

Case Report

Indirect maxillary sinus lift using summer's osteotome technique and immediate implant placement with 2-years follow-up: A case report

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ABSTRACT

The restoration of the posterior edentulous maxilla with dental implants is constantly challenging to the restorative dentist. This is due to the maxillary sinus pneumatization and expansion as a result of the increased osteoclastic activity of the Schneiderian membrane periosteum after tooth extraction, with consequent reduction in bone height or volume, in addition to the lower quality of maxillary bone, when compared to the mandible. This results in insufficient bone for implant osseointegration and primary stability impeding implant placement. Maxillary sinus lift with or without bone graft aims to provide sufficient bone volume, providing the supplementary anchorage and stability mandatory for successful implant osseointegration. This maybe done directly through lateral wall of the sinus which is more invasive, or indirectly through the alveolar bone crest, which is comparatively less invasive. Therefore, the preferred treatment is the minimally invasive indirect sinus lift technique when feasible. The objective of this case report is to demonstrate indirect maxillary sinus lift procedure with immediate implant placement, without bone-graft using minimally invasive Summers' osteotome technique preventing maxillary sinus membrane perforation.

Keywords: Crestal approach, Indirect-maxillary-sinus-lift, Osteotomes, Short implants, Summer's maxillary sinus lift

INTRODUCTION

The necessity to increase bone volume led to the development of maxillary-sinus augmentation procedures, although other treatment options are available to resolve this anatomic limitation, such as the use of angulated, zygomatic, pterygoid, or short implants.^[1] Sinus floor elevation techniques broadened the prosthetic options by facilitating the placement of additional implant support in maxillary quadrants with atrophic ridges and pneumatized sinuses.^[2] Lateral window maxillary sinus lift technique (LWML) was first introduced by Tatum in 1977 and was first reported by Boyne and James in 1980.^[3] This procedure is considered time-consuming, invasive, and expensive.^[3] Summers in 1994 presented the less invasive procedure for sinus floor elevation with immediate placement of an implant known as the osteotomy sinus floor elevation (OSFE) or Crestal approach.^[3] This approach was extensively performed rather than the lateral window approach, which includes an osteotome for elevation of the membrane and floor of the sinus and immediate placement of the implant simultaneously, with or without bone graft placement.^[2] OSFE is usually recommended when residual bone height is $\geq 4-6$ mm.^[1,4] In cases with higher resorption, the LWML

technique is used.^[5] The use of bone grafts for sinus augmentation regardless of the technique is associated with higher success rates; however, it has certain drawbacks, e.g., prerequisite for second surgical site for autogenous bone harvesting, and is associated generally with more clinical complications, e.g., graft infection and mobility, higher cost, and lengthy surgical time.^[3]

Contraindications to the procedure are sinus infection, sinus tumors or pathology, severe allergic rhinitis, or radiation therapy.^[3,4] OSFE offers a number of advantages: The surgery is more conservative, sinus augmentation is localized, there is a low rate of post-operative morbidity, a shorter time to implant loading is possible than with the direct technique, and high survival rates of around 90% are achieved.^[2] The main drawback of OSFE technique is that it is mandatory to perform it blindly because of the impossibility to visualize the sinus.^[2] The most frequent complication reported with OSFE is the Schneiderian membrane perforation which is less frequent compared to LWML technique and was reported in 25-44% of the cases.^[2] Other complications include nasal bleeding, blocked-up nose sensation, infection, sinusitis, and excessive hematoma all which usually resolve few days after surgery.^[1]

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CASE REPORT

A 46-year-old female presented wishing to replace her missing upper and lower teeth with dental implants. Her medical history was not relevant. On intraoral clinical examination, several teeth were missing which included (18-17-16-15-27-28-34-36-38-45-46-48). The Kennedy classification for the upper-arch was class-1 and class-3 modification-2, for the lower arch. On occlusal examination, no interferences were present during anterior and lateral excursions.

On periodontal examination, she had minimal inflammation of the periodontium with good oral hygiene. She had a thick gingival biotype with a general thickness of 3 mm of attached keratinized gingiva. She had 3 porcelains fused to metal bridges, which were intact with no signs of occlusal wear.

On radiographic examination of the upper and lower edentulous areas using periapical radiographs and orthopantomogram, the lower right residual bone dimensions for 34 were 6 mm in width and >10 mm of apical bone height (Seibert's edentulous ridge classification-1983: Class-1.). The width of upper edentulous ridge was 8 mm, while the residual bone height was 6 mm (Seibert's edentulous ridge classification-1983: Class 2) [Figure 1]. The patient was presented as well with other alternative options for replacement of her missing teeth such as fixed bridges and removable dentures, but she insisted on dental implants. Furthermore, for replacement of teeth on her upper right quadrant, she was presented with two possible treatment options for lifting the maxillary sinus (LWML) with the possibility of placing 3 implants (15, 16, and 17) versus OSFE and placement of 1 implant (15). Due to financial constraints and her wish to avoid the complications associated with the direct (LWML) technique, she opted the OSFE approach, in addition to replacement of (34). Therefore, the treatment plan was to place 2 posterior upper and lower implant restorations over a 1-year period. The precise implant positions were planned using Sicut Sirona software. One-stage surgery for

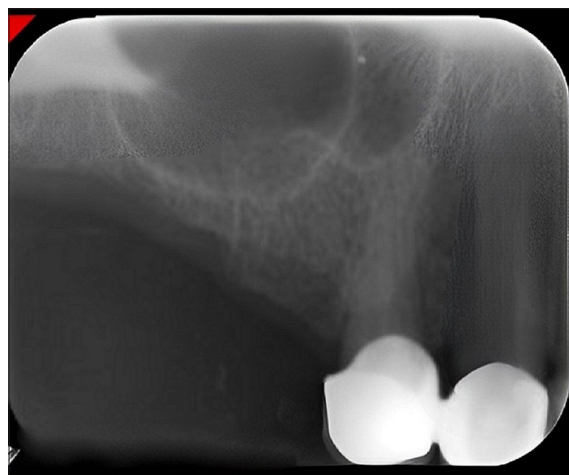


Figure 1: Periapical radiograph of 15 showing residual bone height of 6 mm, below the maxillary sinus.

34 and 2-stage-surgery for 15 were planned. Moreover, OSFE approach to elevate the sinus (2 mm) with simultaneous short (8 mm) implant placement was planned for 15 to avoid bone graft placement. Patient's consent was obtained and the maintenance of good oral hygiene and regular periodontal therapy for the success of the implant restorations was emphasized to her. Primary alginate impressions were taken to fabricate diagnostic-casts, wax-ups, and surgical guide, for planning prosthetically driven position.

Surgical-phase

The two implant surgeries to replace 34 and 15 were done separately, with 2-month gaps. The surgery for 34 was done first. After administration of local anesthesia, a mid-crestal incision was made and full thickness flap was reflected, the osteotomy was carried out sequentially with different drill sizes and (Tissue level RN; Straumann AG, Basel, Switzerland) (3.5 mm × 10 mm) implant with healing abutment was placed in single surgery, after achieving good primary stability (ISQ82-84) using Osstell device. Flap was sutured, post-operative periapical radiographs were recorded, and she was given post-operative instructions and medications, antibiotic (500 mg Amoxicillin 3 times daily) for 7 days and 600 mg Brufen 3 times daily for pain management. She was also instructed to rinse with 0.12% chlorhexidine for 7 days.

After 2 months, OSFE surgery was done for replacement of 15. Local anesthesia was administered, and mid-crestal full-thickness incision was done with vertical releasing incision, buccally. The flap was reflected, and a round bur was used initially to mark the implant location. 2 mm pilot drill was utilized to initially locate the ideal implant position confirmed by periapical radiograph, 1 mm away from the maxillary sinus. Next, the osteotomy site was enlarged by sequential use of implant drills, until the final size at low speed, using the surgical guide. Osteotomes of gradual diameter and mallet with careful controlled force were then used to break the maxillary sinus wall and raise the Schneiderian membrane cautiously by 2 mm. (Bone level implant; Strauman AG, made in Basel Switzerland) which is a short implant (size 4.1 mm × 8 mm) was threaded into the osteotomy site and the flap was sutured [Figure 2]. Sinus membrane's integrity was checked by Valsalva maneuver. An immediate post-operative periapical X-ray was taken [Figure 3]. The primary stability was checked using the Ostell device (ISQ30) and was low. Thus, cover screw was placed and healing abutment was placed in 2nd-stage surgery 3-months later. The same post-operative instructions and medications were repeated. Sutures were removed 10 days later.

Prosthetic-phase

The patient was recalled after 6 months for prosthetic stage. Implant level single-stage additional silicone impressions were made using closed-impression tray technique for 34 and open-tray technique for 15, along with bite registration

and shade selection. After 10 days, definitive abutments with screw retained crowns were placed and occlusion verified. She was recalled for periodontal maintenance supportive therapy and follow-up annually [Figure 4].

DISCUSSION

Placing implants in the atrophic posterior maxillary region using OSFE without simultaneous grafting is a safe and predictable procedure.^[5] A success rate of 98.3% after 4 years was achieved by Fugazzeta with implant placement using OSFE technique.^[5] Lai *et al.* and Pjetursson *et al.* had a cumulative survival rate of 95.71% and concluded that OSFE with and without bone grafts achieves comparable results.^[6,7] Systematic review of sinus floor elevation found that the non-grafted maxillary sinus floor is characterized by new bone formation, besides a high implant survival rate, which was comparable to bone graft-assisted maxillary sinus floor augmentation.^[8] Conversely, with

respect to bone height gained after sinus lift using OSFE, the predictability of formation of new bone was higher when graft material was used compared to without the use of graft material.^[1] Romero-Millán *et al.* reported that with no bone graft, an average gain of 2.86 mm was achieved with a range of 1.7–4.4 mm and with bone graft, the average gain was 3.7 mm, with range of 3.2–4.1 mm.^[1] Furthermore, the probability of gaining 2 mm of new bone was 39.1% when no graft material was used, compared to 77.9% when graft material was used.^[1] The crucial element for the success of the approach, independent of graft application, is bone condensation, through lateral compression and expansion of the adjacent bone, and the presence of the blood clot under the membrane, which encourages bone formation through osteoinductive and conductive activity of growth factors and cytokines from the membrane's periosteum.^[2,9,10]



Figure 2: Osteotomes with straight concave tips and mallet used in the surgery.



Figure 4: 6 months review after placement of the screw retained crowns 15.



Figure 3: Periapical radiograph after implant placement of 15.

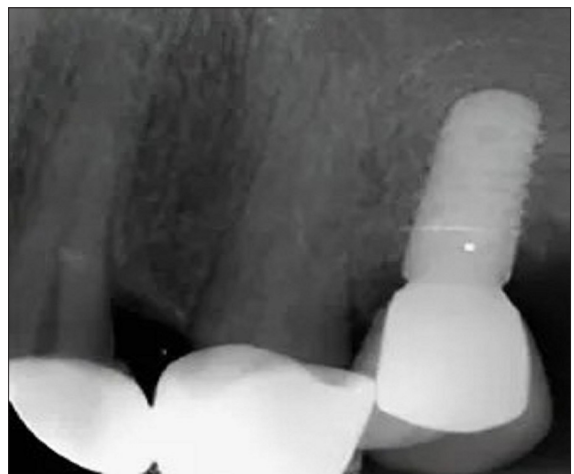


Figure 5: After 2 years' review 15.

After 2 years' review, the implant restorations had stable periodontal health and bone levels, with no signs of occlusal wear [Figure 5].

CONCLUSION

OSFE is a safe and predictable approach with good success rates reported in the literature. The apical bone solely acts as the bone graft that roofs the sinus lining and crestal bone, establishing sufficient primary stability for the implant placement with few post-operative complications.

Ethical approval: Institutional review board approval is not required.

Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent.

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Use of artificial intelligence (AI)-assisted technology for manuscript preparation: The author confirms that there was no use of artificial intelligence (AI)-assisted technology for assisting in the writing or editing of the manuscript and no images were manipulated using AI.

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