
Combined bony closure of oroantral fistula and sinus lift with mandibular bone grafts for subsequent dental implant placement

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Sinus lifting and reconstruction of localized alveolar defects are often required after closure of a large oroantral fistula (OAF) to allow for subsequent implant installation. This study describes a combined surgical technique that involves sinus lifting, bony closure, and reconstruction of the alveolar defect at the site of an OAF. The sinus membrane was reconstructed as a continuous layer by combining the residual sinus membrane with a rotated part of oral mucosa around the OAF. Autogenous bone from the chin and/or ramus was grafted into the prepared sinus space and alveolar defect, and the graft was covered by a buccal advancement flap. This technique was used to treat 8 patients who had large OAFs in the posterior maxillary region. The treatment was successful in all cases, and the technique appears to be suitable for large OAFs where implants are subsequently desired. (**Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2011;111:e8-e14**)

Oroantral fistulas (OAFs) are a complication of oral surgery that most commonly occurs after extraction of the maxillary first molar. Extraction of other teeth can cause OAF, including the second molar, third molar, and premolars.¹⁻³ These fistulas are also associated with tumor resection, osteoradionecrosis, and dental implant failure in the atrophic posterior maxilla.⁴ Although smaller defects of <5 mm in diameter may close spontaneously, larger communications always require proper surgical closure.⁵ However, if these go untreated, ~50% of patients will experience sinusitis 48 hours later and 90% of patients will have sinusitis after 2 weeks.^{1,6}

Therefore, management of these fistulas are recommended to promote closure. Different surgical techniques were introduced to close OAFs, including advancing or rotating intraoral local soft tissue flaps, such as buccal or palatal mucosa, buccal fat pad, submucosal connective tissue, or tongue tissue.⁷⁻⁹

Because of the high recurrence rate of OAF with soft tissue coverage techniques, especially in large bone defects and the continued need for implant rehabilitation and preimplant surgery, such as sinus floor elevation and ridge augmentation, routine soft tissue closure of OAFs has become a major problem, because it

causes matting of the oral mucosa and the schneiderian membrane, which makes elevation of the sinus membrane impossible without tearing it.

Proctor first reported the bony closure of large OAF by grafting a piece of corticocancellous block from the anterior iliac spine.¹⁰ Recently, Hass et al.⁴ introduced another OAF bony closure technique using a monocortical press-fit graft from the chin area which was covered with a Rehrmann flap. The sinus side of the graft was left denuded and healed secondarily through migrating sinus membrane. Conventional sinus lifting was performed several months after grafting.

These techniques are innovative and successful for treating a moderate-size OAF of alveolar type that is completely surrounded with intact alveolar bone to ensure intimate bony contact between press-fit bone graft and the recipient bed. However, in large OAFs with severe loss of the buccal alveolar cortical plate, this bony contact may not have occurred. In addition, the large denuded surface of the sinus side of the graft may increase risk of graft infection. Furthermore, implant surgery requires conventional sinus lifting with bone graft with subsequent prolonged total treatment duration and surgical procedures.¹¹

In 2008, a new surgical technique was introduced by Lee in an attempt to overcome the previous limitations in treating the large OAF.¹¹ The technique involved both bony closure and sinus lifting through soft tissue dissection and closure of antral flap as a first-layer closure followed by grafting the defect using iliac crest bone graft. Based on Lee's technique, the present study was designed to evaluate the effectiveness of simulta-

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Fig. 1. Pre-operative OPG showing OAF in the upper right molar region.

neous bony closure and sinus lifting of large OAFs using mandibular bone grafts for providing a sound base for subsequent implant placement.

MATERIAL AND METHODS

Patients

This study involved 8 patients treated at the Department of Oral and Maxillofacial Surgery, Faculty of Oral and Dental Medicine, Cairo University. All patients enrolled in this study had to fulfill one of the following criteria: patients with OAF and planned for subsequent implant placement, or patients with chronic OAF with unsuccessful attempts for closure.

History and clinical examination were undertaken to determine signs and symptoms of sinusitis, nasal, and fistulous discharge, previous surgical interventions, and site and size of oral communication. Radiographic examination included panoramic radiographs and computerized tomography (Figs. 1 and 2) to evaluate maxillary sinus condition regarding presence of any foreign bodies, remaining roots, and size of bony defect at the OAF site.

Preoperative preparation

Under local anesthesia, surgical widening of OAF was performed by cutting a circular incision around the orifice to remove any inflamed fistulous tract, sinus lining prolapse, and associated sinus polyp that might obstruct sinus drainage and to allow a satisfactory drainage through the enlarged fistula.

All patients received amoxicillin/clavulanic acid (Augmentin; GlaxoSmithKline) and/or methonidazole (Flagyl; Sanofi Aventis) twice daily and analgesic (ibuprofen) to remove any residual infection and inflammation and to control pain. The affected sinus was irrigated through the fistula with physiologic saline solution followed by an iodine-containing solution diluted with physiologic saline solution (1:1) to control infection. This regimen was administered 3 times a week until the lavage fluid no longer

contained inflammatory exudates and there were no signs of gingival inflammation around the OAF orifice, which generally took 2-3 weeks.

Surgical procedures

Recipient bed preparation. All patients received pre-operative amoxicillin/sulbactam (Unasyn 375 mg; Pfizer) twice daily, analgesic (ibuprofen) to control pain, nasal decongestant (Otrivin 0.05%), and systemic decongestant (Triludan; Merrel UK) for 2 days.

The surgical procedures were carried out under general anesthesia through a nasotracheal intubation of the nostril on the opposite side of OAF. A local anesthetic agent (e.g., 1% lidocaine with epinephrine 1:100,000) was injected for hemostasis and to increase tissue bulk. The operative side was scrubbed with Betadine surgical scrub solution, and then routine surgical draping was performed. Before starting surgical procedure, intravenous administration of 8 mg dexamethasone was performed.

A superior-based full-thickness buccal mucoperiosteal flap, for at least a distance of 1 tooth on each side of the OAF, was elevated (except at the OAF alveolar defect) to expose the buccal maxillary alveolar bone around the OAF. Then, at the OAF site, a round split-thickness crestal incision 1-2 mm from the margin of the fistula was made and the oroantral margins elevated from the alveolus bony walls and rotated into the OAF to sustain continuity with the residual sinus membrane. Dissection of this fibrotic fistulous tract and subsequent elevation of the sinus membrane was continued by using a narrow curved sinus elevator until the planned sinus elevation height was reached, and then the excess soft tissue of the flap was excised and the margins were approximated and tension-free sutured together with 5/0 Vicryl to create a closed sinus layer (first-layer closure; Fig. 3).

Autogenous bone harvesting and grafting. A corticocancellous block graft was harvested from the chin and/or retromolar regions. An intraoral incision was placed below the mucogingival junction extended between mandibular canines to expose the anterior surface of the mandibular symphysis. Then a rectangle was outlined with oscillating saw, 5 mm below the apices of the lower anterior teeth. Osteotomes were used for freeing the corticocancellous block, leaving the lingual cortex intact, and a resorbable gelfoam was inserted into the chin defect for hemostasis and to decrease the possibility of postoperative infection. Finally, the soft tissues were replaced and sutured with continuous resorbable suture and reinforced with an interrupted one using 3/0 Vicryl (Fig. 4).

The block graft was divided into 2 pieces, and one piece was placed to reconstruct the sinus floor and to

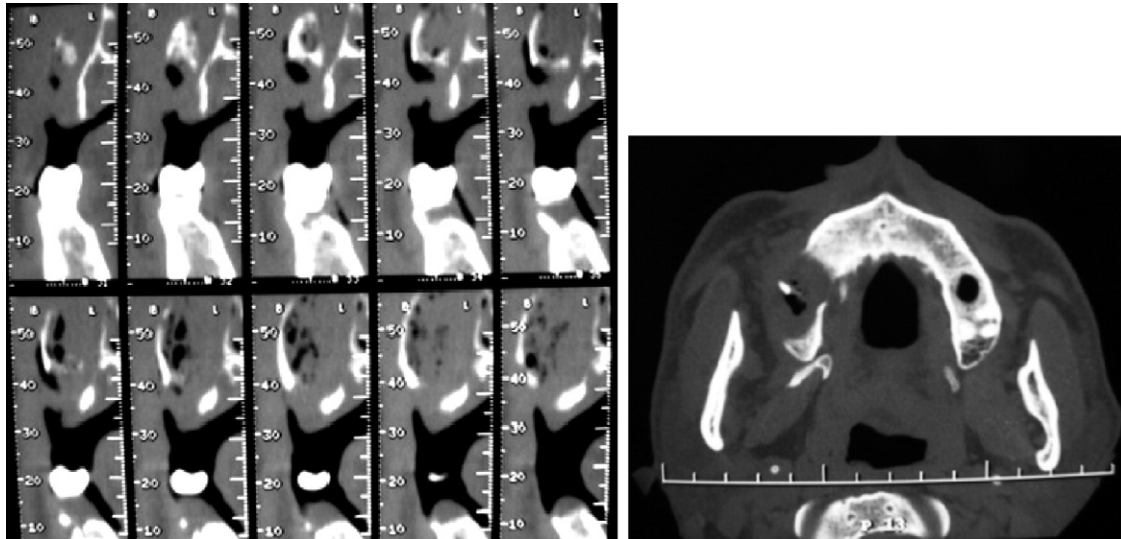


Fig. 2. Coronal (left) and axial (right) CT scans showing a clearly defined large OAF and alveolar defect in the upper right molar region.

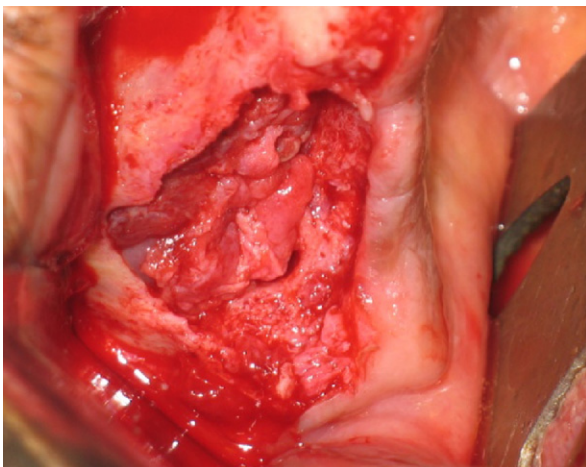


Fig. 3. The oroantral flap was dissected and elevated from both the alveolus and mucosa and rotated into the sinus to create a closed sinus layer and to create a space for bone grafting.

bridge across the bony defect. Then the other piece was used to reconstruct the buccal alveolar plate at the site of the OAF (lateral grafting) and fixed using microplate or screws (Leibinger, Freiburg, Germany). Residual bones were particulated by using bone rongeur and bone mill and were placed to fill the residual spaces between the alveolar walls and the sinus floor, aiming to reconstruct the alveolar portion of the ridge (Fig. 5).

Finally, soft issue closure was established by using a Rehrmann flap that was sutured by mattress and inter-

rupted Vicryl sutures. The microplates and/or screws were removed at the time of scheduled implant placement (i.e., 4-6 months after the bony closure of OAF; Fig. 6).

Routine postoperative instructions, including application of ice compresses to the operated side of the face to minimize edema, cold fluid diet in the day of surgery, and then soft diet for the following 3 days, were given for all patients. The preoperatively prescribed medications were administered for 1 week after surgery, and the patients were instructed to avoid strenuous physical activities (nose blowing, sneezing, vigorous sports) that might raise the pressure within the paranasal sinuses until the sutures were removed 10-14 days after surgery.

RESULTS

In this study, all patients presented with small fistulas combined with the presence of unilateral nasal discharge in mouth rinsing and 2 of them had mild symptoms of chronic sinusitis appeared in the form of post-nasal discharge and headache. All the patients underwent unsuccessful previous surgical attempts of OAF closure with a buccal sliding flap. Sinus lining prolapse was detected in 1 case only, presented in the form of painless exophytic fragile soft tissue which necessitated preoperative surgical excision. The mean age of the patients was 43 years; the causes of the oroantral fistulas, the defect sizes, graft region, and other characteristics are listed in Table I. Intraoperatively, in all cases, there was a severe alveolar bone loss particularly at the buccal aspect of the OAF site that necessitated bony reconstruction.

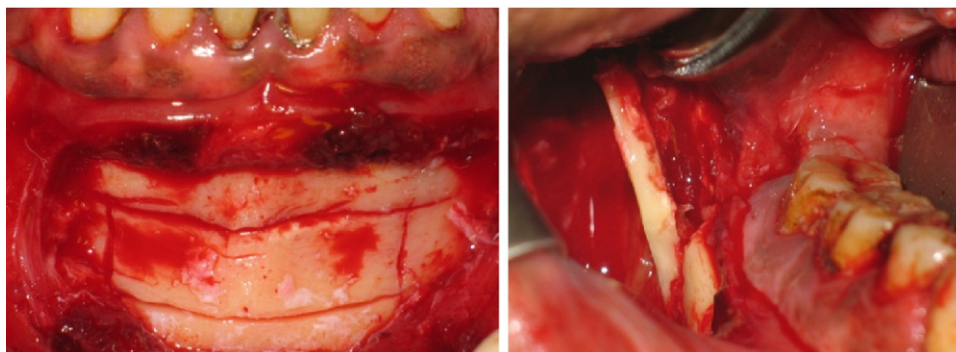


Fig. 4. An intra-operative view showing exposure of the mandibular symphysis and retromolar region and outlining of the corticocancellous grafts.

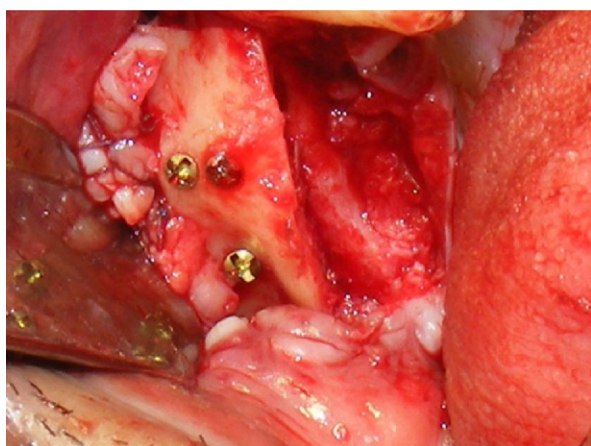


Fig. 5. Corticocancellous graft adapted to the defect and fixed in place using osteosynthesis screws to reconstruct the sinus floor and alveolar defect at the OAF site.

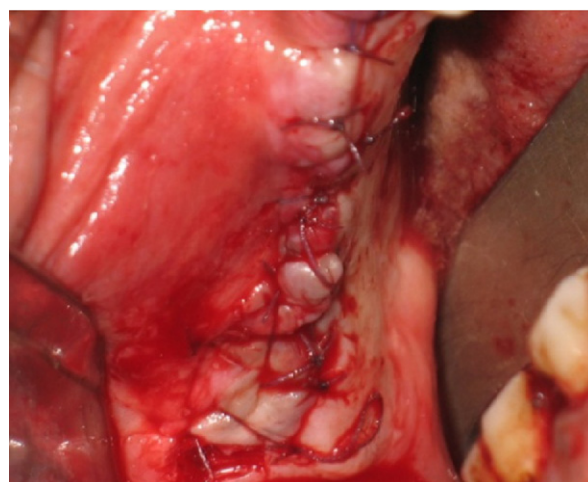


Fig. 6. An intra-operative view showing soft tissue closure using buccal advancement flap.

In all cases, there was a successful closure of the OAF and successful reconstruction of the alveolar bone that provided a solid bony base for implant placement. During the follow-up period, there was no wound dehiscence (except 1 case), infection, maxillary sinusitis, graft rejection, or OAF recurrence. In 1 patient, mucosal dehiscence developed 1 week after surgery; this necessitated daily disinfection with chlorhexidine mouth rinse. The soft tissue defect healed by secondary intention within 3 weeks. Shortening of the vestibular depth was observed in all cases; however, it did not constitute any problem regarding prosthetic rehabilitation.

Implant placement was performed in 4 cases after 4 months. In the other 2 cases, one needed simultaneous implant placement and sinus lift, and the other needed second alveolar grafting followed by implant placement after another 3 months. Normal bone healing was

verified both clinically and radiographically at the time of implant placement (Figs. 7-10). Although the present study was small for statistical analysis, no OAF recurrences nor implant failures were observed after loading for 6 months.

DISCUSSION

Oroantral fistula development is a possible complication after maxillary premolar or molar extraction, with a range of frequency from 0.31% to 4.7%.^{8,12,13} In all cases, the OAF had followed upper first and second molar extraction, with the exception of 1 case in which it followed maxillary fracture open reduction and fixation. Although sinusitis is frequently observed if an OAF was left untreated,⁴ only 2 cases showed clinical and/or radiographic sign of sinusitis. This might be related to the fact that all

Table I. Clinical data of the patients

Patient	Age	Cause of OAF	Site of OAF	Defect size (mm)	Donor site	Graft fixation
1	26	Extraction	L-1M	12	Chin-ramus	Microplate
2	38	Extraction	R-2M	8	Chin	Screws
3	48	Extraction	L-1M	6	Chin	Screws
4	54	Maxillary fracture	R-1M	7	Chin	Microplate
5	43	Extraction	R-1M	10	Chin-ramus	Microplate
6	49	Extraction	R-2M	9	Chin-ramus	Screws
7	38	Extraction	R-2M	11	Chin-ramus	Screws
8	45	Extraction	R-2M	13	Chin-ramus	Screws

OAF, Oroantral fistula.

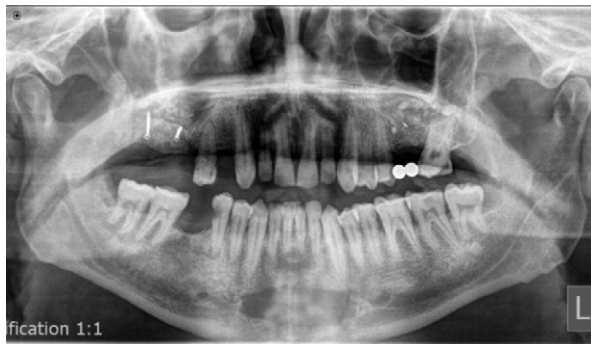


Fig. 7. An immediate post-operative OPG showing bony closure of the OAF with alveolar defect reconstruction.



Fig. 9. One-year post-operative OPG showing gingival formers attached to implants.



Fig. 8. Six-month post-operative OPG showing implant instillation in the grafted region.

patients had a history of previous unsuccessful surgical attempts of their fistula.

Several techniques have been used to treat the OAF, with similar rates of success and failure.^{4,8,12,14,15} Although buccal advancement, palatal rotational flap, and buccal fat grafts are the most commonly used techniques,⁸ it may present some anatomic disadvantages. They can reduce vestibular depth, cause lack of bone support, or cause fusion of the schneiderian membrane

and mucosal tissue.^{4,15} In the past several years, with the increased demand for dental implants, such complications hinder implant surgery at the site of the OAF and necessitate first replacement of the lost alveolar bone to allow subsequent implant rehabilitation, because the regeneration of bone defect does not take place with the simple soft tissue closure of OAF.^{8,12} Therefore, the aim of the treatment in the present study was to achieve closure of the OAF, sinus lifting, and alveolar reconstruction in the same surgical process to allow subsequent implant placement.

In the present study, the split-thickness dissection of a part of the oral mucosa that was continuous with the residual sinus membranes through the OAF was highly successful in restoring the continuity of the residual sinus membrane in the OAF region. In all cases, this oroantral flap maintained a firm continuity, probably owing to the intermingling of cells from the oral mucosa and the residual sinus membranes in the border area. During elevation of the sinus membrane, some thickening of the membrane was observed in all cases, which was considered to be a hyperplastic response resulting from the previous chronic inflammation.^{16,17} However, this thickening of sinus membrane made sinus elevation in the present cases technically easier than in normal healthy cases.

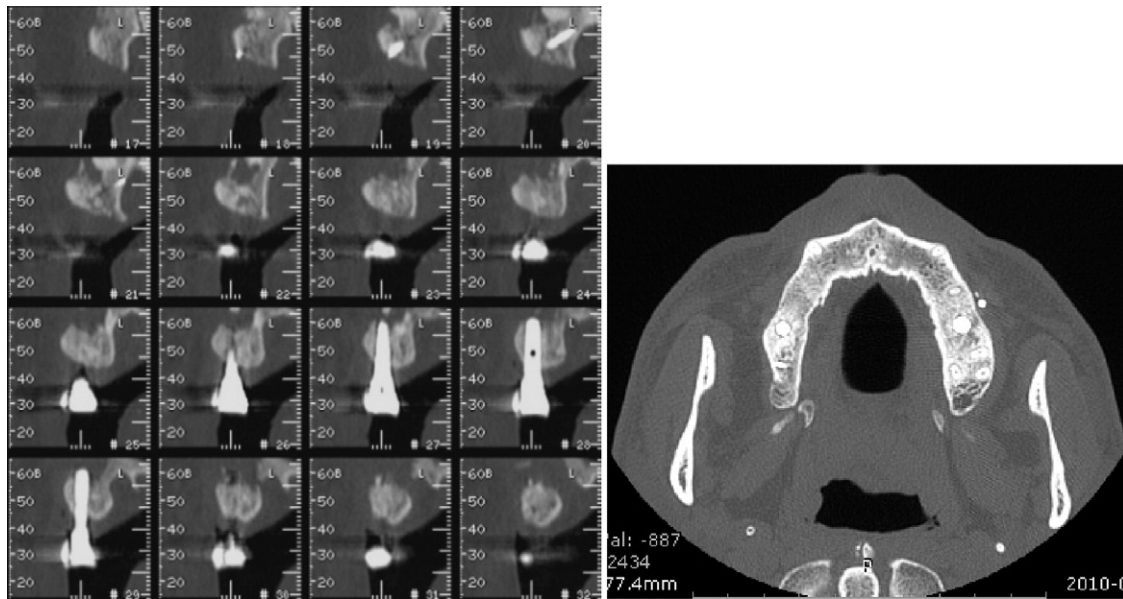


Fig. 10. Coronal (left) and axial (right) CT scans 6 months post-implant instillation showing alveolar defect reconstruction at the site of OAF with normal graft healing around the implant.

Earlier studies recommend making the sinus lifting some time after the bony closure of the OAF.^{4,11} However, the control of sinus infection is an essential factor both for successful OAF closure and for bone graft consolidation. In the present study, this was achieved through the preoperative procedure of widening the small OAF orifice for proper irrigation and drainage, continuous administration of appropriate antibiotics and antiinflammatory drugs for 2-4 weeks, and intraoperatively through restoration of the discontinuous sinus membrane through proper split-thickness dissection and watertight closure of the oroantral flap.

The advantages of using mandibular bone grafts in this study are related to using the same operation field, easily accessibility, reduced operating time, minimal postoperative complains, and absence of visible scar. Furthermore, operating exclusively intraorally was considered to be less extensive surgery by patients compared with using the iliac crest as donor site.^{18,19}

In the present study, a mandibular corticocancellous block graft was an ideal graft material, because it provided a cortical portion for reconstructing both a solid sinus floor and the alveolar defect at the OAF site and its cancellous portion contains viable multipotent mesenchymal stem cells for osteogenesis. Several authors have also attributed reduced volume loss and early incorporation of the chin bone grafts in a shorter healing time compared with iliac crest bone grafts partly to the ectomesenchymal origin of both the donor and recipient sites and partly to the osteogenic character

of the chin donor site (membranous bone). They have reported that membranous bone undergoes less resorption than bone of endochondral origin (iliac crest bone graft), owing to earlier revascularization of membranous bone grafts.^{20,21}

CONCLUSIONS

The present study describes a technique in which OAF closure, sinus lifting, and alveolar bone reconstruction for further implant placement using mandibular bone grafts was performed during the same operation. The technique suggested in this study has the advantages of reducing the total treatment time and number of procedures. In addition, it reduces the risk of graft infection through restoration of a sinus layer over the graft by elevating the residual original sinus mucosa together with some of the oral mucosa around the OAF and rotating it into the sinus. However, it may also present some disadvantages, such as the need for a bone donor site, vestibuloplasty, and second alveolar augmentation. To conclude, we think that this technique may be useful to treat OAF and to provide a solid alveolar bone site for subsequent implant placement.

REFERENCES

1. Killey HC, Kay LW. An analysis of 250 cases of oro-antral fistula treated by the buccal flap operation. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 1967;24:726-39.

2. von Wowern N. Oroantral communications and displacements of roots into the maxillary sinus: a follow-up of 231 cases. *J Oral Surg* 1971;29:622-7.
3. Ehl PA. Oroantral communication. Epicritical study of 175 patients, with special concern to secondary operative closure. *Int J Oral Surg* 1980;9:351-8.
4. Hass R, Watzak G, Baron M, Tepper G, Mailath G. A preliminary study of monocortical bone grafts for oroantral fistula closure. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2003;96:527-34.
5. Martensson G. Operative method in fistulas to the maxillary sinus. *Acta Otolaryngol* 1957;48:253-5.
6. Haanaes HR, Gilhuus-Moe O. A histologic study of experimental oro-paranasal communications in monkeys. *Int J Oral Surg* 1972;1:250-7.
7. Awang MN. Closure of oroantral fistula. *Int J Oral Maxillofac Surg* 1988;17:110-5.
8. Abuabara A, Cortez AL, Passeri LA, de Moraes M, Moreira RW. Evaluation of different treatments for oroantral/oronasal communications: experience of 112 cases. *Int J Oral Maxillofac Surg* 2006;35:155-8.
9. Al-Qattan MM. A modified technique of using the tongue tip for closure of large anterior palatal fistula. *Ann Plast Surg* 2001;47:458-60.
10. Proctor B. Bone graft closure of large or persistent oromaxillary fistula. *Laryngoscope* 1969;79:822-6.
11. Lee BK. One-stage operation of large oroantral fistula closure, sinus lifting, and autogenous bone grafting for dental implant placement. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2008;105:707-13.
12. Anavi Y, Gal G, Silfen R, Calderon S. Palatal rotation-advancement flap for delayed repair of oroantral fistula: a retrospective evaluation of 63 cases. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2003;96:527.
13. Punwutikorn J, Waikakul A, Pairuchvej V. Clinically significant oroantral communications—a study of incidence and site. *Int J Oral Maxillofac Surg* 1994;23:19.
14. Martin-Granizo R, Naval L, Costas A, Goizueta C, Rodriguez F, Monje F, et al. Use of buccal fat pad to repair intraoral defects: review of 30 cases. *Br J Oral Maxillofac Surg* 1997;35:81.
15. Watzak G, Tepper G, Zechner W, et al. Bony press-fit closure of oro-antral fistula: a technique for pre-sinus lift repair and secondary closure. *J Oral Maxillofac Surg* 2006;63:1288.
16. Jung JH, Choi BH, Jeong SM, Li J, Lee SH, Lee HJ. A retrospective study of the effects on the sinus complications of exposing dental implants to the maxillary sinus cavity. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2007;103:623-5.
17. Kurien M, Raman R, Job A. Roentgen examination of maxillary sinus, antral puncture, and irrigation—a comparative study. *Singapore Med J* 1989;30:565-7.
18. Hoppenreijts TJM, Nijdam ES, Freihofer HPM. The chin as a donor site in early secondary osteoplasty: a retrospective clinical and radiographic evaluation. *J Craniomaxillofac Surg* 1992;20:119.
19. Laurie SW, Kaban LB, Mulliken JB. Donor site morbidity after harvesting rib and iliac bone. *Plast Reconstr Surg* 1984;73:933.
20. Koole R. Ectomesenchymal mandibular symphysis bone graft: an improvement in alveolar cleft grafting. *Cleft Palatal Craniofac J* 1994;21:217-1994.
21. Smith JD, Abramson M. Membraneous vs endochondral bone autograft. *Arch Otolaryngol* 1974;99:203-1974.

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