic pressure. J Oral Implantol. 2005;31(4):197-204.
[8] Gasper L. Use of the magnetic mallet in bone-shaping and implantology: a technical report. Ital J Dent Med [Internet]. 2019 [cited 2020 Sep 5]
[9] Bennardo F, Barone S, Vocaturo C, Nucci L, Antonelli A, Giudice A. Usefulness of Magnetic Mallet in Oral Surgery and Implantology: A Systematic Review. J Pers Med. 2022 Jan 14;12(1):108. doi: 10.3390/jpm12010108. PMID: 35055423; PMCID: PMC8781210.
[10] Jha N, Choi EH, Kaushik NK, Ryu JJ. Types of devices used in ridge split procedure for alveolar bone expansion: A systematic review. PLoS One. 2017 Jul 21;12(7): e0180342. doi: 10.1371/journal.pone.0180342. PMID: 28732054; PMCID: PMC5521746.
[11] *Visale K, Manimala V, Vidhyasankari N, Shanmugapriya SV. Magnetic mallets – A stroke of luck in implantology: A review. J Acad Dent Educ 2021;7(1):6-9.*
[12] Choudhary S, Bali Y, Kumar A, Singh V, Singh R, Nayan K. Outcomes Following Hydraulic Pressure Indirect Sinus Lift in Cases of Simultaneous Implant Placement With Platelet-Rich Fibrin. Cureus. 2022 Aug 16;14(8):e28087. doi: 10.7759/cureus.28087. PMID: 36127961; PMCID: PMC9478408.
[13] Felix CBP, Kurien A, Devanarayanan A, Kumar D, Thirumurthy VR, Bindhoo YA. Subantral sinus augmentation using hydraulic lift system and alloplastic phosphosilicate putty followed by simultaneous implant placement for the rehabilitation of an atrophic posterior maxilla: A case report. *J Clin Transl Res.* 2022 Feb 7;8(2):86-92. PMID: 35392123; PMCID: PMC8983394.
[14] Gopi A. Magnetic mallet for indirect sinus lift and simultaneous implant placement: A retrospective study. *J Dent Defens Sect.* 2023 Jul–Dec;17(2):66-70. doi: 10.4103/jodd.jodd_22_23.