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Crestal Approach Sinus (CAS) kit: A novel technique for posterior maxillary rehabilitation: A case series of 10 prospective patients

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ABSTRACT

Rehabilitation of the posterior edentulous maxilla presents maxillofacial surgeons with many challenges. Sinus floor elevation is considered the milestone in the implant dentistry; however, it is associated with numerous complications. To overcome the complications, CAS kit (Crestal Approach Sinus) has been used in the following study. Ten subjects we enrolled in this pilot study using the CAS kit. The study sought to investigate incidence of sinus membrane perforation, implant stability, marginal bone loss and the area of bone regeneration. Each patient experienced satisfactory results with minimal complications. The invention of the CAS kit has the potential to prove suitability in overcoming the complications and disadvantages of conventional sinus floor elevation techniques.

Keywords: Sinus Lift, CAS kit, Osteotome, Atrophic Maxilla.

1. INTRODUCTION

Placement of the implant in the posterior atrophic maxilla was a dilemma for the dental surgeons due to its morphology and density. Challenges exist due to its close approximation of the teeth to the maxillary sinus. The basic principle for elevation of the sinus membrane is to decrease the amount of Residual Bone Height (RBH). Sinus Floor Elevation (SFE) was considered a transition in the field of implant dentistry for implant placement in posterior maxilla. The apical root resorption following tooth extraction combined with progressive sinus pneumatization leads to the urge of sinus lift procedures (Cawood and Howell, 1998). Multiple techniques exist for the sinus lift procedure that is used in day-to-day practice. Common techniques range from 'Bone added osteotome sinus floor elevation' technique (BAOSFE) to the Sinus floor elevation using inflatable balloon (Soltan and Smiler, 2005). More recent advances include the crestal approach sinus kit from OSSTEM (CAS Kit) (Figure 1).

Figure 1 CAS Kit

The objective of this series report is to explore the benefits and drawbacks of employing a CAS-kit in a posterior atrophic maxilla. The most common sinus lift procedure is the sinus membrane perforation. This approach often leads to post-operative discomfort for the patient. Crestal approach sinus lift technique was first introduced by Tatum and later modified by summers. Other authors have demonstrated several modifications in osteotome design such as intervening material like protein rich fibrin, with bone graft or without bone graft (Stelzle and Benner, 2011). This technique increases the primary implant stability by increasing peri-implant bone volume resulting from compaction of the bone instead of removing it (Lopez-Nino et al., 2012). However, the aggressive tapping of mallet often leads to nasal discharge, dizziness and headache postoperatively. To overcome these adverse effects including the sinus membrane perforation, changes have been made to the design of these instruments.

CAS kit was first introduced by the Korean implant company 'OSSTEM' for sinus floor elevation (SFE). The method for performing a conical osteotomy that simultaneously fracture the bone floor and elevates the sinus membrane using hydraulic pressure (Benavides et al., 2012). CAS kit provides high predictable outcome, minimal morbidity with accelerated bone gain all while decreasing the total working time (Younes et al., 2015). The present report involves five patients with implant placement by sinus lift using CAS- Kit. Their postoperative outcomes were assessed.

2. CASE PRESENTATION

Ten healthy patients were reported to the outpatient clinic with a chief complaint of missing teeth in the upper back region of the jaw. Clinical and radio graphical assessments were made using cone beam computed tomogram (CBCT) and a treatment plan of sinus floor elevation followed by implant placement using CAS kit technique was considered (Figure 2).

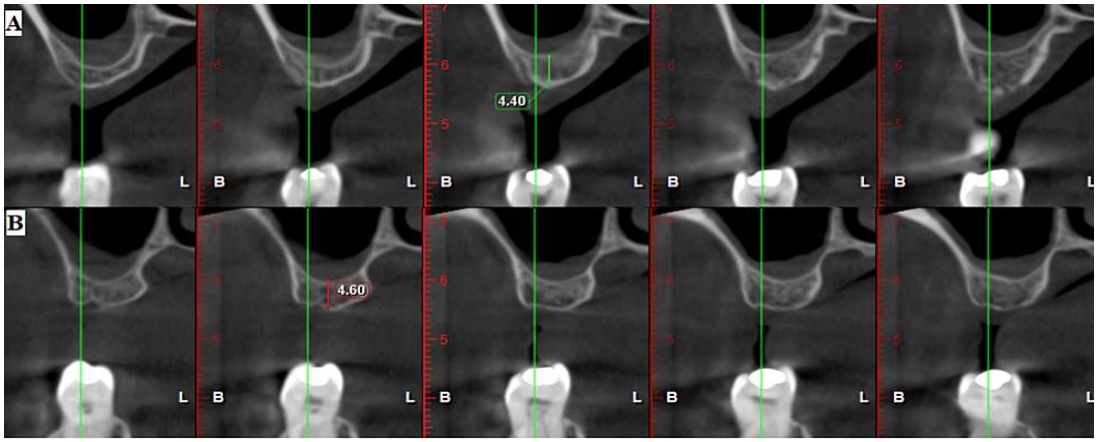

Figure 2 A: Pre-OP CBCT showing bone height with 16; B: Pre-OP CBCT showing bone height with 17

Routine haematological investigations and diagnostic impressions were made. The patient was prepared and a para-crestal incision was followed by full-thickness mucoperiosteal flap reflection was performed over the implant recipient site. The sinus lift with CAS kit was served with a 2mm twist drill with a stopper set 1-2mm inferior to the sinus floor. The diameter of the drill was increased to 2.8mm with a stopper in place at 400 to 800 rpm to avoid possible tearing of the membrane. The preparation of the sinus floor was assessed by using a depth gauge and the resiliency of the sinus membrane was evaluated. After confirming the intact sinus floor, a 2.8mm twist drill was used with a stopper 1mm longer until complete erosion of the floor was achieved. The hydraulic lifter was inserted into the drill hole and 1 to 3ml of saline solution was gently injected and retracted back into the sinus to elevate the Schneiderian membrane. After a confirmation sinus lift, the diameter of the drilling device was gradually increased with the connected stopper as per the diameter of the selected implant with a drill speed of no more than 800rpm.

Figure 3 Implant placement with 16,17 using CAS Kit technique

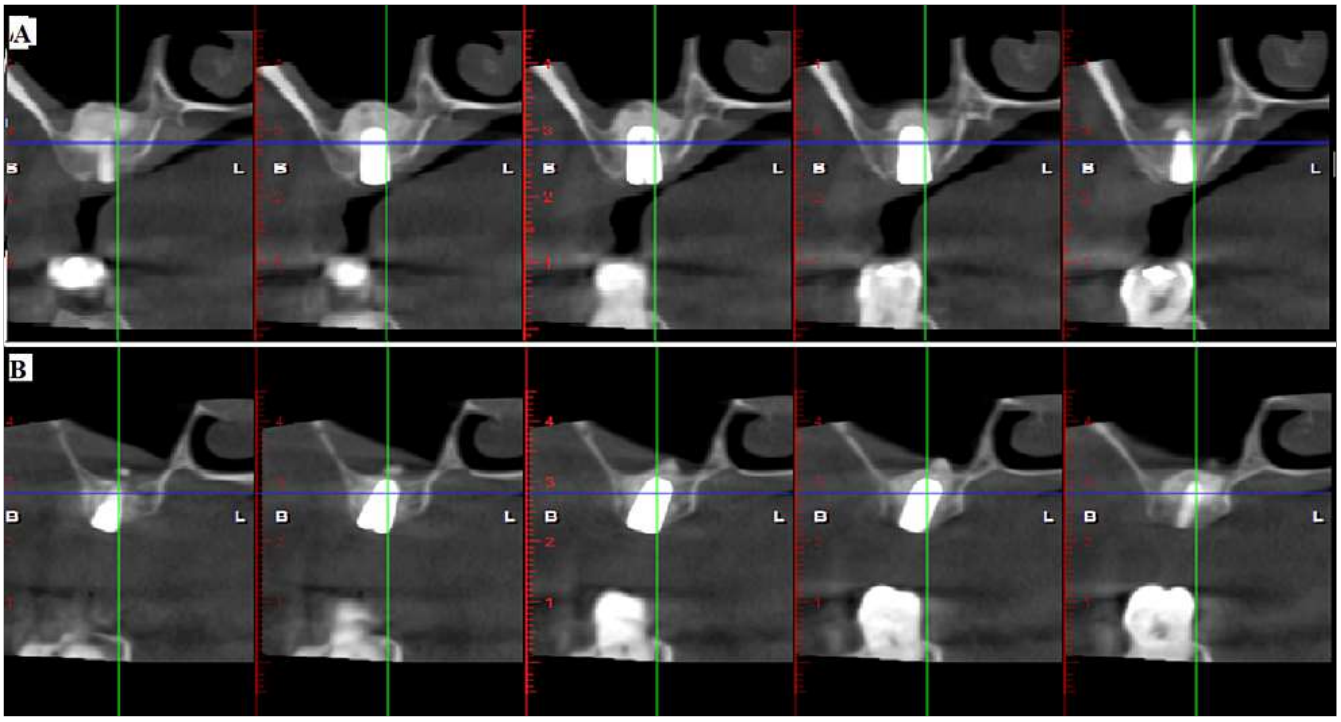

Figure 4 A: Implant placement with 16; B: Implant placement with 17

After completion of the sinus lift procedure, the integrity of the sinus was checked by the Valsalva maneuver. A self-tapping implant (osteom) of a specific diameter was placed into the prepared site by using a piezo motor connection at a speed of 15rpm and 30Ncm torque to submerge the implant. The cover screw was connected and the closure was completed (Figure 3). After three months, the second stage of implant surgery was performed by giving a mid-crestal incision, followed by exposing the full-thickness mucoperiosteal flap. The cover screw was replaced by using a suitable gingival former. The patient was recalled after ten days for an impression-making procedure. Each implant's stability was manually evaluated by a blind assessor by tightening the abutment screw to a 20Ncm torque. An individual crown with adjusted occlusion was delivered to each patient. Clinical photographs and CBCT were taken at regular follow-up at three-month intervals (Figure 4). Also, per operative and post-operative CBCT were evaluated for the amount of bone formation around the implant (Figure 5). The primary outcome measured was sinus membrane perforation, duration of surgery, implant stability, marginal bone loss and bone regeneration (Table 1). All the patients showed satisfactory outcomes with minimal adverse effects.

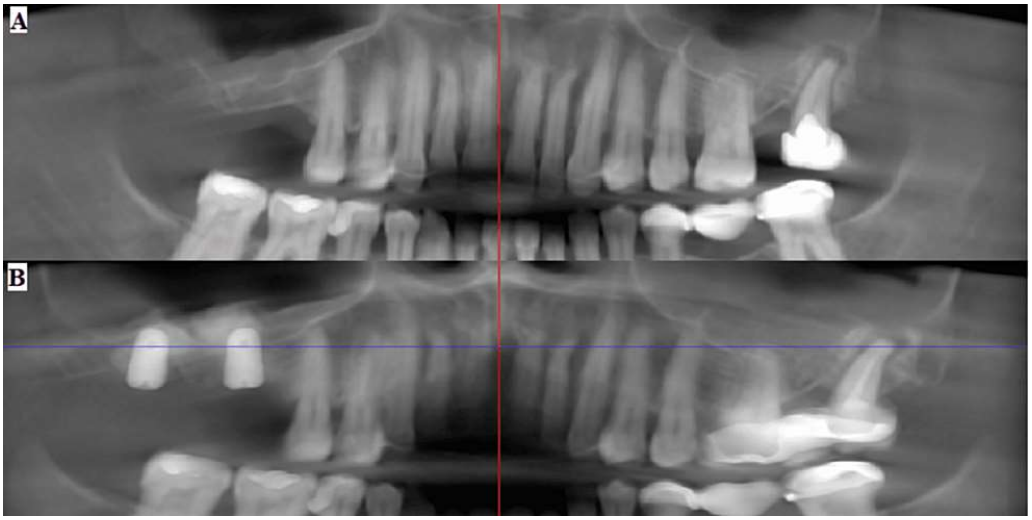

Figure 5 A: Pre-Operative OPG; B: Postoperative OPG showing implant placement 16; 17 with sinus lift technique using CAS kit

Table 1 Demographic detail of 10 patients

Sr. No.	Age (In Years)	Tooth No.	RBH in mm	Sinus Membrane Perforation	Duration of Surgery (In Minutes)	Amount Of Marginal Bone Loss (In mm)	Amount Of Bone Regeneration (In mm)	Primary Stability of Implant (In Ncm)
1	29	16,17	4.4,4.6	No	13	0	5.6	35
2	38	17	4.2	No	17	0	4.3	45
3	35	16	4.4	No	15	0.1	5.7	40
4	31	16	4.0	No	12	0	3.9	40
5	28	26	3.4	No	18	0.1	4.1	50
6	24	27	3.6	Yes	12	0	6.4	35
7	51	26	4	No	14	0	6	50
8	55	25	4.2	No	14	0	5.8	50
9	45	25	5.4	No	10	0	4.6	45
10	23	16	5	No	16	0	5	50

3. DISCUSSION

Implantation is the best modality for the rehabilitation of missing teeth. Rehab for the posterior atrophic maxilla is one of the most common and difficult procedures. In the maxillary sinus, there is a pyramidal-shaped structure near the posterior maxillary teeth. The apical root resorption following tooth extraction with progressive sinus pneumatization leads to the urge of sinus lift procedures (Hu et al., 2009). The Sinus lift procedure can be performed with either direct or indirect methods. SLE procedure can be performed by using Osteotome through the 'Bone added osteotome sinus floor elevation' technique (BAOSFE) or Sinus floor

elevation using an inflatable balloon. The major disadvantage of this technique is that it has a high chance of creating perforations (Zitzmann and Scharer, 1998). The earliest and most reliable technique constitutes the osteotome technique. This is considered the golden standard procedure. The most frequent side effect related to the sinus lift membrane procedure is perforation of the sinus membrane, which leads to nasal discharge, headache nasal stiffness postoperatively, leading to discomfort for the patient (Esposito et al., 2014). Many studies have demonstrated the modifications in the conventional design, such as trephine bur, stopper, water balloon and a hatch reamer for minimizing the common adverse effects of the osteotome. To overcome this complication a novel modality CAS Kit was introduced.

"Alsabbagh et al., (2020) compared three different techniques of indirect sinus lift by sinus floor elevation by bone added osteotomy by inflatable balloons and crestal approach system known as CAS Kit from OSSTEM". Many studies have demonstrated successful implant placement in the sinus lift procedure by using crestal approach. They determined the limit of 3.0±0.8 mm in sinus membrane elevation in osteotome technique. Kim et al., (2013) have reported 92.9% of surgeon's experienced ease in handling and cutting with CAS kit. It was designed to cut the bone efficiently at various speeds. It elevates the sinus membrane by hydraulic pressure. Only 4.1% of surgeons experienced membrane perforation which was statistically significant in comparison with other modalities (Kim et al., 2013).

The most common complication of sinus floor elevation is perforation of the Schneiderian membrane. The incidence rate of membrane perforation is 22% to 40%. A study demonstrated by Hudaifa et al., (2022) the relation between the prevalence of perforation and the width of sinus floor elevation. They stated that the risk of perforation is more when the membrane is reflected in the narrow anterior region, becoming less in the middle portion and nothing in the posterior region. The existence of septa becomes more likely to get perforated.

The present study showed the better efficiency of CAS kit technique with decreased chances of membrane perforation due to its unique shape and design of bur. This ultimately reduces the chances of perforation with a lesser duration of surgery. CAS kit has demonstrated good primary stability of implant with less amount of marginal bone loss and an adequate amount of bone generation around the implant, which has ultimately proven a good technique for placement of an implant in the posterior atrophic maxilla. Despite commonly practiced multiple techniques for maxillary sinus floor elevation; CAS kit is one of the better modalities for implant placement and has the potential to outweigh the conventional techniques of implant placement with minimal shortcomings.

4. CONCLUSIONS

The use of CAS kit for sinus lift followed by implant placement demonstrated more bone preservation, providing better implant stability, with less time under surgery. The recent modalities can provide better outcomes and act as an alternative to conventional osteotome techniques. The scarcity of literature on the CAS kit is an area in need of further investigation. More studies need to be conducted to understand the outcomes of the CAS kit technique.

Informed consent

Written & Oral informed consent was obtained.

Authors' contributions

Dr Himanshu Shende has collected information and prepared the manuscript which has been thoroughly reviewed by Dr Bhushan Mundada and Dr Nitin Bhola. All the authors have read and agreed to the final manuscript.

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Conflict of interest

The authors declare that there is no conflict of interests.

Data and materials availability

All datas collected during this study are available upon reasonable request from the corresponding author.

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