

Case Report

Treatment of Mucous Retention Cyst in Association with Sinus Lift and Implant Placement: A Case Report with 1-Year Follow-Up

Antoine Berberi ¹, Georges Aad ², Sara Kebbe,¹ Rebecca El Hachem,¹ and Nabih Nader¹

¹Department of Oral and Maxillofacial Surgery, Faculty of Dental Medicine, Lebanese University, Beirut, Lebanon

²Department of Oral Medicine and Maxillofacial Radiology, Faculty of Dental Medicine, Lebanese University, Beirut, Lebanon

Correspondence should be addressed to Antoine Berberi; aberberi@ul.edu.lb

Received 17 February 2023; Revised 17 August 2023; Accepted 26 August 2023; Published 14 September 2023

Academic Editor: Giovanni Mergoni

Copyright © 2023 Antoine Berberi et al. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Sinus lift augmentation techniques, lateral or crestal approaches, have been well documented, with bone substitute graft, or without bone material, with immediate or delayed implant placement as a treatment option for the atrophic maxilla in the posterior area. However, the sinus lift procedures performed in the presence of cysts, mucocèles, mucous retention cysts (MRCs), and antral pseudo-cysts could mainly decrease the sinus cavity volume and could increase the possibility of ostium obstruction and might lead to infection followed by failure of the grafting procedure. A radiological assessment should be made with computerized tomography (CT) or cone-beam CT to evaluate the remaining bone volume and to detect any pathology in the sinus. Different techniques were described in the literature for sinus lifting and bone grafting in patients with cysts. For some authors, cysts should be treated before sinus grafting and six months later, the procedure could be performed. For others, sinus lifting can be performed without lesion removal. At this time, controversy exists regarding the decision on whether lesions must be removed/aspirated or not before sinus grafting. In this study, we report a case where an MRC was aspirated and instantaneously, the sinus membrane was lifted and grafted, and implants were installed with 1-year follow-up after loading. Identifying lesions in the maxillary sinus is essential before planning any type of sinus augmentation and implant placement.

1. Introduction

The treatment of the atrophic posterior maxilla with sinus lift augmentation techniques has been well-documented with a high rate of success [1, 2].

The remaining height of the crestal bone orients the practitioner for lateral or crestal approaches with bone substitute graft [3–5] or without bone material [3, 6] with immediate [1, 2] or delayed implant placement [2, 7].

However, the sinus lift procedures when performed in the presence of cysts could remarkably decrease the sinus cavity volume, increase the possibility of ostium obstruction, and might lead to sinusitis followed by failure of the grafting [8, 9].

These cysts incorporate mucocèles (M), mucous retention cysts (MRCs), and antral-pseudo cysts (APCs) [10].

Thus, the sinus anatomy and its Schneiderian membrane should be carefully evaluated when a sinus lift procedure is planned [11, 12].

MRCs and APCs are frequently found incidentally during radiographic examinations [10].

MRCs are frequent lesions and appear after a high proliferation of the fluid's level inside the sinus membrane and manifest as dome-shaped radiopacities in the sinus [13, 14].

Although its etiology is controversial, many investigators have suggested an environmental cause and their formation has been related to seasonal changes, mainly in the beginning of spring and autumn [13, 15].

Most of them are asymptomatic, although some discomfort such as congestion, postnasal drip, flow of yellow fluid from the nose, headache, and recurrent rhino sinusitis that

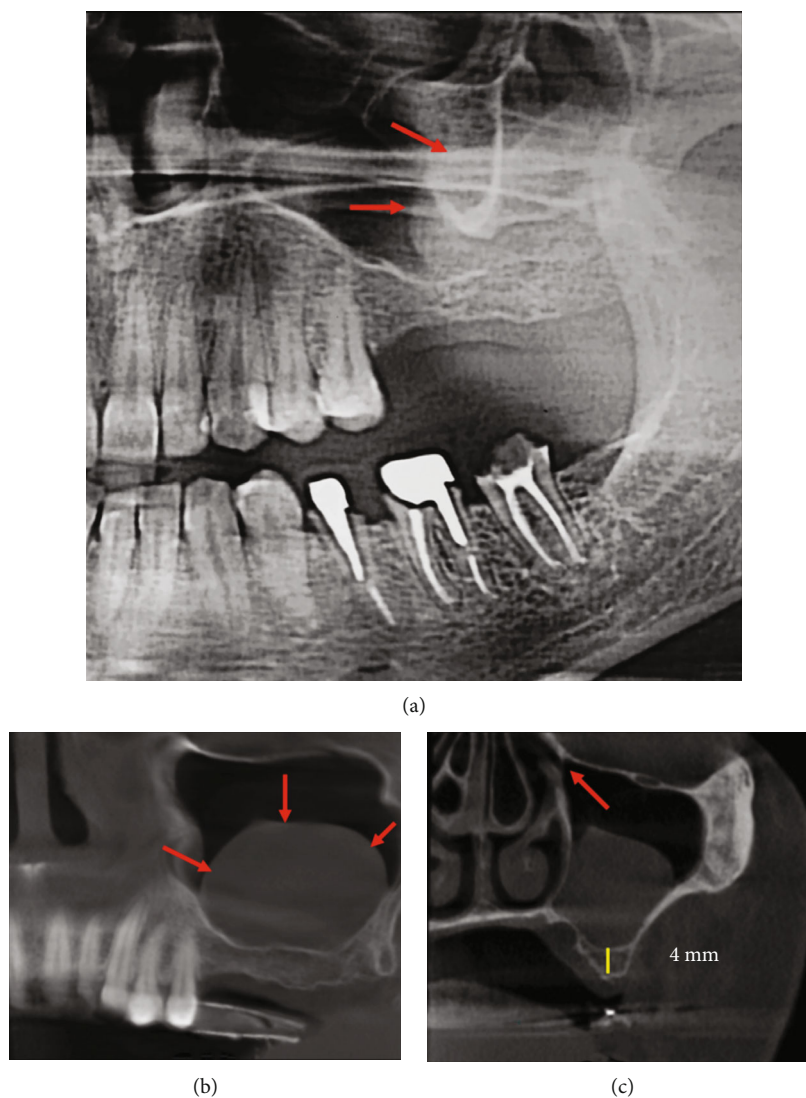


FIGURE 1: (a) Panoramic radiograph showed a radiopacity in the left maxillary sinus (arrow: border of the cyst). (b) A sagittal cut of the CBCT displayed a round-shaped radiopaque lesion on the left maxillary sinus (arrow: border of the cyst). (c) Axial cut revealed the radiopacity lesion inside the sinus, 4 mm residual bone height, and the ostium remains clear (arrow: ostium).

could exceptionally result in nasal obstruction may be reported [14, 16].

Cysts can dissolve without any medication. In 60% of cases the volume remains stable, in 30% the volume shrinks or can disappear completely, and only in 10% the volume increases [13].

Bhattacharyya found that MRCs are found in one sinus in 12.4% of cases and both sinuses in 18% of cases. In 50% of cases, they were located on the sinus floor. In 88% they were solitary [17]. Shear and Speight revealed that the frequency rate of APCs varies between 1.6% and 8.7% [18].

Wang et al. described that most MRCs of the maxillary sinus suddenly relapse or show a non-significant change in volume [16].

A differential diagnosis should be made with other lesions, such as mucocèles and inverted papilloma [12, 13, 15].

Implant placement in the atrophied posterior region of the maxilla needs precision and evaluation of the maxillary sinus. The panoramic radiographs provide a general appreciation, but it is not suitable for a complete assessment [19].

A precise evaluation should be done with computerized tomography or cone-beam computed tomography (CBCT) to determine the remaining bone volume and to detect any pathology in the sinus to be able to plan the maxillary sinus augmentation procedure with or without simultaneous implant placement [19, 20].

Different techniques were described in the literature for sinus lifting and bone grafting in patients with MRC and APC [8, 9, 21]. Some authors reflected their existence as a contraindication and suggested a previous lesion removal before grafting [22]. Six months later, the sinus grafting could be performed and implants could be placed at the

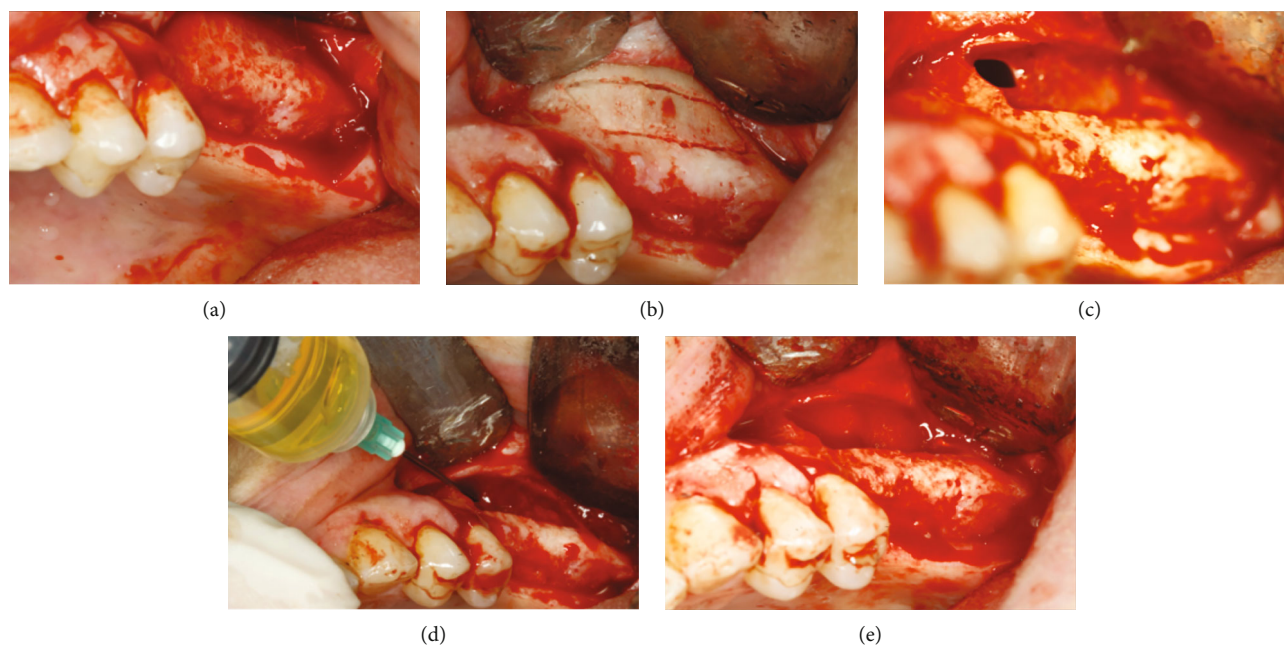


FIGURE 2: (a) Mucoperiosteal flap was elevated, and the bone wall of the sinus was exposed. (b) Osteotomies of the bony window were performed with the piezo surgery. (c) The bony window was detached in one piece, and a small perforation of the sinus membrane was observed in the upper mesial part of the window. (d) The yellow cystic fluid was aspirated with a sterile syringe with a 22 G needle. (e) The Schneiderian membrane was lifted carefully through the bony window area, and the perforation was sealed with a collagen membrane.

same time or postponed for a period of 3 months to achieve an osseointegration [23].

For other authors, patients could undergo sinus lifting with no lesion removal, in a single stage or delayed approach [24].

In this study, we report a case where an MRC was aspirated, instantaneously, the sinus membrane was lifted, and implants were placed.

2. Case Report

A 47-year-old female patient visited the Department of Oral & Maxillofacial Surgery, complaining of masticatory difficulties due to the loss of her left maxillary posterior teeth besides her need for a sinus lift to be able to place the implants. The interrogatory revealed that the patient had no medical problems.

A panoramic radiograph showed a missing first and second maxillary molars with a residual bone height of less than 4 mm, and a radio-opacity image was observed in the left maxillary sinus (Figure 1(a)). CBCT revealed a round-shaped radio-opaque lesion on the left maxillary sinus with a clear ostium (Figures 1(b), 1(c) and 1(d)).

The preliminary diagnosis varies between an antral pseudo-cyst or MRC. The treatment plan was to aspirate cystic fluid to lift the sinus membrane to place the two implants simultaneously, and restore the missing molars. The surgical procedure was performed under local analgesia (4% articaine with 1:200,000 epinephrine). A crestal incision was made medially from the second premolar to the third molar area with two lateral releasing incisions. Then, a muco-periosteal flap was elevated and the bone wall of

the sinus was exposed (Figure 2(a)). Osteotomy of the bony window was done with the piezosurgery instruments. The bony window was removed in one piece, and then the sinus membrane was lifted by a special curette and raised to achieve a curtain effect (Figure 2(b)).

A small perforation of the sinus membrane was observed in the upper mesial part of the window (Figure 2(c)). The cystic fluid was aspirated through the perforation with a sterile syringe with a 22 G needle (volume 5 ml). The aspirated fluid color was yellow, and the cyst membrane was sent for histological evaluation (Figure 2(d)).

The Schneiderian membrane was then lifted carefully through the bony window area, and the perforation was sealed with a collagen membrane (CollaTape® Zimmer-Biomet; Figure 2(e)).

Implant sites were drilled, and the first layer of bone substitute was packed into the cavity between the residual crestal bone, the palatal bone, and the Schneiderian membrane (Figures 3(a) and 3(b); Puros Cortical 0.25–1.0 mm particulate; Zimmer Biomet). Two implants (4 mm × 13 mm, Astra Tech-Dentsply®) were then placed. The final layer of bone substitute was placed (Figure 3(c)) and a resorbable membrane was positioned under the bony wall (Figure 3(d)). Interrupted O sutures were made using a 3-0 silk suture (Figure 3(e)).

Post-operative medications based on amoxicillin–clavulanic acid 1 g as an antibiotic (2 g/day for 7 days), mefenamic acid as anti-inflammatory (two tablets/day for 5 days), paracetamol, codeine phosphate hemihydrate, and caffeine in combination as painkillers (two tablets in case of pain), 2-week prescribed mometasone furoate as a systemic nasal decongestant (twice/day), and 0.12% chlorhexidine

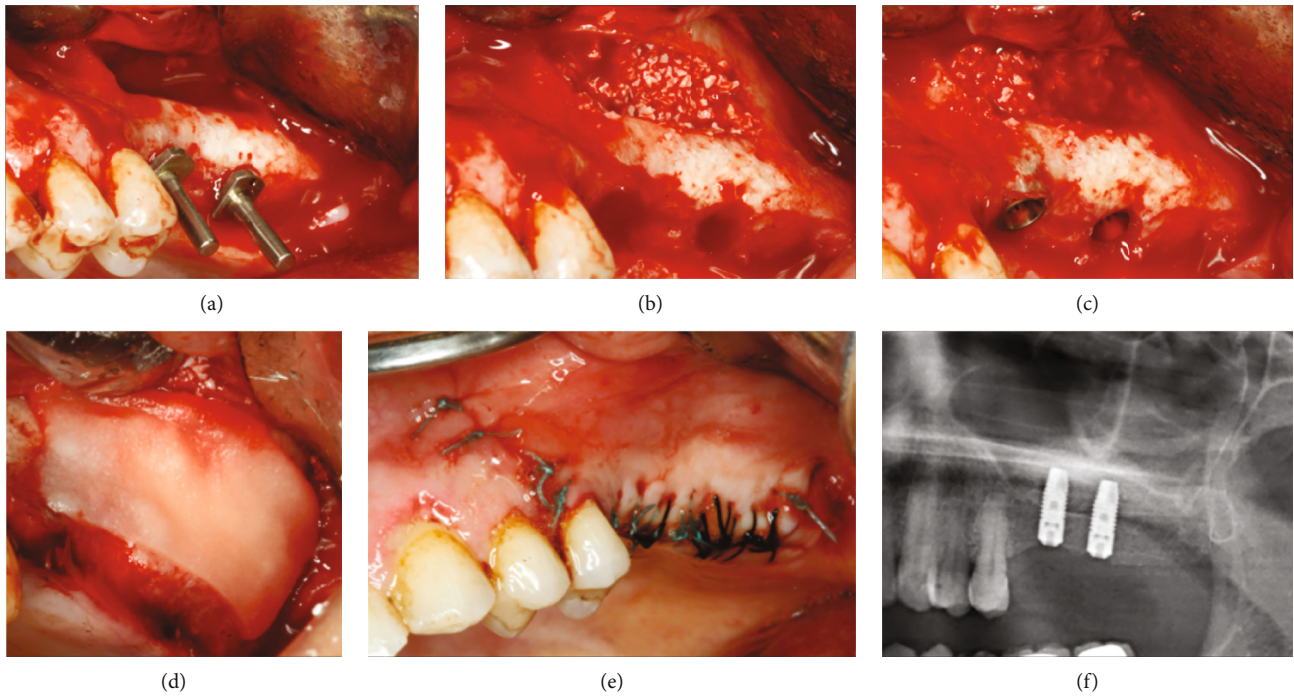


FIGURE 3: (a) Implant sites were prepared. (b) The first layer of bone substitute was packed into the cavity. (c) 2 implants were placed, and the final layer of bone substitute was placed. (d) Resorbable membrane was positioned under the bony wall. (e) Interrupted O sutures were made using a 3-0 silk suture. (f) Panoramic radiograph showed a well-defined area with two implants in the middle.

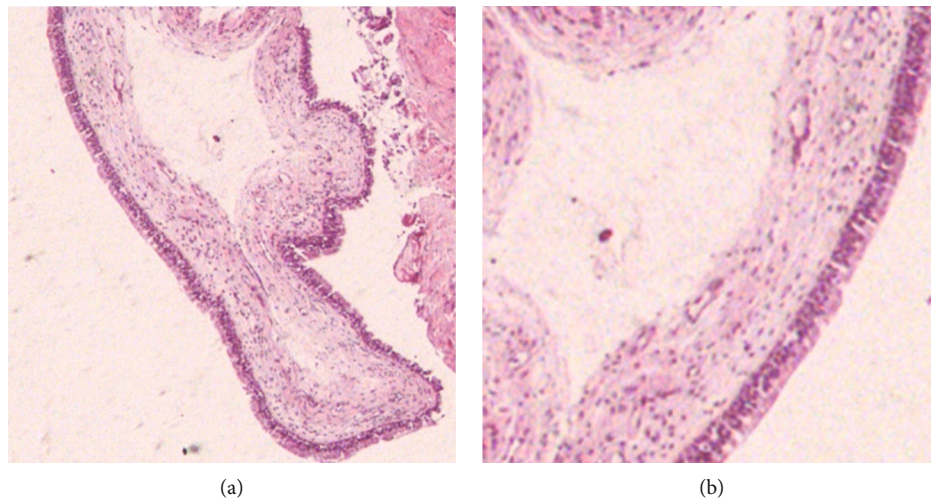


FIGURE 4: (a, b) The histological sections showed a virtual cystic cavity lined by a columnar pseudo-stratified epithelium with an underlying layer of loose connective tissue and a mononuclear inflammatory infiltrate was noted in the underlining tissue (H&E $\times 20$ and H&E $\times 40$).

gluconate as an oral rinse (three times/day with water for 10 days). One week later, the sutures were removed, and no signs of nasal congestion were stated.

The microscopic result after cyto-centrifugation came from some blood cells with macrophages and inflammatory cells, and the diagnosis was in favor of MRC. In addition, the histological sections showed a virtual cystic cavity lined by a columnar pseudo-stratified epithelium with an underlying layer of loose connective tissue, and a mononuclear inflammatory infiltrate was noted in the underlining tissue [hema-

toxylin and eosin (H&E) $\times 20$ and H&E $\times 40$] (Figures 4(a) and 4(b)).

Panoramic radiograph showed a well-defined area with two implants in the middle (Figure 3(f)).

The panoramic reconstruction and para-axial cuts of the CBCT at 5 months showed a well-limited augmented area covering from the buccal to the palatal bone, and no pathologies were detected inside the maxillary sinus (Figures 5(a), 5(b), and 5(c)). Crowns were fabricated and cemented to the abutments. The para-axial cut of the CBCT one year

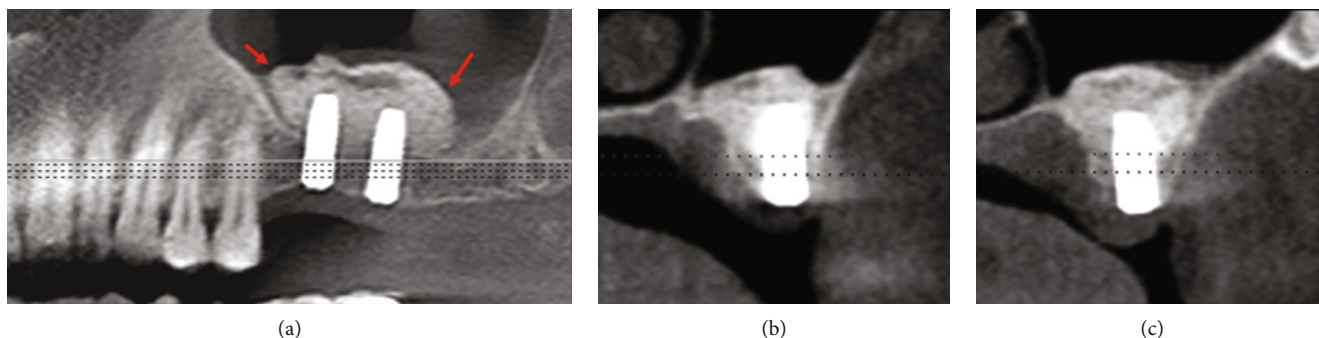


FIGURE 5: (a) Panoramic reconstruction showing well-limited grafted material within the middle of the two implants. No pathology was detected in the sinus. (b) The para-axial cut of the mesial implant completely embedded in the graft material. (c) The para-axial cut of the distal implant also well surrounded by the bone graft.

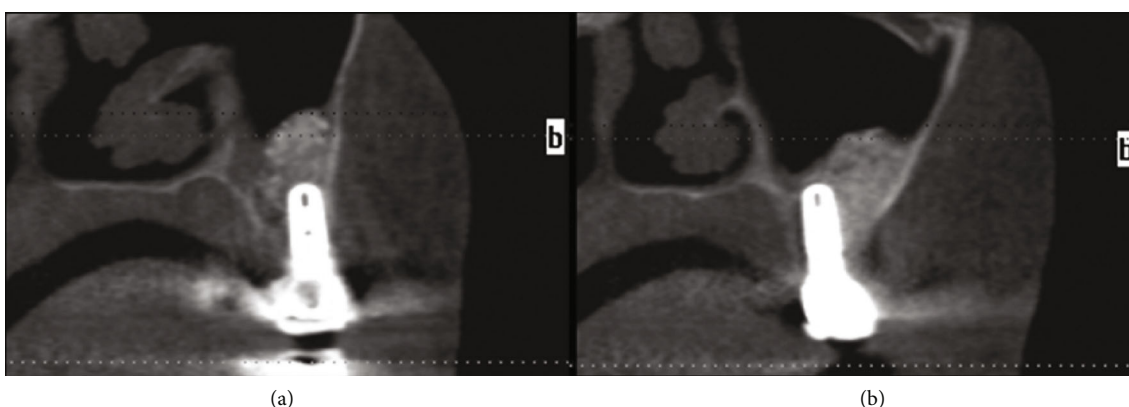


FIGURE 6: Axial cut of the left maxilla, one year after loading, showing the implant surrounded by the grafted material without any recurrence of the mucous retention cyst. (a) The first implant. (b) The second implant.

after loading showed a very integrated graft inside the sinus, and the implants are well integrated (Figures 6(a) and 6(b)).

3. Discussion

Disagreements exist about the indications of the sinus lifting procedure when MRC and APC are present, without previous treatment and a waiting period for healing achievement [10, 11].

Treatment of those lesions during the sinus augmentation procedure by aspiration or surgical excision is very well documented in the literature and some authors state that decreasing the cyst volume by aspiration helps to reduce the intra-sinus pressure and thus, the risk of perforation of the Schneiderian membrane [10, 11, 23, 24, 25].

For others, when the lesions are symptomatic or the diagnosis is uncertain, enucleation should be considered before sinus lift surgery [23, 26].

Treatment planning, when sinus lift surgery should be performed and when cysts exist inside the maxillary sinuses, is divided into three options:

- (1) Cyst/pseudocyst should be treated before the sinus lifting procedure and implant placement [25, 26].

- (2) Aspiration/removal could be performed simultaneously with sinus graft surgery [27–29].

- (3) The lesion can be left untreated [26, 28, 29].

Schneiderian membrane perforation is one of the common accidents that occur in sinus grafting with a variable rate between 7% and 60% [1, 30].

Moreno Vazquez et al. in a retrospective study of sinus lifting evaluating 127 patients, reported a high rate of Schneiderian membrane perforation in 25.7% [31].

Díaz-Olivares et al. in a systematic review that included 1,598 sinuses lifting using the lateral approach, reported a perforation rate of 30.6% [32].

Small or limited perforations are corrected intra-operatively by using collagen membranes [33] two separate bioabsorbable membranes [34], or fibrin glue that could lead to a newly formed epithelium [35] or PRF for its autogenous characteristics [36].

Park et al. recommend that the blood clot after perforation leads to membrane repair [37]. Testori et al. suggested that self-repairing could be observed with small perforations [38].

Large perforations could be treated with a two-stage approach using a collagen sponge [39] or by suturing the

membrane with resorbable sutures [36, 40]. In those cases, the augmentation surgery will be postponed from 3 to 6 months to permit membrane reparation [41].

In our case, the liquid of the cyst was aspirated, and the small perforation was treated with collagen membrane during the sinus lift procedure and the implants could be placed with a good primary stability.

This technique reduced the treatment period and the patient recuperated her missing teeth in a short period.

4. Conclusion

In conclusion, the aspiration of the cyst fluid concomitantly with the sinus lift procedure with bone substitutes shows a new bone formation inside the sinus and around the implants according to radiographic and clinical assessments. Identifying lesions in the maxillary sinus is essential before planning any type of sinus augmentation and implant placement. Do we need to remove the cyst before or during the sinus lifting procedure?

Each case should be assessed individually and a discussion with an Ear–Nose–Throat specialist could be required. Since in our case, the cyst was small without any obstruction and ventilatory problems, aspiration and sinus augmentation simultaneously reduced the number of surgeries and shortened the treatment time. The small perforation treated with collagen and bone substitute was well covered by the sinus membrane.

Data Availability

The available data are presented in the manuscript.

Consent

The patient has signed the consent form.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

References

- [1] P. Felice, R. Pistilli, M. Piattelli, E. Soardi, C. Barausse, and M. Esposito, “1-stage versus 2-stage lateral sinus lift procedures: 1-year post-loading results of a multicentre randomised controlled trial,” *European Journal of Oral Implantology*, vol. 7, no. 1, pp. 65–75, 2014.
- [2] J. J. Romero-Millán, J. Aizcorbe-Vicente, M. Peñarrocha-Diago, P. Galindo-Moreno, L. Canullo, and D. Peñarrocha-Oltra, “Implants in the posterior maxilla: open sinus lift versus conventional implant placement. A systematic review,” *The International Journal of Oral & Maxillofacial Implants*, vol. 34, no. 4, pp. e65–e76, 2019.
- [3] L. D. Silva, V. N. de Lima, L. P. Faverani, M. R. de Mendonça, R. Okamoto, and E. P. Pellizzer, “Maxillary sinus lift surgery— with or without graft material? A systematic review,” *International Journal of Oral and Maxillofacial Surgery*, vol. 45, no. 12, pp. 1570–1576, 2016.
- [4] E. A. Al-Moraissi, A. S. Alkhatari, B. Abotaleb, N. H. Altairi, and M. Del Fabbro, “Do osteoconductive bone substitutes result in similar bone regeneration for maxillary sinus augmentation when compared to osteogenic and osteoinductive bone grafts? A systematic review and frequentist network meta-analysis,” *International Journal of Oral and Maxillofacial Surgery*, vol. 49, no. 1, pp. 107–120, 2020.
- [5] A. Berberi and N. Nader, “Subantral augmentation with mineralized cortical bone allograft material,” *Implant Dentistry*, vol. 25, no. 3, pp. 353–360, 2016.
- [6] A. Berberi, N. Nader, R. Bou Assaf, H. Fayyad-Kazan, S. Khairalah, and N. Moukarzel, “Sinus floor augmentation with ambient blood and an absorbable collagen sponge: a prospective pilot clinical study,” *Implant Dentistry*, vol. 26, no. 5, pp. 674–681, 2017.
- [7] H. J. Kim, S. Yea, K. H. Kim et al., “A retrospective study of implants placed following 1-stage or 2-stage maxillary sinus floor augmentation by the lateral window technique performed on residual bone of <4 mm: results up to 10 years of follow-up,” *Journal of Periodontology*, vol. 91, no. 2, pp. 183–193, 2020.
- [8] O. Mardinger, I. Manor, E. Mijiritsky, and A. Hirshberg, “Maxillary sinus augmentation in the presence of antral pseudocyst: a clinical approach,” *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontics*, vol. 103, no. 2, pp. 180–184, 2007.
- [9] M. Chiapasco and D. Palombo, “Sinus grafting and simultaneous removal of large antral pseudocysts of the maxillary sinus with a micro-invasive intraoral access,” *International Journal of Oral and Maxillofacial Surgery*, vol. 44, no. 12, pp. 1499–1505, 2015.
- [10] C. Beaumont, G. G. Zafiroopoulos, K. Rohmann, and D. N. Tatakis, “Prevalence of maxillary sinus disease and abnormalities in patients scheduled for sinus lift procedures,” *Journal of Periodontology*, vol. 76, no. 3, pp. 461–467, 2005.
- [11] L. Tavelli, A. E. Borgonovo, D. Re, and C. Maiorana, “Sinus presurgical evaluation: a literature review and a new classification proposal,” *Minerva Stomatologica*, vol. 66, no. 3, pp. 115–131, 2017.
- [12] A. Ritter, N. Rozendorn, G. Avishai, E. Rosenfeld, I. Koren, and E. Soudry, “Preoperative maxillary sinus imaging and the outcome of sinus floor augmentation and dental implants in asymptomatic patients,” *The Annals of Otolaryngology, Rhinology, and Laryngology*, vol. 129, no. 3, pp. 209–215, 2020.
- [13] S. Meer and M. Altini, “Cysts and pseudocysts of the maxillary antrum revisited,” *SADJ*, vol. 61, no. 1, pp. 10–13, 2006.
- [14] E. I. Giotakis and R. K. Weber, “Cysts of the maxillary sinus: a literature review,” *International Forum of Allergy & Rhinology*, vol. 3, no. 9, pp. 766–771, 2013.
- [15] D. G. Gardner, “Pseudocysts and retention cysts of the maxillary sinus,” *Oral Surgery, Oral Medicine, and Oral Pathology*, vol. 58, no. 5, pp. 561–567, 1984.
- [16] J. H. Wang, Y. J. Jang, and B. J. Lee, “Natural course of retention cysts of the maxillary sinus: long-term follow-up results,” *The Laryngoscope*, vol. 117, no. 2, pp. 341–344, 2007.
- [17] N. Bhattacharyya, “Do maxillary sinus retention cysts reflect obstructive sinus phenomena?,” *Archives of Otolaryngology – Head & Neck Surgery*, vol. 126, no. 11, pp. 1369–1371, 2000.
- [18] M. Shear and P. M. Speight, *Cysts of the Oral and Maxillofacial Regions*, Wiley-Blackwell, Oxford, 4th edition edition, 2007.
- [19] L. Maestre-Ferrín, S. Galán-Gil, C. Carrillo-García, and M. Peñarrocha-Diago, “Radiographic findings in the maxillary sinus: comparison of panoramic radiography with computed

- tomography,” *The International Journal of Oral & Maxillofacial Implants*, vol. 26, no. 2, pp. 341–346, 2011.
- [20] V. Arisan, Z. C. Karabuda, H. Avsever, and T. Özdemir, “Conventional multi-slice computed tomography (CT) and cone-beam CT (CBCT) for computer-assisted implant placement. Part I: relationship of radiographic gray density and implant stability,” *Clinical Implant Dentistry and Related Research*, vol. 15, no. 6, pp. 893–906, 2013.
- [21] T. Hadar, J. Shvero, B. I. Nageris, and E. Yaniv, “Mucus retention cyst of the maxillary sinus: the endoscopic approach,” *The British Journal of Oral & Maxillofacial Surgery*, vol. 38, no. 3, pp. 227–229, 2000.
- [22] Y. Lin, X. Hu, A. R. Metzmacher, H. Luo, S. Heberer, and K. Nelson, “Maxillary sinus augmentation following removal of a maxillary sinus pseudocyst after a shortened healing period,” *Journal of Oral and Maxillofacial Surgery*, vol. 68, no. 11, pp. 2856–2860, 2010.
- [23] J. D. Han, S. H. Cho, K. W. Jang et al., “Lateral approach for maxillary sinus membrane elevation without bone materials in maxillary mucous retention cyst with immediate or delayed implant rehabilitation: case reports,” *Journal of the Korean Association of Oral and Maxillofacial Surgeons*, vol. 43, no. 4, pp. 276–281, 2017.
- [24] M. G. Choi, C. H. Hong, E. J. Choi, W. J. Park, Y. G. Kim, and D. G. Gil, “Sinus lifts in the presence of pseudoantral and mucous retention cysts,” *Journal of the Korean Association of Oral and Maxillofacial Surgeons*, vol. 48, no. 2, pp. 101–110, 2022.
- [25] S. B. Kim, P. Y. Yun, and Y. K. Kim, “Clinical evaluation of sinus bone graft in patients with mucous retention cyst,” *Maxillofacial Plastic and Reconstructive Surgery*, vol. 38, no. 1, p. 35, 2016.
- [26] N. Celebi, Z. B. Gonen, E. Kilic, O. Etoz, and A. Alkan, “Maxillary sinus floor augmentation in patients with maxillary sinus pseudocyst: case report,” *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontics*, vol. 112, no. 6, pp. e97–102, 2011.
- [27] Y. K. Hu, C. Yang, and W. T. Qian, “Endoscopic-assisted sinus floor augmentation combined with removal of an antral pseudocyst of the ipsilateral maxillary sinus,” *The Journal of Craniofacial Surgery*, vol. 28, no. 6, pp. 1549–1551, 2017.
- [28] J. H. Oh, X. An, S. M. Jeong, and B. H. Choi, “Crestal sinus augmentation in the presence of an antral pseudocyst,” *Implant Dentistry*, vol. 26, no. 6, pp. 951–955, 2017.
- [29] T. Gong, C. Hu, Y. Chen, N. Zhou, H. Wu, and Y. Man, “Raising the transcrestal sinus floor in the presence of antral pseudocysts, and in sinus floors with a normal Schneiderian membrane: a retrospective cohort study,” *The British Journal of Oral & Maxillofacial Surgery*, vol. 57, no. 5, pp. 466–472, 2019.
- [30] C. Stacchi, F. Andolsek, F. Berton, G. Perinetti, C. O. Navarra, and R. Di Lenarda, “Intraoperative complications during sinus floor elevation with lateral approach: a systematic review,” *The International Journal of Oral & Maxillofacial Implants*, vol. 32, no. 3, pp. e107–e118, 2017.
- [31] J. C. Moreno Vazquez, A. S. Gonzalez de Rivera, H. S. Gil, and R. S. Mifsut, “Complication rate in 200 consecutive sinus lift procedures: guidelines for prevention and treatment,” *Journal of Oral and Maxillofacial Surgery*, vol. 72, no. 5, pp. 892–901, 2014.
- [32] L. A. Díaz-Olivares, J. Cortés-Bretón Brinkmann, N. Martínez-Rodríguez et al., “Management of Schneiderian membrane perforations during maxillary sinus floor augmentation with lateral approach in relation to subsequent implant survival rates: a systematic review and meta-analysis,” *International Journal of Implant Dentistry*, vol. 7, no. 1, p. 91, 2021.
- [33] C. Ferreira, C. Matinelli, A. Novaes-Jr, and T. Pignaton, “Effect of maxillary sinus membrane perforation on implant survival rate: a retrospective study,” *The International Journal of Oral & Maxillofacial Implants*, vol. 32, no. 2, pp. 401–407, 2017.
- [34] S. Froum, I. Khoully, G. Favero, and S. Cho, “Effect of maxillary sinus membrane perforation on vital bone formation and implant survival: a retrospective study,” *Journal of Periodontology*, vol. 84, no. 8, pp. 1094–1099, 2013.
- [35] B. Choi, S. Zhu, J. Jung, S. Lee, and J. Huh, “The use of autologous fibrin glue for closing sinus membrane perforations during sinus lifts,” *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontics*, vol. 101, no. 4, pp. 426–431, 2006.
- [36] E. Öncü and E. Kaymaz, “Assessment of the effectiveness of platelet rich fibrin in the treatment of Schneiderian membrane perforation,” *Clinical Implant Dentistry and Related Research*, vol. 19, no. 6, pp. 1009–1014, 2017.
- [37] W. B. Park, J. Han, P. Kang, and F. Momen-Heravi, “The clinical and radiographic outcomes of Schneiderian membrane perforation without repair in sinus elevation surgery,” *Clinical Implant Dentistry and Related Research*, vol. 21, no. 5, pp. 931–937, 2019.
- [38] T. Testori, S. Wallace, M. Del Fabbro, and S. Taschieri, “Repair of large sinus membrane perforations using stabilized collagen barrier membranes: surgical techniques with histologic and radiographic evidence of success,” *The International Journal of Periodontics & Restorative Dentistry*, vol. 28, no. 1, pp. 9–17, 2008.
- [39] A. S. Dagba, J. Mourlaas, D. Ochoa Durand, T. Suzuki, and S. C. Cho, “A novel approach to treat large Schneiderian membrane perforation—a case series,” *International Journal of Dentistry and Oral Health*, vol. 6, p. 1, 2015.
- [40] F. Hernández-Alfaro, M. M. Torradeflot, and C. Marti, “Prevalence and management of Schneiderian membrane perforations during sinus-lift procedures,” *Clinical Oral Implants Research*, vol. 19, pp. 91–98, 2008.
- [41] N. Boreak, P. Maketone, J. Mourlaas, W. C. W. Wang, and P. Y. C. Yu, “Decision tree to minimize intra-operative complications during maxillary sinus augmentation procedures,” *Journal of Oral Biology*, vol. 5, no. 1, p. 8, 2018.