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# Sinus membrane perforations and the incidence of complications: a retrospective study from a residency program

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**Objective.** The purpose of this study is to evaluate sinus membrane perforations and the incidence of complications in a residency program.

**Study Design.** Data from 107 consecutive direct sinus augmentation procedures were reviewed retrospectively from 2008 to 2012.

**Discussion.** All perforations were repaired intraoperatively with the use of a collagen tape. Intraoperative membrane perforations were observed in 64 of 107 cases (59.8%). Of the perforations, 58 were less than 5 mm in diameter and 6 were 5 mm or greater in diameter. It was found that there were 6 cases (5.6%) that experienced postoperative complications. Of those, 3 occurred in cases with no perforations, 2 with perforations less than 5 mm in diameter, and 1 with a perforation 5 mm or more in diameter. These differences were not statistically significant ($P > .05$). All observed post-operative complications were related to symptoms of acute infection.

**Conclusions.** Although membrane perforation was a frequent intraoperative finding, there was no evidence that the presence and size of membrane perforation influences the likelihood of postoperative complications. (Oral Surg Oral Med Oral Pathol Oral Radiol 2015;■:1-5)

Maxillary sinus augmentation has proven to be a successful and predictable technique for providing sufficient bone height and density necessary for stable implant placement in the atrophic and pneumatized posterior maxilla.[1] One common technique, known as the *lateral window approach*, was first reported by Boyne and James in 1980.[2] A common intraoperative finding in this surgical approach is perforation of the Schneiderian membrane (Figure 1). The literature reports perforation rates ranging from 10% to 60%.[3-8] A retrospective study by Hernandez-Alfaro et. al (2006) found that the diameter of 56% of perforations were less than 5 mm, 26.92% between 5 and 10 mm, and 19.23% greater than 10 mm.[9] Perforations are thought to occur as a result of operator error, presence of a septa, thin membranes, sinus pathology, previous entrance into the sinus, and overfilling of graft placement.[5,6]

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Conflicting evidence exists between the association of membrane perforation and postoperative complications. Although many studies have shown an association between perforation and acute sinus or graft infection,[5,10] others have reported no such complications.[11-13]

Previous studies have found that membrane perforation can lead to postoperative complications, such as acute or chronic sinus infection, bacterial invasion, swelling, bleeding, wound dehiscence, loss of the graft material, and a disruption of normal sinus physiologic function. Hernandez-Alfaro et al. (2006) suggested that although perforation size did not affect the frequency of postoperative complications, it did correlate with higher implant failure.[9]

It is thought that the displacement of a biomaterial into the sinus membrane may be responsible for acute and chronic sinusitis, impairing the prognosis of implants.[9,14] In an attempt to prevent this and other complications, a resorbable collagen tape is commonly

## Statement of Clinical Relevance

Although some clinicians consider membrane perforation a serious intraoperative complication during direct sinus augmentation, this study showed that when repaired intraoperatively, the presence and size of membrane perforation did not increase the likelihood of postoperative complications, such as infection.

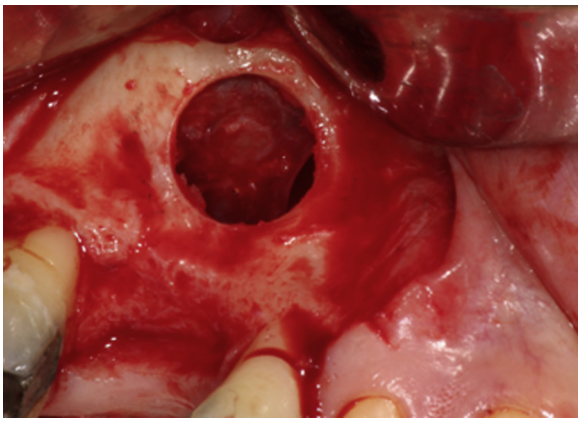

Fig. 1. Intraoperative perforation of the sinus membrane.

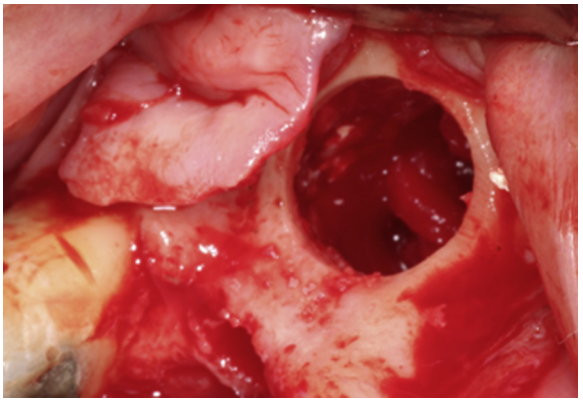

Fig. 2. Collagen tape in place to seal the sinus membrane perforation.

placed to repair a small perforation in the sinus membrane.[15] The purpose of this study is to evaluate sinus membrane perforations and the incidence of complications in a residency program.

## MATERIALS AND METHODS

Local institutional review board approval was obtained for this study (IRB # 13-001485), and the guidelines outlined in the Declaration of Helsinki as revised in 2008 were strictly followed. During the period 2008-2012, 107 sinus floor augmentation procedures were performed by the same surgeon using the lateral window technique. Eighty-five patients underwent unilateral sinus augmentation, and 11 had the procedure performed bilaterally. All patients were considered Class I or II according to the American Society of Anesthesiologists Physical Status Classification System. Uncontrolled systemic disease, ongoing chemotherapy or radiotherapy, conditions of compromised immune defenses, or ongoing sinus disease precluded patients from this study.

Preoperative cone beam computed tomography was performed, and a treatment plan for each patient was created on the basis of bone volume, density, and quality. On the day of surgery, patients were administered antibiotic prophylaxis, namely, amoxicillin 2 g (or clindamycin 600 mg in penicillin allergies) 1 hour before the procedure. All sinus lift procedures were performed using the lateral window technique. If a membrane perforation was observed during the procedure, it was subsequently repaired intraoperatively by placing a commercially available collagen tape (Collatape, Zimmer Dental, Carlsbad, CA) (Figure 2). ProOsteon (Interpore Cross, Irvine, CA), Mastergraft (Medtronic Sofamor Danek, Memphis, TN), or Bio-Oss (Geistlich Pharma North America Inc., Princeton, NJ), with autogenous bone in a ratio ranging from 90:10 to 50:50, were used as grafting materials. The amount of graft material placed depended on bone levels and anatomic variations of the sinus. With the graft material placed, the flap created was rotated back into place, and sutures were applied to achieve primary soft tissue closure. Antibiotics and analgesics were then prescribed. Postoperative follow-up appointments were scheduled for 6 to 12 days after each procedure, with continued recall appointments ranging from 2 to 10 months thereafter.

Statistical significance was calculated by the Student *t* test, in which the level of significance *P* value was used. A *P* value of less than .05 was considered statistically significant.

**Table I.** Comparison of membrane perforation size and presence of postoperative complications

| | *Postoperative complications* | | |
|---|---|---|---|
| *Membrane perforation* | *Yes* | *No* | *Total* |
| None | 3 | 40 | 43 |
| <5 mm | 2 | 56 | 58 |
| ≥5 mm | 1 | 5 | 6 |
| Total | 6 | 101 | 107 |

## RESULTS

One hundred and seven (107) sinus lift procedures were performed on 95 patients (56 males, 39 females). The average age of each patient was 61 years (range 24-92 years). Eighty-five patients underwent unilateral sinus augmentation, and 11 had the procedure performed bilaterally. Membrane perforations were repaired in 58 cases with the collagen tape and without the tape in 49 cases.

Schneiderian membrane perforations occurred in 64 of the cases (59.8%). Perforations were separated according to size, yielding 58 (90.6%) perforations that were less than 5 mm in diameter and 6 (9.4%) that were 5 mm or greater in diameter (Table I). There were 6 cases (5.6%) that experienced symptoms of

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