Large oroantral fistula repair using combined buccal and palatal flaps: a case series

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Aim
The aim was to detect the efficacy of combined buccal advancement and palatal rotational flaps in closure of large oroantral fistulas (OAFs) after dental extraction.
Materials and methods
A 3-year prospective study was conducted between February 2014 and May 2017. A total of 11 patients with large OAF after dental extraction were included in the study. Seven patients developed OAF after dental extraction of the maxillary first molar teeth, whereas two patients developed an OAF after dental extraction of the second maxillary premolars. The last two patients developed an OAF after dental extraction of the second maxillary molars.
Results
Closure of the defect was achieved in 10 cases, whereas only one case had failure. In addition to postoperative pain, swelling, and reduction of the vestibular sulcus, one patient experienced postoperative nasal adhesions between the nasal septum and inferior turbinate.
Conclusion
A combined buccal and palatal flap is efficient in closure of large delayed OAF secondary to dental extraction. Further study is required to assess new bone formation after repair of large OAF using this technique.

Keywords:
buccal advancement flap, combined flaps, maxillary tooth extraction, oroantral fistula, palatal rotational flap

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Introduction

The oroantral fistula (OAF) is a pathological communication between the oral cavity and the maxillary sinus. Like any fistula, it is lined by epithelium arising from the oral mucosa and/or from the antral sinus mucosa, which, if not removed, could inhibit spontaneous healing [1].

OAF is a common complication following posterior maxillary dental extraction owing to the close relationship between the floor of the maxillary sinus and the root apices of the molar teeth and premolars. The incidence of OAF after dental extraction varies from 0.3 to 3.8% [2].

OAF must be closed as it causes contamination of the maxillary sinus from the oral cavity resulting in sinusitis, in addition to communication of the oral cavity squamous epithelium with the pseudostratified columnar ciliated respiratory cells of the maxillary sinus [3]. Many options for the closure of the fistula exist including soft tissue with or without bony closure. In this study, we assessed the closure of large OAF using combined buccal and palatal flaps.

Materials and methods

Patients

This is a prospective study. A total of 11 patients experienced delayed large OAF after dental extraction. This study was conducted in the Otorhinolaryngology Department, Faculty of Medicine, Ain Shams University Hospitals, between February 2014 and May 2017. They were operated under general anesthesia. Preoperative computerized tomography (CT) of the paranasal sinuses (coronal and axial thin cuts) was done for all patients. The study protocol was explained to the patients in detail, and an informed written consent was obtained from all the patients involved in this study, including the use of their lesion photographs, CT photographs, operative video recordings, and follow-up photographs. Preoperative treatment of sinus infection and perioperative strict control of blood glucose level for diabetic cases were ensured.

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Ethical approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and the national research committee and with the 1964 Helsinki declaration and its later amendments. This study did not have any influence on patient management. Application of the classification system in each case was by formal recognition of what was already implemented regularly in clinical practice.

Inclusion criteria

The study included patients with a large OAF (>5 mm in diameter) with the following criteria:

(1) After dental extraction for dental caries.
(2) More than 3 weeks of presentation (delayed).
(3) Maxillary sinusitis evident by preoperative CT of the paranasal sinuses (Fig. 1).

A total of 11 patients were included in this study. Seven patients experienced OAF following extraction of the first molar, two patients after extraction of second molar, and another two patients after extraction of the second premolar. The diameter of the OAF ranged from 8 to 13 mm.

Exclusion criteria

The exclusion criteria included the following:

(1) OAF owing to any maxillary sinus pathology like a benign or a malignant tumor.
(2) Patients experiencing renal or hepatic diseases.

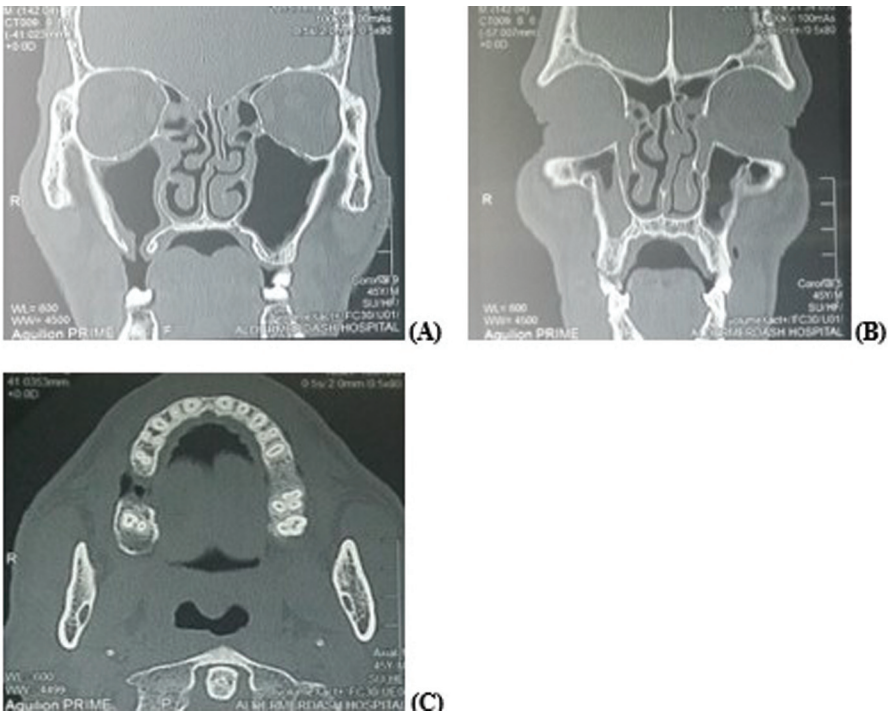
Surgical technique

After induction and oral endotracheal intubation, along with amoxicillin plus clavulanic acid injection, the mouth was opened using the Boyle-Davis mouth gag (surgical holdings; manufacturer of surgical instruments; UK). Excision of the fistula was done by making a circular incision with a 2-mm margin around the OAF, and the epithelial tract and any inflammatory tissue (like granulation tissue) within the opening were completely excised (Fig. 2).

Two divergent cuts were made from each end of the fistula extending into the vestibule. Then drilling of the alveolar ridge was done all around the fistula (Fig. 3). The trapezoidal buccal mucoperiosteal flap was reflected from the alveolar process and the lateral wall of the maxilla releasing it to the gingivolabial sulcus, taking care not to injure Stenson's duct (Fig. 4).

A full-thickness mucoperiosteal palatal rotational flap of adequate width (to cover the defect) was harvested with a viable greater palatine artery at its base posteriorly (Fig. 5). The buccal advancement flap was sutured to the palatal rotational flap, ensuring a watertight closure with 4-0 vicryl sutures (Fig. 6). Lastly, middle meatal antrostomy has been done endoscopically for all cases with good irrigation of the maxillary sinus with isotonic saline.

Figure 1

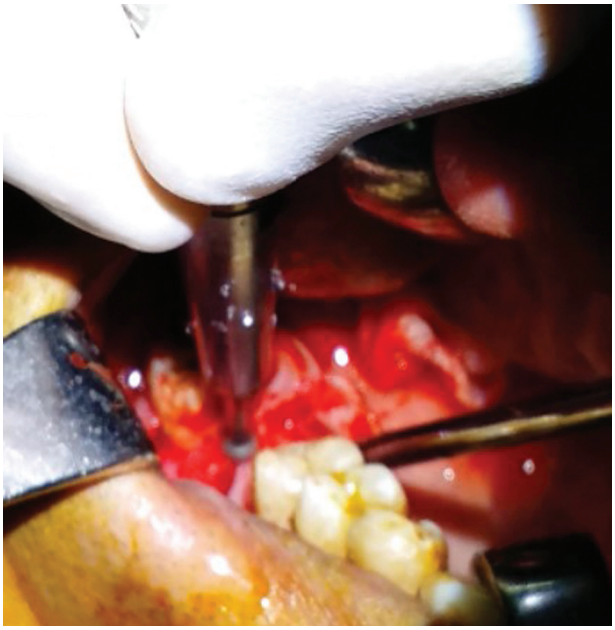


(A, B): coronal, (C): axial Preoperative CT scan showing a right oroantral fistula with alveolar bone defect associated with right maxillary sinusitis.

Figure 2

Oroantral fistula filled with granulation tissue.

Figure 3



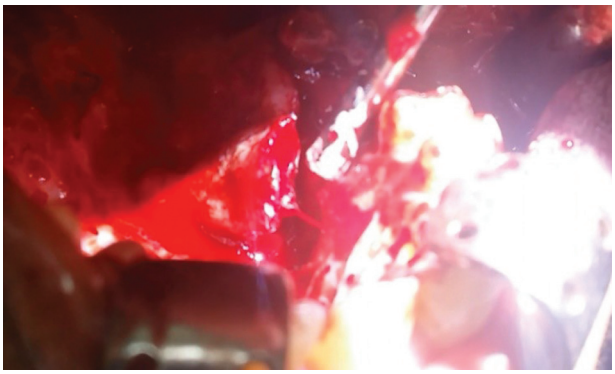
Drilling the edge of the fistula.

Figure 4

Buccal advancement flap.

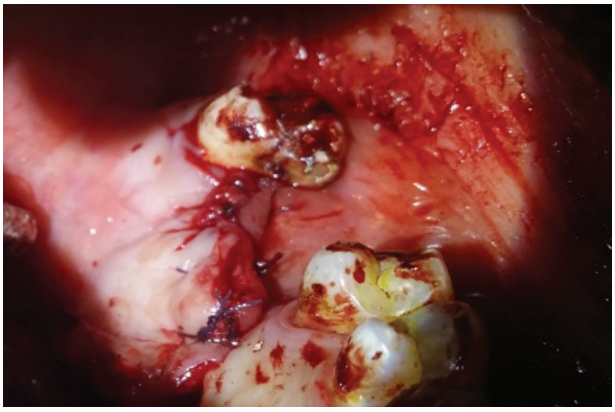
Amoxicillin plus clavulanic acid (1 g twice daily) was given for 7 days postoperatively along with analgesics, whereas isotonic nasal saline wash was done for 1 month.

Figure 5



Harvest of the Palatal rotational flap with pulsating viable greater palatine artery.

Figure 6



Suturing of buccal and palatal flaps together.

Patients were instructed to avoid getting hard food on the operated side for 2 weeks postoperatively, tongue rolling over the suture line for 1 week, and nose blowing or sneezing with a closed mouth for 2 weeks. Clinical assessment of the patients was done at 1, 2, 4, and 12 weeks, postoperatively (Fig. 7).

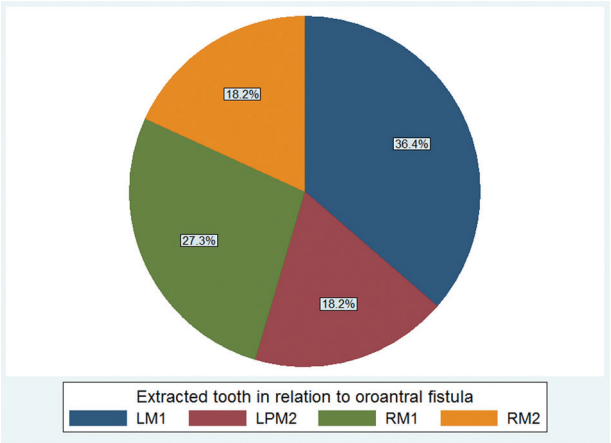
Technical notes for a successful repair of OAF are as follows:

(1) Tension-free advancement of the buccal and palatal flaps is important.
(2) Proper treatment of any sinus infection is a must with adequate nasal irrigation.
(3) Elimination of any diseased bone.
(4) Complete excision of the fistulous tract.
(5) Palatal flap:
    (a) The anterior extension of the flap must exceed the diameter of the bony defect.
    (b) It must have a sufficient length to allow its lateral rotation without exerting tension on its base with resultant kinking of its blood supply, and also make the incisions with a gentle curve to

Figure 7

Follow up (2 weeks postoperatively with closure of the defect).

Figure 8



Extracted tooth in relation to oroantral fistula formation. RM1 = right 1st molar; RM2 = right 2nd molar; LM1 = left 1st molar; LPM2 = left 2nd premolar.

eliminate the need for a back-cut on the palatal flap which is done to avoid its kinking [1].

Statistical methods

Data were analyzed using Stata version 14.2 (StataCorp LLC, College Station, Texas, USA). Normality of numerical data distribution was examined using the Shapiro–Wilk test. Normally distributed numerical data were presented as mean±SD and range. Categorical data were presented as number and percentage.

Results

A total of 11 patients were included in this study, with age range from 33 to 50 years and a mean age of 42 years. Only one patient had a previous history of failed primary closure of the fistula done by the referral dentist.

The diameter of the OAF in this study ranged from 8 to 13 mm, with a mean of 11 mm. Seven patients experienced OAF after first maxillary molar extraction, two patients after second maxillary molar extraction, and two patients after second maxillary premolar extraction (Fig. 8).

The duration from dental extraction to the surgical intervention date ranged from 4 to 10 weeks with a mean of approximately 7 weeks. Three patients were diabetic. Closure of the defect was successful in 10 cases, whereas only one case had failure. In addition to postoperative pain, swelling, and reduction of the vestibular sulcus, one patient (number 4) experienced postoperative nasal adhesions between the nasal septum and inferior turbinate, which was removed in the clinic (Tables 1 and 2).

Discussion

Oroantral communication (OAC) is a complication that can occur after the extraction of the upper maxillary posterior teeth. If not identified and treated properly, a large OAC may develop into OAF. OAF is a pathological epithelialized communication between the oral cavity and the maxillary sinus. It is a frequent complication that occurs most commonly after dental extraction of the maxillary molar and premolar teeth owing to the projection of the root of teeth within the maxillary sinus or the proximity of the root apices to the sinus floor. This epithelialization usually occurs when the OAC persists for at least 48–72 h. Moreover, chronic periapical infection of the posterior maxillary teeth is a predisposing factor for OAF after tooth extraction [4].

Within few days, transmission of micro-organisms from the oral cavity to the antrum causes maxillary sinusitis. With the epithelialization of the fistulous tract and osteitis of the surrounding bony margins, spontaneous healing is inhibited, resulting in chronic fistula formation [5].

Extraction of the upper first molars is the most common cause for OACs, followed by the upper second premolars and the second molars [6]. Upper third molar tooth extraction may cause OAC especially if it is accompanied with osteotomy [7]. Others causes of OAF include maxillary cysts, benign or malignant tumors, trauma, and implant dislodgement into maxillary sinus [8].

A small OAF of diameter 1–2 mm, without epithelialization and in the absence of sinus infection, can heal spontaneously after a blood clot is formed; however, larger fistulas (3 mm in diameter or more) or those present for more than 3 weeks (particularly if complicated by sinusitis or periodontal inflammation)

Table 1 Summary of cases

Case no.	Age (years)	Sex	DM	Extracted tooth	Fistula size (mm)	Duration of fistula (weeks)	Previous trial of closure	Successful closure
1	42	Male	Positive	RM1	13	4	Positive	Successful
2	35	Male	Negative	RM2	12	9	Negative	Successful
3	44	Female	Negative	LM1	11	8	Negative	Successful
4	41	Male	Negative	LM1	10	7	Negative	Successful
5	45	Female	Negative	LM1	10	8	Negative	Successful
6	43	Female	Positive	RM1	12	6	Negative	Failed
7	38	Female	Negative	LPM2	8	10	Negative	Successful
8	47	Female	Negative	LPM2	9	7	Negative	Successful
9	50	Female	Positive	RM1	12	5	Negative	Successful
10	40	Female	Negative	RM2	13	5	Negative	Successful
11	33	Male	Negative	LM1	11	6	Negative	Successful

DM, diabetes mellitus; LM1, left first molar; LPM2, left second premolar; RM1, right first molar; RM2, right second molar.

Table 2 Descriptive statistics for the studied series

Variables	Values
Age (years)	41.6±5.0 (33–50)
Sex (male/female)	4/7
DM	3 (27.3)
Extracted tooth	
LM1	4 (36.3)
LPM2	2 (18.2)
RM1	3 (27.3)
RM2	2 (18.2)
Fistula size (mm)	11±1.6 (8–13)
Duration of fistula (weeks)	6.8±1.8 (4–10)
Previous trial at closure	1 (9.1)
Outcome of procedure	
Successful closure of fistula	10 (90.9)
Failed closure of fistula	1 (9.1)

Data are represented as mean±SD (range) or number (%).

will persist requiring early surgical closure. OACs wider than 5 mm require the use of flaps for closure [9,10].

Acute sinusitis can occur in approximately 90% of patients experiencing untreated OAF for 2 weeks owing to contamination by food or saliva [11].

Probing (the introduction of a probe through the fistula into the antrum) should never be attempted because it may lead to sinusitis or widening of the fistula owing to the pushing of foreign bodies or oral flora into the maxillary sinus. Large OAF are clinically seen on inspection and are evident by CT of the paranasal sinuses which gives an accurate estimate of the bony defect of the fistula and also reveals the presence and location of any dental roots, implants, or any foreign body that may have been dislodged into the sinus. CT also detects presence of maxillary sinusitis or associated periodontal disease [1,11].

Immediate closure of the OAF has a high success rate (approaching 95%), which is significantly higher than for the closure of chronic fistulae [1]. Options for the repair of the OAF include palatal rotational, buccal advancement flaps, and buccal pad fat flap [12].

Advantages of the palatal flap include the following:

(1) Good vascularization (the greater palatine artery).
(2) No lowering of the vestibule (like with the use of buccal flaps), so can be used in patients wearing dentures.
(3) Moreover, palatal flap is firmer and more resistant to trauma and infection than buccal flap [2].

Disadvantages of palatal flaps are the denudation of the palatal surface that requires secondary healing, pain, and the roughness and deepening of this area owing to secondary epithelialization over two to 3 months. The unpleasant complication is necrosis of the palatal flap if its blood supply (greater palatine artery) is jeopardized because of kinking along its arch of rotation or owing to the back-cut used to eliminate this kinking [1,2].

Borgonovo *et al.* [1] mentioned that palatal flap is feasible only in closing fistulas in the premolar region because excessive tension in the molar region may cause ischemia of the flap owing to occlusion of greater palatine artery. However, we think that it can be used in fistula of the molar region if good release was done with a gentle curve incision, eliminating the need for a back-cut on the palatal flap required to avoid its kinking.

Borgonovo *et al.* [1] also concluded that buccal advancement flaps alone are best for small OAF, and that they should not be used alone in large OAF, instead buccal flap must be combined with palatal flaps to give the best results. Disadvantages of the buccal flap include lowering of the vestibulum representing a serious

problem to patients wearing removable dentures and requiring a second procedure (vestibuloplasty) to release the gingivolabial sulcus [1].

Yilmaz *et al*. [13] showed that blood supply of palatal flap is better than buccal flap and hence it is preferred in large and recurrent OAF.

Buccal fat pad can be used in a fistula of 8–20 mm in diameter. Over a period of 3 weeks, the fatty tissue converts into granulation tissue and epithelizes [9].

Risk factors for failure of closure of OAF include the size of the fistula, sinus infection not properly treated preoperatively, osteitis of the fistula margins (hence the drilling of the bony margins of OAF in all cases in this study), epithelialization of the fistulous tract, and excessive tension on the flap impairing blood supply for healing. The most common reported cause of chronicity of the OAF and also failure of repair is the insufficient treatment of the sinusitis, hence the need for endoscopic middle meatal antrostomy in all cases in this study [14,15].

Endoscopic sinus surgery can be used successfully to treat sinus infection associated with OAF instead of the Caldwell–Luc procedure to decrease morbidity and complications [16].

In large oroantral fistulas with a diameter more than 5 mm, failure rate increases owing to the large defect in the underlying bone that supports the overlying flap. Many options for the reconstruction of this bony defect exist, including autologous bone graft [17], nonporous hydroxyapatite blocks, and titanium plate with wiring. However, these materials are not widely accepted in routine surgical closure of OAF owing to cost, difficult handling, increased rate of infection, and exfoliation [18–20].

Auricular cartilage graft is a new technique for the closure of OAF. It is biocompatible, highly resistant to infection, easy to harvest and manipulate, nonresorbable, and cost effective. It does not require vascularization for the integration to the recipient site decreasing the failure rate of the graft. Additionally, it acts as a barrier between the sinus membrane and the oral mucosa, which allows successful healing. A disadvantage of this technique is defect formation at the donor site occurs [21].

Sandwich technique is another new technique for the closure of OAF, in which both hard tissue (bone) and soft tissue closure is achieved. It uses Bio-Oss, which is a bone grafting material similar to human bone and highly successful in new bone formation, sandwiched between two sheaths of Biogide (a resorbable synthesized collagen membrane). The porous surface facing the bone allows the ingrowth of bone-forming cells. Owing to its high purity, no allergic reaction or infection is observed. It is a simple and excellent technique, especially when subsequent placement of endosseous dental implant is considered without the need of donor site surgery for bone grafting [22].

Although new techniques (like the sandwich technique) avoid the disadvantages of the palatal and buccal flaps, they are not used in our institute owing to cost issues. In this study, new bone formation has not been assessed. The study focused on whether this technique is suitable for the soft tissue closure of large OAF. Further study is required to detect long-term new bone formation using this technique, which is an important issue now for the subsequent placement of endosseous dental implants.Previous studies showed that the frequency of occurrence of OAF is nearly the same in both sexes [6,23]. Females exhibit larger sinuses than males and should, therefore, be at a greater risk of OAF [24]. In this study, the frequency of occurrence of OAF is more in females than males noting that this study group is small.

Mean age of patients in our study was 42 years, knowing that the incidence of OAC is high after the third decade as the maxillary sinus reaches its greatest size [6,12].

Although Hassan *et al*. [25] mentioned that diabetes could be a risk factor for failure of OAF closure, the three diabetic patients in this study had successful closure of the OAF using this technique with good healing (noting that strict perioperative control of blood glucose in diabetic patients was ensured in this study).

Conclusion

Combined buccal advancement and palatal rotational flaps procedure is efficient in closure of large OAF. Further study is required to assess new bone formation after repair of the OAF using this technique.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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