Management and simultaneous implant placement of maxillary sinus membrane perforation: A report of two cases

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Abstract:
Rehabilitation of the long-standing edentulous posterior maxilla with dental implant poses a unique challenge. This is due to mainly two reasons – pneumatization of the maxillary sinus and atrophy of the alveolar bone. The challenge is intensified when the native bone is around 2–3 mm. This requires vertical bone augmentation in the form of direct sinus lift/lateral wall sinus lift procedure. The most common complication associated with this procedure is the sinus membrane perforation resulting in unfavorable stabilization of the graft and associated bone regeneration. Simultaneous implant placement becomes all the more difficult in such situations. As a result, of which implant placement has to be deferred resulting in extended treatment duration and multiple surgical appointments. The present case report represents two such sinus membrane perforation repair cases associated with lateral wall osteotomy approach for sinus augmentation with simultaneous implant placement in the posterior maxilla.

Key words: Direct sinus lift, perforation repair and implant placement, sinus membrane perforation

INTRODUCTION

Maxillary sinus augmentation procedures are usually done by the crestal or lateral approach, which are the more predictable treatment modalities for placing the implant in the atrophic maxillary posterior area. Although associated with high risk of intra- or postsurgical complications, sinus elevation surgery is considered one of the most predictable bone augmentation procedures.[1] According to evidence-based literature review, there is high level of predictability in the outcome of lateral wall sinus elevation surgery.[1-3]

Intraoperative complications are primarily the result of surgical difficulties associated with the presence of complex anatomic limitations such as thin membrane, septa, and thick or convex lateral walls. Various complications associated with the procedures include Schneiderian membrane perforation, intraoperative bleeding, perforations of the buccal flap, and injury to the infraorbital nerve.

The most common intraoperative complication in sinus elevation surgery is the perforation of the Schneiderian membrane,[4] which ranges between 10% and 55%[5] when rotary window preparation is used. Perforation may result in decrease in bone formation or infection in maxillary sinus thus resulting in subsequent implant failure.[6,7]

Various techniques have been used in literature for repair of Schneiderian membrane perforation that increased the survival rate of implants.[8-10] The most common perforation repair procedures include direct repair of Schneiderian membrane by suturing or indirect repair by use of resorbable-guided tissue regeneration membrane.[11-14]

Based on the size of the perforations, Hernández-Alfaro et al.[7] [Table 1]:

- Less than 5 mm
- Between 5 and 10 mm
- More than 10 mm.

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Treatment options in cases of sinus membrane perforations, depending on the extent
This article shows cases management of two such cases where sinus membrane perforation during lateral sinus lift procedure has occurred. In many cases where the procedure is abandoned usually, a successful attempt was made to simultaneously repair the perforation as well as place the implant.

CASE REPORTS

Case 1
A 62-year-old female patient reported to the department of periodontology with the chief complaint of missing teeth within the upper left region of the jaw.

There was no significant relevant medical history. On intraoral examination, missing teeth 16, 26, 27, 36 were revealed. Investigations including orthopantomogram (OPG), cone-beam computed tomography (CBCT), complete blood count (CBC), bleeding time (BT), and clotting time (CT) were carried out. According to CBCT, the residual bone measurement for the prospective implant site was approximately 3.2 mm [Figure 1a]. As a result of which direct sinus lift procedure was opted for.

The surgical site with respect 26 and 27 was administered with 2% lignocaine hydrochloride (1:200,000 adrenaline). Full-thickness flap was reflected after giving mid-crestal incision with 26 and 27 region and vertical releasing incisions on the mesial line angle of 25 [Figure 1b]. Thinning of the lateral window to gain access for the sinus membrane elevation was done with a round bur [Figure 1c]. During the sinus elevation, sinus membrane perforation of approximately 6–7 mm occurred [Figure 1d]. Perforation of sinus membrane was managed by 6-0 resorbable chromic gut suture [Figure 1e] followed by placement of collagen membrane, i.e., periocol [Figure 1f].

Following perforation repair and sinus membrane elevation, osteotomy site preparation and implant placement (implant size – TS 4.5 mm × 10 mm Osstem) was done with respect to 26 [Figure 1g and h].

The sinus space was packed with demineralized freeze-dried bone allograft (DFDBA) + FDBA + hydroxyapatite and collagen membrane (Periocol) following the implant placement. 3-0 reverse cutting direct loop sutures were placed.

The patient was prescribed tablet amoxicillin and clavulanic acid 625 mg 2/day for 5 days, diclofenac 50 mg 2 tablets for 3 days, and cetirizine 5 mg 2 tablets for 5 days. Chlorhexidine gluconate 0.2% mouthrinse twice daily for 2 weeks was prescribed to the patient.

Table 1: Treatment modalities for sinus membrane perforation repair

| Extent of perforation (mm) | Surgical treatment of sinus membrane perforations |
|--------------------------|-----------------------------------------------|
| 5                        | Suturing                                       |
|                          | Resorbable collagen membrane                   |
| 5-10                     | Lamellar bone + resorbable collagen membrane   |
| >10                      | Lamellar bone                                 |
|                          | Lamellar bone + buccal fat pad                 |
|                          | Bone block graft                              |

The second-stage implant surgery was done with scalpel, and healing abutment was placed. A screwed-retained metal-ceramic prosthesis was delivered [Figure 1i and j].

Case 2
A 37-year-old male patients reported to the department of periodontology with the chief complained of missing teeth within the upper right region.

There was no significant relevant medical history. Intraoral examination revealed missing tooth 16 Investigations, including OPG, CBCT, CBC, BT, and CT, were carried out. According to CBCT, the residual bone measurement for the prospective implant site was approximately 2-3 mm of sinus membrane perforation [Figure 2c]. Perforation of the sinus membrane was managed by collagen membrane, i.e., pericoll [Figure 2d]. Following perforation repair and sinus membrane elevation, osteotomy site preparation and implant placement (implant size – 4.5 mm × 10 mm Dentium) was done with respect to 16 [Figure 2e and f].

The sinus space was partially packed with DFDBA + FDBA + platelet-rich fibrin following the implant placement. The bony window was obliterated with Chorion membrane. 3-0 reverse cutting direct loop sutures were placed.

The patient was prescribed amoxicillin and clavulanic acid 625 mg 2 tablets for 5 days, diclofenac 50 mg 2 tablets for 3 days, and cetirizine 5 mg 2 tablets for 5 days. Chlorhexidine gluconate 0.2% mouthrinse twice daily for 2 weeks was prescribed to the patient.

The second-stage implant surgery was done with scalpel and healing abutment was placed. A screwed retained metal-ceramic prosthesis was delivered [Figure 2g].

DISCUSSION

Maxillary sinus augmentation is commonly done to increase bone dimension for placement of dental implants in the posterior maxilla. The most important factor during the sinus augmentation procedure is to maintain the integrity of the Schneiderian membrane so that once lifted, it can become the recipient site for the bone graft and stabilizes the graft during the healing period. Sinus membrane perforation is the most common complication of sinus elevation surgery (prevalence – 10%–55%) which has an adverse impact on graft remodeling[15]

For repair of small sinus membrane perforations (small membrane perforations <5 mm), numerous techniques can be employed such as circumelevation technique, Loma Linda Pouch technique, tissue fibrin glue technique, suturing, or by covering the sinus membrane perforation

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For repair of larger perforation (>5 mm) various techniques advocated are – lamellar bone plates, resorbable barrier membranes, and suturing alone or suturing in combination with fibrin glue. In the present Case 1, Schneiderian membrane perforation was repaired by using a resorbable chromic gut suture and grafting.

The results of sinus augmentation techniques are made more pronounced and predictable by the use of different graft materials such as autogenous, allogogenous, xenograft, and alloplastic materials.

Sinus elevation surgery with simultaneous implant placement requires ≥4 mm of native bone for primary stability. In the current case report, implants were placed simultaneously with sinus augmentation procedure in spite of native bone <4 mm (Case 2 = 3.6 mm, Case 1 = 3.2 mm) after managing the perforation of the sinus membrane. This makes it a novel approach to sinus augmentation.

Figure 1: (a) Preoperative cone-beam computed tomography. (b) Mid-crestal and vertical incision. (c) Full-thickness flap elevated exposing the lateral bony wall. (d) Perforation of sinus membrane encountered during membrane elevation. (e) Perforation repair was done with 6-0 chromic gut suture. (f) Collagen membrane placed to repair the perforated sinus. (g) Implant placed with 26. (h) Postoperative radiograph showing graft containment and implant. (i) Metal-ceramic prosthesis. (j) 10-month postoperative cone-beam computed tomography showing functional implant and prosthesis.

Figure 2: (a) Preoperative cone-beam computed tomography. (b) Mid-crestal and vertical incision. (c) Full-thickness flap elevated exposing the lateral bony wall and perforation of sinus membrane encountered during membrane elevation. (d) Collagen membrane placed to repair the perforated sinus membrane. (e) Implant placed with 16. (f) Postoperative radiograph showing graft containment and implant. (g) Metal-ceramic prosthesis.
procedure because mostly the implants in such cases of larger perforation are placed with delayed approach. This case report manages the simultaneous implant placement with perforation repair. Postoperative radiograph showed appreciable bone fill and osseointegration at the implant site.

The patient was rehabilitated with a functional prosthesis despite the above-mentioned complication. The advantage of the simultaneous implant placement encompasses reduction in various aspects such as surgical procedures, treatment time, morbidity, financial expense, patient anxiety, and the tenting effect of the implant on the repaired sinus membrane acting as a space maintainer.

CONCLUSION

While implants have become the treatment of choice for replacement of missing teeth, tooth loss following periodontal or other complications result in a reduced bone support. Intraoperative complications may lead to postoperative complications if not addressed in time. These cases suggest that surgical complications did not significantly influence implant survival as consultation was sought immediately and preparations for addressing the complications were made beforehand. The case with membrane tears had comparable results as the uncomplicated cases, hence proving that timely intervention gives predictable results without significantly increasing the treatment time or number of surgical procedure.

Declaration of patient consent
The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest
There are no conflicts of interest.

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