

**MANAGEMENT OF THE POSTERIOR MAXILLA WITH SINUS LIFT USING
HYDRAULIC LIFT SYSTEM: A CASE REPORT****¹Dr. Neelam Mishra, ²Dr. Prajakta Rao, ³Dr. Prakash Talreja, ⁴Dr. Varsha Rathod and ⁵Dr. Aishwarya Kubal**¹PG Student, Periodontology, Primary Researcher,²MDS Periodontics, Professor and Guide,³MDS Periodontics, Associate Professor,⁴MDS Periodontics, HOD and Professor,⁵PG Student, Periodontology,

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ABSTRACT

The maxillary sinus enlarges in the long run after tooth loss in the posterior maxilla and makes implant placement more complex when combined with crestal resorption.^[1] Maxillary sinus augmentation becomes necessary to provide adequate bone height volume to place implant fixtures.^[1] In this case report, a 42-year-old man reported to the department with grossly decayed tooth with 13,14, 23,24 and history of extraction with 15,16,25,26. Preoperative radiographs revealed inadequate bone height with 15,16 and 25,26. Extraction was done with 13,14,23,24 and sinus lift was planned for 15,16 and 25,26 using hydraulic lift system followed by implant placement with 13,15,16 and 23,25 and 26. Maxillary sinus was well augmented with the bone graft material which lead to increase in vertical height of maxillary bone. This aided in placement of implants. The hydraulic lift system: Crestal approach sinus (CAS KIT) provides an alternative, lower-risk method for sinus lift when compared to conventional technique.

KEYWORDS: Maxillary sinus augmentation, Hydraulic lift system, Crestal approach sinus (CAS KIT).**INTRODUCTION**

The success of dental implant depends on many factors and it has been vastly reviewed in many studies. An important criterion for successful implant is presence of adequate quantity and quality of bone. The edentulous posterior maxilla presents with challenges to implant surgeon, it is even more challenging when edentulous span is more. It is unique as compared to other regions of mouth due to presence of maxillary sinus.^[2]

After tooth extraction or after loss of posterior teeth, subsequent maxillary sinus pneumatization results in atrophy of the alveolar bone which can affect the proper rehabilitation of patients. The resorption of the buccal bone plate leads to initial decrease in bone width. As the edentulous area continues to resorb, there is a continuous loss of bone height and density and an increase in antral pneumatization. This causes challenges in implant fixture placement.^[3]

To overcome these challenges, maxillary sinus lift surgery (also known as maxillary sinus floor augmentation surgery) has become a popular therapeutic option.

Maxillary sinus augmentation was introduced by introduced by Tatum in 1977 and was published as a clinical study by Boyne and James in 1980.^[2]

This procedure is suitable for the rehabilitation of both a posterior tooth and a completely edentulous maxilla in regions with loss of alveolar bone and sinus pneumatization.

Two approaches are commonly used for this procedure

1. The lateral window technique (direct approach/technique)
2. The osteotome intrusion technique. (crestal approach/indirect technique)

After introduction of crestal approach, which is known as the osteotome technique, it gained popularity among physicians since it offers several benefits over the lateral approach (direct sinus lift).

The crestal technique is less aggressive than the lateral approach, as well as is easier and requires less time for wound healing. However, the crestal approach using osteotomes has numerous limitations; it is entirely

dependent on the clinician's competence and creates ringing in the brain when striking the mallet within the sinus and the risk of maxillary sinus membrane perforation increases during malleting. It may also result in problems such as headache and dizziness following the sinus lift operation.

Therefore, various surgical procedures and devices have been developed to overcome the shortcomings of the osteotome technique. Among them, a device that employs hydraulic pressure to elevate the sinus membrane has been proven; to have a minimal risk of sinus membrane perforation and is simple to operate. Some companies have devices for the crestal approach sinus lift operation, which involves a specific drilling method and hydraulic pressure.^{[5],[6]}

In this case, the crestal approach sinus (CAS) kit of Osstem was used, which uses the previously mentioned

hydraulic lift mechanism in combination with a drill.

Surgical Procedure

A 42-year-old man reported to the department with grossly carious teeth with 13,14, 23,24 and missing teeth with 15,16,25,26. Preoperative radiographs (fig 1.1) revealed inadequate bone height with 15,16 and 25,26.

Initially case history of the patient was recorded and thorough clinical evaluation was carried out. In preliminary treatment phase extraction was advised with 13,14,23,24 which was followed by the phase I therapy. After studying the CBCT, dental implant placement was planned with 13,15,16,23,25, and 26 along with, maxillary sinus lift for 15,16,25, and 26 uses a hydraulic lift system (CAS kit).

The 1st quadrant was named as site 1 (13,15,16) and 2nd quadrant was named as site 2 (23,25,26).



Fig 1.1: Cone Beam Computed Tomography (CBCT)



Fig 1.2: Clinical pre-op image

SITE: 1

Local anaesthetic was administered in the operative area and a crestal incision was made along the alveolar crest, and the full thickness flap was elevated. According to the manufacturers guideline, first the twist drill with a

diameter of 2.0 mm was selected to drill 2.0 mm within the alveolar bone, for safer drilling a stopper was connected to twist drill before the drilling was initiated. The recommended drilling speed of 800 rpm was used. (Fig 1.3).

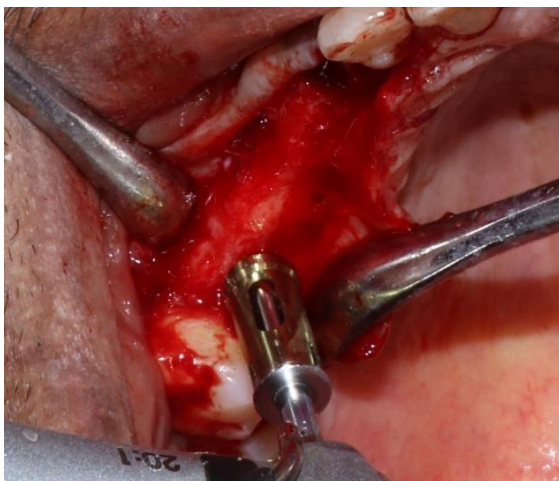


Fig 1.3 – Drilling with stopper connected



Fig 1.4 - Autograft incorporated in the drill head

After first drilling was complete, the diameter of the drill was subsequently increased in consecutive order with the stopper still connected to it (changed according to drill

size), considering the diameter of the implant to be placed in the area 15 and 16 which was upto 4 mm.

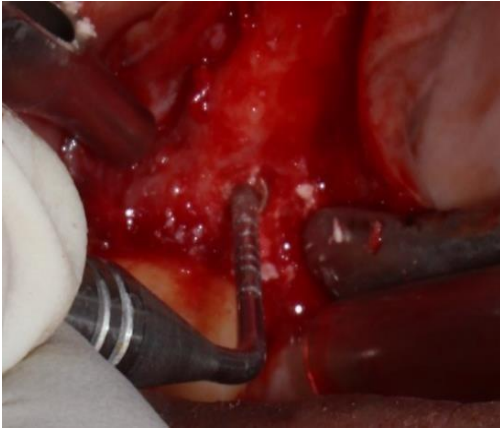


Fig 1.6- Measuring gauge to check drilling depth



Fig 1.7 - Hydraulic lifter with saline

While drilling autograft was collected inside the drill head as it has a specific conical shape to it, which was later used for augmentation. (fig 1.4)

A dip was felt after the final drill, indicating that the sinus membrane was reached. Then, a depth gauge was inserted to check the penetration through the maxillary sinus membrane. (fig 1.6). The hydraulic lifter was inserted into the drilled socket and 0.3 ml saline solution was injected slowly with the 1.0-ml syringe to elevate the maxillary sinus membrane, after the sinus was lifted the saline was aspirated back to the syringe. (fig 1.7)

The area was then filled with bone graft material using a bone carrier and a bone condenser. The grafts used for augmentation were autograft (which was retrieved during drilling), and xenograft. (Fig 1.8) The bone graft material was compacted to the lateral portion and tapped within the sinus with a mallet.

A 5mm sinus lift was performed in both the socket (15 and 16). Implant of size 3.75×10mm and 4.2×8mm was placed in the region 15 and 16 respectively using the self-tapping method, and the cover screw was placed. Followed by Implant placement in the region 13. Finally, the elevated flap was sutured back using 3-0 sutures.



Fig 1.8- Autograft and xenograft



Fig 1.9 - Implant placed in 16

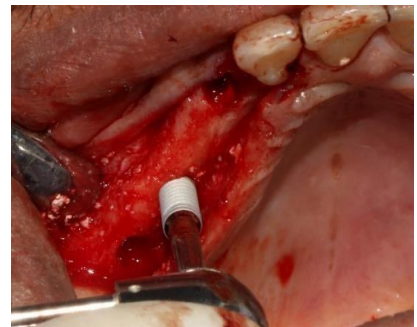


Fig 1.10- Implant placed in 15

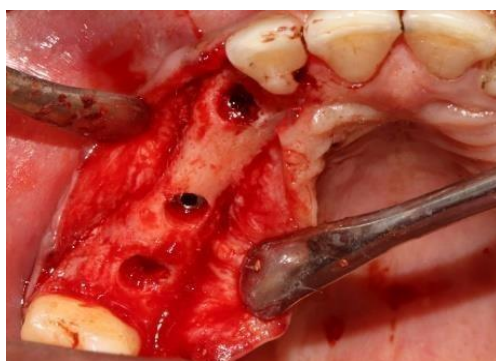


Fig 1.11 - Implant placed in 13,15,16



Fig 1.12 - Suturing done

SITE: 2

Same procedure was repeated for 2nd quadrant for the sinus lift of 25 and 26 followed by implant placement with 23, 25 and 26. (Fig 2.1- 2.9)

Post-operative instructions were given and medications were prescribed, patient was recalled after 10 days for suture removal and follow up.

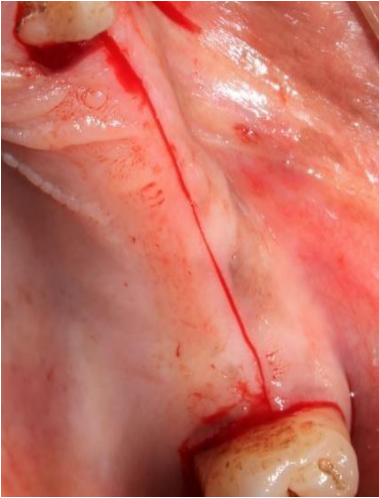


Fig 2.1- Crestal incision



Fig 2.2 - Flap reflection



Fig 2.3-Drilling with stopper connected



Fig 2.4 - Hydraulic lifter



Fig 2.5 - Bone grafts (autograft+xenograft)



Fig2.6-Graft placement

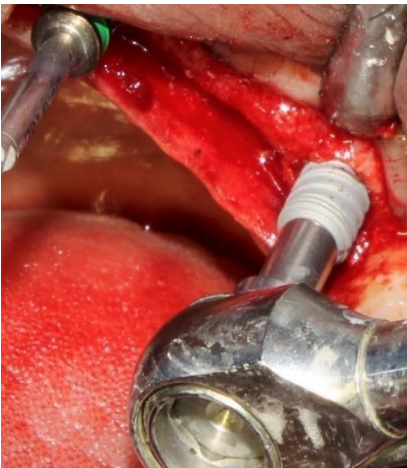


Fig 2.7 - Implant placement with 26

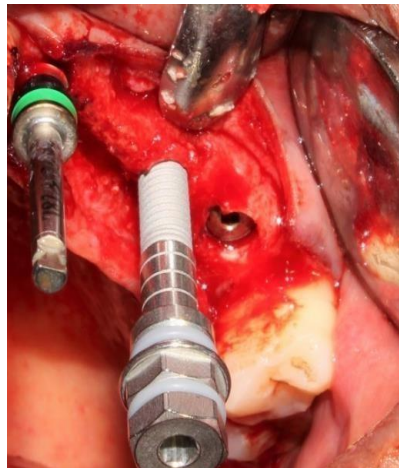


Fig 2.8 - Implant placement with 25

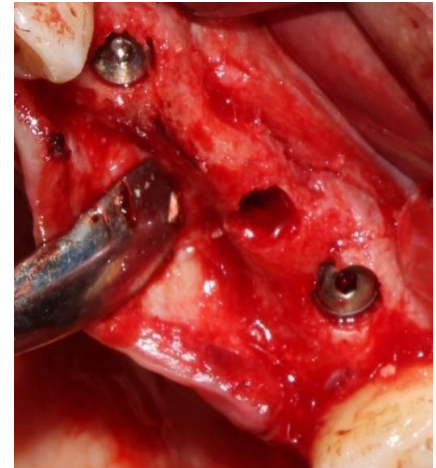


Fig 2.9 - Implants placed with 23,25,26

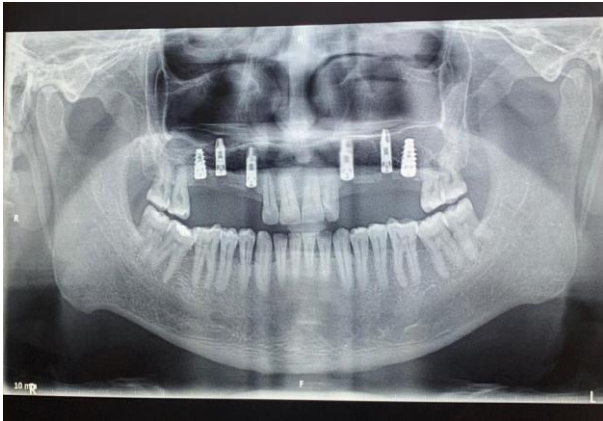


Fig. 2.10 -2 weeks post-operative OPG.

Two week post-operative: Patient presented with no post-operative complications; healing was uneventful, maxillary sinus was well augmented with the bone graft material which resulted in increased vertical height of maxillary bone. This facilitated the insertion of implants of the desired length.



Fig 2: 11-3 months post-operative OPG.

Three months post-operative: All implants have Osseo integrated well, and bone formation was even seen over the cover screw.

DISCUSSION

The sinus lift is a necessary procedure for managing atrophic edentulous posterior maxilla before placement of implants. This procedure has been well established in clinical implant dentistry with many different techniques and modifications. The pneumatized sinus with thin wall is difficult to manage during implant placement which had led to the development of technique called "Sinus lift Procedure." This technique was proposed by Tatum in 1977.^[2]

There are basically two approaches: lateral approach and crestal approach. Initially in 1980 Boyne and James performed the conventional sinus augmentation procedure which involved the direct visualization and manipulation of the Schneiderian membrane, through the lateral window osteotomy. They did >10mm bone augmentation through lateral approach in the atrophic maxilla which sometimes led to significantly higher

post-surgical morbidity and an increased risk of membrane perforation.^[7] As this procedure is invasive, it sometimes resulted in postoperative problems such as bleeding, edema, and membrane perforation.

Therefore, crestal approach sinus lift surgery was introduced which had lower risk and it could be performed with different techniques and different bone-grafting materials, such as allograft, autogenous bone, and platelet derivatives themselves or combined with grafting materials, in order to combine the properties of the growth factors.

There are different techniques which can be performed for indirect sinus lift such as, Summer's technique, balloon technique, intralift system etc.^[8]

In Summers technique which was introduced in 1994, he used osteotome for sinus floor elevation which is also a minimally invasive technique. This technique allows localized maxillary sinus elevation through the alveolar crest, but it has been proved to be effective only when the crestal boneheight is more than 6 mm.^[4]

However, inspite of all benefits, if the osteotome technique is utilised incorrectly, it might result in compressive necrosis or cortical bone fracture, and as a result, patients may experience headaches or inner ear damage following a sinus lift treatment. In addition, because of the limited view of the surgical field during the entire procedure, the osteotome technique thoroughly depended on the dentists' skill set. Because the osteotome technique may sometimes perforate the maxillary sinus membrane or form an excessive bony cavity at the implant placement area, there is a risk of instability of the implant in the initial stage as well as postoperative complications.^[9]

Lalo et al. proposed a device for reducing the sinus membrane perforation by an osteotome and drilling with a stopper,^[10] whereas Tilotta et al. introduced a surgical procedure using an osteotome equipped with a trephine bur and stopper.^[11]

Comparatively, the indirect sinus lift technique has many advantages over lateral open approach, as it is more conservative, lesser risk of sinus membrane rupture, simultaneous implant placement can be done, better bone healing, better positioning of bone grafting material and high predictable implantsurvival rate.^[3]

In this case the sinus membrane was elevated via a crestal approach using the hydraulic sinus lift method, which is characterised by the hydraulic detachment of the mucosa with the use of injection of a saline via spontaneous expulsion or aspiration, and simultaneous filling of the sub Schneiderian space with solid or semisolid grafting material.

Hiossen's Crestal Approach Sinus KIT (CAS-KIT) is

specifically designed for easy and safe lifting of the membrane in the maxillary sinus from a crestal approach. The main component of the CAS- KIT is the CAS-Drill, which has a unique design which helps to enhance convenience and safety of maxillary sinus surgery by; safely lifting the membrane while drilling, precision cutting, flexible cutting speed from low to high speed (800rpm), formation of conical shaped bone chip, generation of bone particles, smooth & stable insertion, easy path correction and septum surgery. It comes with a hydraulic Lift System that easily & safely lifts the membrane with the help of saline. It is a simple and intuitive surgical system.^[12]

In a survey done by Yong Kyun Kim in 2013, 75.0% of dentists routinely used the hydraulic lifter for hydraulic sinus membrane elevation.^[12]

CONCLUSION

Crestal approach sinus lift using CAS kit was safe and comparatively easy procedure. It is a user- friendly kit, also there was less trauma which led to uneventful healing and no post-operative complications. Alveolar bone height was increased which facilitated the placement of desired length of implants and as compared to the lateral approach technique, indirect sinus lifting technique is safer and it presents with predictable success rates when selecting the cases for appropriate procedure. Other methods such as Peizosurgery which is considered to be one of the safest method for sinus lift.^[13] Newer methods are currently used such as Densah burs which facilitates conservative approach to manage posterior maxilla poor bone quality and achieve sinus lift.^[14,15] As there is insufficient literature to support this as an ideal procedure, for maxillary sinus lift; more longitudinal studies need to be carried out to decide as to which out of the known procedures is best suited. All sinus lift procedures direct or indirect require sound knowledge of sinus anatomy, correct preoperative evaluation, diagnosis, proper surgical techniques, regular recalls, and review.

REFERENCES

1. Stern A, Green J. Sinus lift procedures: an overview of current techniques. *Dental Clinics of North America*. Jan 1, 2012; 56(1): 219.
2. Tatum Jr H. Maxillary and sinus implant reconstructions. *Dental Clinics of North America*, Apr 1, 1986; 30(2): 207-29.
3. Sathvik N, Nessapan T, Ganapathy D. Indirect sinus lift techniques: A literature review. *Drug Invention Today*, 2019; 11(2): 90-93.
4. Summers RB. A new concept in maxillary implant surgery: the osteotome technique. *Compendium (Newtown, Pa.)*, Feb 1, 1994; 15(2): 152-4.
5. Lopez MA, Bassi MA, Confalone L, Carinci F. Maxillary sinus floor elevation via crestal approach: the evolution of the hydraulic pressure technique. *Journal of Craniofacial Surgery*, Mar 1, 2014; 25(2): e127-32.
6. Tallarico M, Meloni SM, Khanari E, Pisano M, Cochran DL. Minimally Invasive Sinus Augmentation Procedure Using a Dedicated Hydraulic Sinus Lift Implant Device: A Prospective Case Series Study on Clinical, Radiologic, and Patient-Centered Outcomes. *International Journal of Periodontics & Restorative Dentistry*, Jan 1, 2017; 37(1).
7. Boyne PJ. Grafting of the maxillary sinus floor with autogenous marrow and bone. *Oral Surg*, 1980; 38: 613-6.
8. Abadzhiev M. Alternative sinus lift techniques. *J IMAB*, 2009; 2: 23-7.
9. Vazquez JC, de Rivera AS, Gil HS, Mifsut RS. Complication rate in 200 consecutive sinus lift procedures: guidelines for prevention and treatment. *Journal of Oral and Maxillofacial Surgery*, May 1, 2014; 72(5): 892-901.
10. Lalo J, Broukhris G, Djemil M, Beleh M. Technique sécurisée d'élévation du plancher du sinus maxillaire par voie crestale par ostéotome à «butée». *Implantodontie*, Apr 1, 2005; 14(2): 62-70.
11. Tilotta F, Lazaroo B, Gaudy JF. Gradual and safe technique for sinus floor elevation using trephines and osteotomes with stops: a cadaveric anatomic study. *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology*, Aug 1, 2008; 106(2): 210-6.
12. Kim YK, Cho YS, Yun PY. Assessment of dentists' subjective satisfaction with a newly developed device for maxillary sinus membrane elevation by the crestal approach. *Journal of periodontal & implant science*, Dec 1, 2013; 43(6): 308-14.
13. Pavlíková G, Foltán R, Horká M, Hanzelka T, Borunská H, Šedý J. Piezosurgery in oral and maxillofacial surgery. *International journal of oral and maxillofacial surgery*, May 1, 2011; 40(5): 451-7.
14. Rostom DA. Patient Perception and Radiographic Assessment of Sinus Lifting Procedure using Densah Bur versus Osteotome-mediated sinus lifting: A Randomized Clinical Trial. *Advanced Dental Journal*, Apr 1, 2021; 3(2): 0.
15. Taha TA. Evaluation for Primary Stability of Implant in closed sinus lifting cases using Densah bur Versus Osteotome in partially edentulous patients (A randomized Clinical Trial). *CU Theses*, 2020.