

Management of Perforated Schneiderian Membrane During Sinus Augmentation Surgery Followed By Immediate Implant Placement: A Case Report

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Abstract: Augmentation of the maxillary sinus floor is well accepted surgical procedure for the placement of dental implants in the posterior atrophic maxilla. When the procedure is complicated by perforation of the sinus membrane, the proper management of the perforation is important as it can threaten the coverage of the graft materials. In this case report, we describe a technique for repairing a perforation of the sinus membrane by suturing the membrane and placing the GTR membrane over it followed by immediate placement of the implants. We observed 100% success rate of the immediate implants placed with sinus bone grafting in the patient whose membrane was perforated. Suturing the perforated area of the membrane and securing the bone graft with collagen membrane was an effective alternative for repair of a perforation of the sinus membrane.

Key- Words: maxillary sinus, Schneiderian membrane, Perforation.

Key Messages: Perforation of the maxillary sinus is the most common surgical complication that occurs during the sinus augmentation surgery. If the perforation is small it will heal by itself but larger perforation need to be treated as it will threaten the graft.

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I. Introduction

Augmentation of the maxillary sinus floor is a purely accepted surgical procedure for the placement of dental implants in the posterior atrophic maxilla. It was first introduced by Tatum et al,¹ the trapdoor technique which consists preparation of a top hinge folding to the lateral wall of the sinus which is luxated along with the Schneiderian membrane to the horizontal position. The space below the lifted door is filled with bone grafting material. Freeing the membrane lining is a delicate procedure, which is performed by specialized instruments. However, during the membrane elevating procedure, the membrane can be damaged, due to overfilling of grafting material, infection, or perforation.

In the previous reports on the procedure, Perforation of the Schneiderian membrane is a well-documented phenomenon. It is considered probable to occur due to variety of anatomical modalities in the shape of the inner aspect of the maxillary sinus, like sharp angle and ridgeline, septa, and spines.² Perforation of the sinus membrane most commonly occurs when the lateral wall is being fractured, but it can also happen when the membrane is being elevated off the inferior and anterior bony aspect of the sinus or due to irregularities of the sinus floor.²⁻⁴

Valassis and Fugazzotto,⁴ classified the perforation based on its position and extent (Fig. 1). Class I and class II perforations are most easily repaired, while class IV is the most difficult. The perforation will heal by itself if it is small and located in the area where the elevated mucosa is folded together. Large perforation in an unfavourable area needs to be closed as it threatens the coverage of the graft materials.⁵

The present case report we present a management of Perforated Schneiderian membrane during augmentation surgery followed by immediate implant placement. The purpose of the report was to present data on the clinical and radiological outcomes of perforated Schneiderian membrane management using, suturing followed by guided tissue regeneration membrane placement and bone augmentation utilizing Bioresorbable Demineralized Bone Matrix.

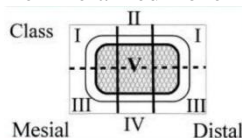


Figure 1 :- area where sinus membrane perforation can occur grouped by location.

Class 1 :- membrane perforation is located at the superior border of osteotomy at its mesial or distal sixth

Class 2 - perforation is located in the mid superior aspect of the osteotomy, extending mesiodistally for two-thirds of the dimension of the total osteotomy site.

Class 3 – membrane perforation is located at the inferior border of osteotomy at its mesial or distal sixth

Class 4 – perforation is located in the central two-third of the inferior border of osteotomy site.

Class 5 – perforation is a pre-existing area of exposure of the sinus membrane, due to a combination of extensive antral pneumatization and severe ridge resorption.

II. Case Report

A 44-year-old female patient reported to the Department of Periodontology in 2016, with a chief complaint of missing teeth in the right and left back region of the upper jaw since 1 year. On examination, teeth no #15, 16 and #25, 26 were missing (Fig. 2 - a,b) Detailed case history of the patient revealed that both the teeth were extracted due to extensive caries and persistent pain. The patient had no relevant extraoral or intraoral abnormalities. Blood investigations were done and were within normal limits. The patient was systemically healthy. The Panoramic radiograph revealed insufficient bone height in 15, 16 region for placement of the implant and the maxillary antrum was pneumatized (Fig. 2 - d). Intra Oral Periapical Radiograph (IOPA) done using a grid of 1 mm, showed only 5 mm bone was present below the sinus in #16 region (Fig. 2 - c).

Alveolar bone was homogenous in nature and bone mapping revealed the crestal width of bone in relation to # 15, 16 was 16 mm. Prior to the surgery, informed consent was taken from the patient. Alternatives to the treatment were explained and she was also informed about the benefits and risks of each treatment option. As the patient wanted fix prosthesis due to the inconvenience of removable one, implant placement has opted.

Pre-surgical diagnostic models were prepared. In the cast, the inter-occlusal distance was measured as 9 mm with respect to #15 and #16. Phase 1 therapy was completed.



Figure 2 :- a,b – per-operative lateral and occlusal view showing missing 15, 16. c,d - Digital orthopantomogram (OPG) and IOPA revealed a residual bone height of 5 mm in relation to 16 with a pneumatized sinus.

Surgical phase

Prior to the surgical procedure, preparation of the patient following aseptic condition was done. The patient was instructed for pre-procedural rinsing with 0.2% chlorhexidine gluconate. The maxillary posterior segment was anaesthetized with posterior superior alveolar, infraorbital nerve block and palatal infiltration using local anaesthesia of 2% lignocaine with 1:80,000 adrenaline. Midcrestal incision was made using a no.15 surgical blade extending from the distal surface of #14 up to the mesial surface of #17. A vertical incision was extended until the end of the buccal vestibule (Fig. 3 - a). A full thickness mucoperiosteal flap was raised until the zygomatic buttress (Fig. 3 - b).

Bony window osteotomy

A bony window was then traced in the #15, 16 region at a slow speed rotating instrument (Nsk Ex-6 Dental straight Handpiece) and a round carbide bur under constant irrigation with normal saline. It began with the most coronal horizontal preparation, with a length of approximately 14 mm positioned approximately 3 mm apical to the residual crestal bone. A round bony window was made in the area of the second premolar–first molar (Fig. 3 - c). This produced a bony window in which the frame is represented by the Schneiderian membrane (sometimes red in colour, sometimes blue). At this point, during the osteotomy since due to slight excess pressure the bur slipped inside the membrane perforating it (Fig. 3 - d).

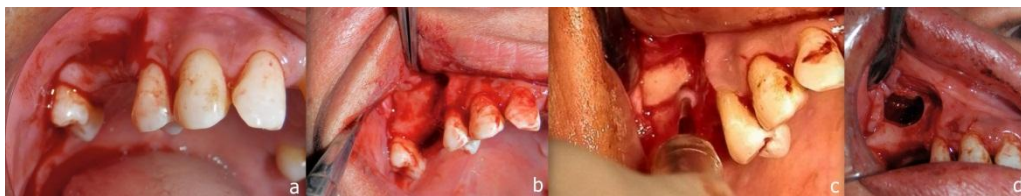


Figure 3 :- a - Placement of para – crestal and vertical releasing incisions. b - Flap elevated exposing the lateral bony wall. c - Preparation of bony window. d - Infracture of bony window perforation of sinus membrane encountered during membrane elevation.

Management of perforation

When a membrane perforation was discovered, immediate cessation of all reflection and isolation and visualization of the perforation was done. Sterile gauze was packed as needed superior to the site to aid in maintaining a clear field for examination of the area. On careful examination a membrane perforation of 8mm was detected, the membrane surrounding the perforation was delicately dissected with a blunt instrument, along with the bony window in an attempt to relieve the pressure, at the perforated area. (Fig. 4 - a). According to Valassis and Fugazzotto,⁴ class 4 perforation was located in the central two-thirds of the inferior border of the osteotomy site. Depending on the extent of the perforation, which was approximately 8mm, direct suturing of the membrane with 6/0 Vicryl (Ethicon, Norderstedt, Germany) and patching with a collagen membrane (Fig. 4 -b,c).

Once the resulting space had been examined and injury to the membrane was repaired, the implants sites were prepared (Fig. 4 - d). Carefully the osteotomy fixture sites were prepared according to the standard clinical procedures for the implant system (ADIN dental implant system, Israel.). A sinus elevator was inserted into the prepared cavity to protect the elevated membrane during the insertion of the implants (11.5 x 3.75 mm and 11.5 x 4.2 mm) (Fig. 4 - e,f). All implants placed at the sinus lift procedures were considered to be clinically stable. Both implants protruded a minimum of 5 mm into the sinus cavity. After insertion of the implants, the bone graft was placed (Fig. 4 - g). The posterior part of the cavity was grafted first, followed by the anterior portion and finally the central area. Filling material consisted of Demineralized bone graft matrix (OSSEOGRAFT™ - Advanced Biotech, India) mixed with the patient's blood. Care was taken not to obstruct the middle nasal meatus to allow free sinus drainage. After graft placement and packing, a collagen membrane (HEALIGUIDE® - Advanced Biotech) was trimmed such that 2-3 mm of surrounding adjacent was covered and the membrane was at the level of the window covering all its borders (Fig. 4 - h). The membrane was stabilized in place using firm pressure with moist gauze for 2–3 minutes. The mucoperiosteal flap was repositioned and sutured with monofilament sutures (Fig. 4 - i).



Figure 4 :- a - the membrane surrounding the perforation was delicately dissected. b,c - The Perforation was sutured with 5-0 vicryl suture. d - Implant osteotomy sites prepared in 15, 16. e,f - ADIN 4.2 x 11.5 mm and 3.75 x 11.5 mm, Implant placed in prepared osteotomy sites. g - Bone graft placement in the defect. h - GTR membrane placement. i – suture.

Postoperative care

Blowing the nose and sneezing with open mouth was contraindicated for 1 week after surgery. Antibiotics (Amoxicillin 500mg three times/day) and analgesic (Diclofenac Sodium 50mg three times/day) were prescribed for 7 days. Sutures were removed after 10 days following surgery. After 6 months, the healing abutments were replaced and within 3 weeks implants were loaded with screw-retained PFM crowns (Fig. 5 – c,d). The access holes were closed with composite fillings (Fig. 5 – e).



Figure 5 :- a - Measurement of implant stability. b,c - the aid of resonance frequency analysis (Osstell" instrument, Integration Diagnostics AB, Gothenburg, Sweden, Pre-loading implant stability measurement. d - Placement of healing abutment. e - Formation of gingival collar. f – crown prosthesis.

Post-operative radiological and clinical assessment

The clinical variables maxillary sinusitis, pain and success of the implants were recorded. Radiographic assessment including panoramic radiography and intra-oral periapical radiograph 6 months postoperatively. Immediately before and one week after placement of the implant panoramic or periapical radiographs were taken, which were used to assess for any displacement of the bone graft and bone and the implant contact.

Resonance Frequency Analysis

Implant stability measurements were made during stage 2 surgery i.e after 6 months and after 12 months of healing, with the aid of resonance frequency analysis (Osstell" instrument, Integration Diagnostics AB, Gothenburg, Sweden). On these occasions, a transducer was attached to each implant, and measurements were recorded in implant stability quotient (ISQ) units.

III. Results

Class IV perforation of the sinus membrane was observed during the surgical procedure and was treated using suture directly with a resorbable material (Vicryl 6/0) and a resorbable collagen membrane. Postoperative recovery was uneventful and slight swelling was noted. The patient followed- up daily for the first 10days until the sutures were removed. During this period there was no sign of wound dehiscence, sinus infection, exposure of the graft, local inflammation, or pain. After the sutures had been removed, the patient was monitored two-weekly for the first two months, and no complications were reported. Therefore, according to the site of the perforation in the sinus membrane (classified according to the scale described by Vlassis and Fugazzotto 4), there was a Class IV perforation. In residual ridge of 3 mm, Radiographic examinations showed an increase in the thickness of bone in the floor of the maxillary sinus. Implant length was 11.5 mm, and their diameters were 3.75 and 4.2 mm. The radiographic follow-up showed osseointegration of the implants and after six months, the patient received fixed prostheses (Fig. 6 – a,b) The success rate of the implants 2 years after implantation in the augmented sinus was 100%. At the 12-months postloading follow-up resonance frequency analysis (RFA) were 83 ISQ in 6 months and 94 ISQ post loading (Fig. 5 – a,b,c).

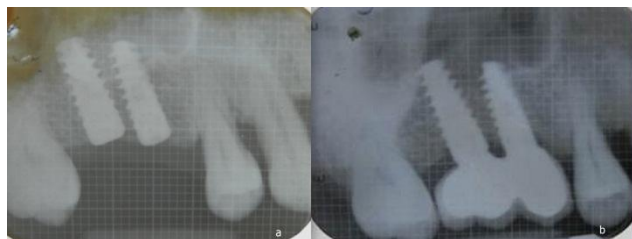


Figure 6 :- Post-operative IOPA. a – six months. b – 1 year.

IV. Discussion

The sinus membrane perforation is the most commonly reported complication, and it occurred in 10% to 35% of cases,^{6,8} the cause can be technical or due to anatomical variation in the sinus.^{6,7} In our case the perforation was technical, as due to slight extra pressure the bur perforated the sinus. A piezoelectric surgical unit are now frequently used in sinus augmentation procedure as it gives atraumatic osteotomy and minimizes the risk of membrane perforation.⁹

Different techniques have been advocated for treatment of perforation of the Schneiderian membrane during the sinus floor elevation and augmentation but the preferred management is not clearly defined.¹⁰ Various techniques to manage the perforations include suturing^{4,11,12} and use of a fibrin adhesive.^{12,13} Various techniques used for the treatment of membrane tear are circum-elevation technique, Loma Linda Pouch technique and the perforated membrane can be managed by using tissue fibrin glue, suturing or by covering them with a resorbable barrier membrane in case of small perforation (<5 mm), if the perforation is >5 mm larger barrier membranes, lamellar bone plates or suturing either alone or in combination with fibrin glue can be used.¹⁴ In the present case report, the perforated membrane was repaired with resorbable suture and collagen membrane.

Various bone grafting materials have improved the results of sinus augmentation techniques and made them more predictable. In this case, the allogeneous bone graft was used to graft the sinus. Overall implants placed in the area provided a high level of success. On crestal bone loss was noticed before loading and after loading and the level stayed stable throughout 2 years of follow-up.

V. Conclusion

Sinus perforation can be easily managed with proper skills, depending on the area of perforation. Small perforation can heal by itself but large perforation needs to be repaired as it is a major threat to the bone graft.

References

1. Tatum OH. Maxillary and sinus implant reconstruction. *Dent Clin North Am.* 1986;30(2):207-29.
2. Van den Berg JP, Ten Bruggenkate CM, Disch FJ, Tuinzing DB. Anatomical aspects of sinus floor elevation. *Clin Oral Implants Res.* 2000;11(3):256-65.
3. Galli SKD, Lebowitz RA, Giacchi RJ, Glickman RJ, Jacobs JB. Chronic sinusitis Complicating sinus lift surgery. *Am J Rhinol.* 2001;15(3):181-6.
4. Valassis JM, Fugazzotto PA. A classification system for sinus membrane perforations during augmentation with option to repair. *J Periodontol* 1999;70:692-9.
5. Pikos MA. Maxillary sinus membrane repair: Report of a technique for large perforations. *Implant Dent* 1999;8(1):29-34.
6. Hernandez-Alfaro F, Torradeflot MM, Marti C. Prevalence and management of Schneiderian membrane perforations during sinus lift procedures. *Clin Oral Implants Res.* 2008;19(1):91-8.
7. Gehrke SA, Taschieri S, DelFabbro M, Corbella S. Repair of a perforated sinus membrane with a subepithelial palatal conjunctive flap: technique report and evaluation. *Int J Dent.* 2012;2012:489762.
8. Vina-Almunia J, Penarrocha-Diago M, Penarrocha-Diago M. Influence of perforation of the sinus membrane on the survival rate of implants placed after direct sinus lift. Literature update. *Med Oral Patol Oral Cir Bucal.* 2009;14(3):E133-6.
9. Vercellotti T, De Paoli S, Nevins M. The piezoelectric bony window osteotomy and sinus membrane elevation: introduction of a new technique for simplification of the sinus augmentation procedure. *Int J Periodontics Restorative Dent.* 2001;21(6):561-7.
10. Shlomi, B, Horowitz I, Kahn A, Dobriyan, A, Chaushu, G. The effect of sinus membrane perforation and repair with Lambone on the outcome of maxillary sinus floor augmentation: a radiographic assessment. *International Journal of Oral & Maxillofacial Implants* 2004;19:559-62.
11. Khoury F. Augmentation of the sinus floor with mandibular bone blocks and simultaneous implantation: a 6-year clinical investigation. *International Journal of Oral & Maxillofacial*

- Implants 1999;14(4):557-64.
12. Schwartz-Arad D, Herzberg R, Dolev E. The prevalence of surgical complications of the sinus graft procedure and their impact on implant survival. *Journal of Periodontology* 2004;75(4):511-16.
 13. Pikos MA. Maxillary sinus membrane repair: Report of a technique for large perforations. *Implant Dent.* 1999;8(1):29-34.
 14. Fugazzotto PA, Vlassis J.A simplified classification and repair system for sinus membrane perforations. *J Periodontol.* 2003;74(10):1534-41.

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