Evaluation of different treatment modalities for closure of oro-antral communications and formulation of a rational approach

Hemant Batra¹ · Govind Jindal² ✉ · Supreet Kaur³

¹ Professor and Head

² Reader

³ Postgraduate Student

Dept. of Oral and Maxillofacial Surgery,
BRS Dental College and Hospital,
Panchkula

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Abstract Oro-antral communication is a common occurrence following removal of maxillary premolars and molars because of anatomic proximity of root apices of these teeth and maxillary antrum. Various methods have been described in literature for closure of these communications which vary from simple local methods like buccal advancement flap to complex distal flaps and grafts. Out of these plethora of the treatment modalities available for the treatment of oro antral fistula, the most simple and commonly used ones are either the buccal flap or the buccal pad of fat. In our study we compared the results, advantages and disadvantages of using buccal advancement technique and buccal fat pad individually and also in combination. With this paper, we aim to shed light on the efficacy of buccal pad of fat and the buccal flap, either alone or together, for the closure of OAF of various regions. We also aim to provide a systematic and rational approach for repair of oro-antral communications.

Keywords Oroantral communication · OAF · Buccal pad of fat · Buccal flap

Address for correspondence:

Hemant Batra
H. No. 1029, Sector 36C
Chandigarh, India
E-mail: hemant_batra69@yahoo.com

Introduction

Oro-antral Communication (OAC) is an unnatural communication between the oral cavity and maxillary sinus and when it fails to close spontaneously, it remains patent and is epithelialized so that oro-antral fistula develops. It commonly results following extractions of maxillary first and second molars [1], the incidence ranges from 0.31% to 4.7% [2]. It can also occur following trauma, tumours, cysts, minor surgery and following pathologies in the maxilla. OAC if left untreated may rapidly cause acute sinus disease, Wassmund found sinusitis in 60% of cases on the fourth day after sinus exposure [3], therefore for a favourable outcome, the diagnosis of OAC is needed early [4]. Numerous surgical techniques have been described in the literature, mostly based on mobilizing the tissue and advancing the resultant flap into the defect [5,6]. The surgical method may vary depending upon size of the defect, its location, and few other factors like

available reconstructive options. Perhaps adequate closure can be obtained using any of the methods available, yet it seems ethical to choose a method which best suits the need of the patient and helps in overcoming the disease without significant morbidity.

Material and method

In the present study, 19 patients were selected from 2005 to 2008 and were treated for 21 OAC. The patients who had a presence of OAC were included irrespective of age, sex, caste and religion. The patients who had any systemic disease, making them unfit for surgery were excluded from the study. Also the OAC secondary to malignancies were not included in the study. All patients were divided randomly into three groups for surgical closure of OAC, they were:- Group 1 with buccal advancement flap alone, Group 2 buccal fat pad alone and Group 3

with a combination of buccal fat and buccal advancement flap. The data recorded included patient's gender, age, location, method of treatment and short term complication, if any. Among the 19 patients 14 were males and 5 were females, age group ranged between 28 years to 65 years. Complete and symptom free closure of OAC was considered to be a successful outcome.

In all the three techniques, epithelialization of the fistula tract, osteitis on fistula margin and infected and degenerated polypoid mucosa when present were removed before closure. Antral infection was first controlled with antimicrobials and antral irrigation carried out. All the patients were followed for atleast 3 months postoperatively.

The surgical steps for each group and relevant anatomy are described below.

Group 1: The Rehrman Buccal Advancement Flap: It is the most common method of closing oroantral fistula (OAF) or perforations [7].

Technique

After debridement of the epithelium and the inflammatory tissue of the fistulous tract (if any), the defect is covered with a buccal mucoperiosteal advancement flap. The flap is trapezoidal in shape, with its base at the buccal sulcus to maintain adequate blood supply. Following reflection of the flap from the underlying bone, small horizontal relieving incisions through periosteum at the base of the flap is made which allows for greater lengthening if necessary. The ends of the flap are sutured above the de-epithelialized palatal mucosa (Fig. 1).

The major drawback to this technique is the reduction in vestibular depth (Fig. 2). In most cases, the buccal sulcus reshapes in 4–8 weeks, but upto 40% of patients may suffer permanent vestibular loss [7].

Group 2: The Buccal Fat Pad (BFP): It has been a popular method for the closure of oro-antral communications, as a single layer (Stajeic), with free skin grafts (Egyedi) or even covered by lyophilized porcine dermis (Fujimura). Heister [8] first described the anatomy of buccal pad of fat in 1732 and in 1801 Bichat [9] verified its fatty histology. Its use as a pedicled graft was first reported by Egyedi [10] and its embryology, vascularization, volume and function were studied by Tideman [11], Marx [12] and others.

Anatomical basis of clinical application

BFP is a rounded and biconvex structure, surrounded by a capsule and located inside both the masticatory spaces. It comprises of a body from which four processes: -buccal, pterygoid, superficial temporal and deep temporal (Fig. 4).

It is the buccal extension of the fat pad that is used for closure of the oro-antral communications. Size remains constant irrespective of overall body weight and fat distribution [13], Volume is 13 sq. cm x 6mm or 9.6ml, and Weight is 9.3gm and Average thickness – 6mm

Buccal fat pad fills masticatory spaces, dampens muscle mobility and adds to facial morphology.

Histologically, it is composed of the same kind of fat as the orbital one. Its function is to help the muscular motion and to contribute to the external morphology and the shape of the face.

Pedicled graft means that the viability of the graft is maintained by the original arterial supply while the transposed tissue is becoming revascularized from the host

Fig. 1 Schematic diagram of buccal advancement flap (a) Buccal flap mobilized (b) Secured in place to cover OAC

Fig. 2 Buccal advancement flap method (a) OAC revealed after reflection of mucoperiosteal flap and excision of fistulous tract (b) OAC has been closed after buccal advancement flap is sutured to palatal mucosa. Also disadvantage of buccal advancement flap method is evident as loss of vestibular depth after closure

bed. The irrigation of the fat pad depends upon the buccal and deep temporal branches of the maxillary artery, the transverse facial branch of superficial temporal artery and from the smaller branches of the facial arteries [11]. Therefore it takes an axial graft pattern when removed from its usual place.

Surgical technique

A circular incision with 3mm margins was made around the OAC, epithelial tract and inflammatory tissue within the opening were completely removed. Two divergent cuts were then made from each end of the circular incision extending into the vestibule. When Cald-well-luc procedure was done, the vertical incisions were extended to the anterior and posterior vestibule. The trapezoidal buccal mucoperiosteal flap was then reflected from the alveolar process and the lateral wall of the maxilla (Fig. 3a). The BFP was exposed through 1cm long vertical incision in the

reflected periosteum posterior to the zygomatic buttress (Figs. 3b, 5b). The BFP was gently advanced into the bony defect and sutured to the palatal mucosa without tension. Finally, the mucoperiosteal flap was replaced in its original position, and sutures were placed between BFP and the buccal flap so that a part of BFP was exposed into oral cavity (Figs. 3c and 5c).

Epithelization of the exposed fat tissue occurs between 2–4 weeks postoperatively. The superficial layer of fat tissue becomes replaced by granulation tissue and is finally covered with stratified squamous epithelium migrating from the margin of the gingival. In addition, it appears that the original components of the active replacement by granulation tissue come from highly vascularized fat tissue and from fresh wound around the OAF [14].

The advantages of using it are: high success rate, wide applicability, simple procedure, done under local anesthesia (LA), no additional removal of bone or tooth, low rate of complications, decrease risk of infections, can be easily be trimmed

Fig. 3 Schematic diagram of buccal pad flap (a) Buccal flap mobilized (b) Buccal fat pad brought in from intraoral incision (c) BFP Secured in place to cover OAC

Fig. 4 Anatomy of buccal pad of fat

to appropriate shape and no loss of sulcus depth.

Its disadvantages are: single use, the possibility of postoperative trismus, limited use for small and mid-sized defects and no rigid support [15].

The combination approach

In the combination approach we used a double layer flap closure method to repair the OAC, that is, a BFP covering OAC with a layer of buccal mucosal flap over it. In literature, Fujimura et al. 1990 advocated the cover of lyophilized porcine dermis

over the grafted BFP. They reported that with the use of this covering, stretched BFP that showed some perforations healed without complications. The perforations in the BFP were probably filled with granulation tissue, presumably through the help of the lyophilized porcine dermis.

Technique (Figs. 5a and 5d)

In this approach, the incisions are similar as in previous method, the only difference was that the buccal mucoperiosteal flap was advanced to cover the exposed BFP, and was secured in place by suturing with the palatal mucosa so that no part of BFP was exposed into oral cavity. This makes it a double layered closure of the OAF with the inner layer of BFP toward the bone defect, and outer layer of buccal mucosal advancement flap exposed to the oral cavity (Fig. 5d).

Results

Nineteen OAC were successfully treated, and two failed. One that failed with buccal advancement was repaired successfully with buccal pad of fat and the second (also treated with buccal advancement) who was a chronic smoker refused to undergo the second surgery and finally lost to follow-up.

Observations

As the results were compiled, certain observations were made which were found to worth considering when suggesting a surgical method for closure of OAF. The cases that help in understanding are listed in Table 3.

Discussion

Based upon the observations made in the cases we treated with the two techniques alone and in combination, it is recommended that the method of closure for OAF should be based upon certain factors that not only influence the ultimate outcome of surgical closure but also post closure rehabilitation [13]. They are as follows:

Size of the defect: Usually an OAF <2mm in diameter closes spontaneously but when there is more than >3–4 mm defect, opening persists and requires closure [14].

Spontaneous healing of small perforation is likely to begin 48 hours after tooth extraction and remains possible for about two weeks. If larger defects are present, use BFP rather than advancement flaps [13].

Condition of the antral mucosa: severe sinusitis present prior to antrum exposure may need another surgery (Caldwell Luc)

Fig. 5 Buccal fat pad method (a) OAF revealed (b) Buccal pad of fat mobilized into situ via intraoral incision (c) Buccal pad of fat is sutured to palatal mucosa

Fig. 6 The double layer/combination method (a) OAC revealed after excision of fistulous tract (b) Buccal pad of fat mobilized into situ via intraoral incision (c) OAC has been closed after buccal pad of fat is sutured to palatal mucosa (d) Buccal advancement flap is sutured to palatal mucosa covering buccal pad of fat

to remove the diseased lining [13]. This additional procedure leads to increase in the size of the defect and hence requires closure by a larger flap by either BFP or combination technique.

Location of the defect: if OAF is posteriorly located (especially in third molar area) or palatally located, use of buccal flap becomes difficult since the tension on the flap increases because of the need for excessive mobilization to cover the defect. Hence in such situation

also use of BFP becomes more advantageous.

Future restorative need of the patient: patients who are planned for removable dentures whether partial or complete require adequate vestibular depth. In such cases use of BFP is preferred. Whereas cases in which fixed prosthesis is planned either of the treatment option can be used since shortening of vestibular depth is not a concern.

Dental status of the patient: in edentulous cases having OAF the use of buccal flap results in narrowing of gingivobuccal sulcus which may interfere with prosthetic rehabilitation using dentures [16,17]. In such situations again BFP is preferred.

Primary or secondary (recurrent) defect: in primary reconstruction of OAF buccal advancement flap should be preferred keeping BFP as a reserve for future needs keeping in mind the versatility of the flap, provided that the above factors donot indicate its use. On the contrary, the use of BFP is indicated in cases that have failed with other methods [14].

It is therefore, opined that patients with OAF should be treated with appropriate surgical technique keeping not only their present condition in mind but also their future prosthetic restorative options. The method of closure should be chosen based upon individual patient's needs and not randomly. The closure of OAF should be undertaken with a rationale behind it rather than just randomly practicing the available technique. This is evident from the observations made from the cases cited in the table.

By reviewing our cases, we can conclude that the buccal advancement flap can be used with success in cases where vestibular obliteration will not be a problem. Though the buccal pad of fat may be used in almost all of the cases, yet its use should be limited to certain clinical situations and indications if they exist. It can be kept as a reserve for later use if needed. Also, we could not see any advantage of covering BFP with buccal flap in combination technique. This is beneficial only when BFP is stretched excessively or

Table 1 Case distribution

Surgical technique used for closure	No. of OAC	Whether primary or secondary	Whether immediate or delayed	No. of complication
Buccal advancement	7	7 primary 0 secondary	5 delayed 2 immediate	2 (Both were a failure due to suture dehiscence)
Buccal pad of fat	8	7 primary 1 secondary	8 delayed 0 immediate	0
Combination	6	6 primary 0 secondary	6 delayed 0 immediate	0

Table 2 Region and side of OAC

Region	Right	Left
First premolar	1	0
Second premolar	2	1
First molar	4	3
Second molar	2	4
Third Molar	2	2

Table 3 Selected cases for observations

Area of defect	Surgical technique used for closure	Advantage	Disadvantage	Observation made
Max. Rt. 1st and 2nd Molar Distal extension (See Figure 2)	Buccal advancement flap GROUP 1	Simple, less time consuming	Vestibular obliteration	Since distal extension case, therefore future problem with denture retention and stability
Max. Rt. 2nd Molar Distal extension	Buccal Fat Pad + Buccal advancement flap GROUP 3	Double layered	Vestibular obliteration, Time consuming	Since distal extension case, therefore future problem with denture retention and stability
Max. Rt. 1st Molar (isolated defect, Other molars present) (See Figure 6)	Buccal fat pad + Buccal advancement flap GROUP 3	Double layered	Vestibular obliteration occurred but did not cause a problem since distal tooth exists and FPD can be given	Distal tooth exists, buccal advancement flap can be done if FPD is the future restorative option No added advantage
Max. Rt. 1st molar (large isolated defect with loss of buccal cortex and soft tissue) (See Fig. 5)	Buccal fat pad GROUP 2	No chances of vestibular obliteration	Careful surgical technique is desired to avoid perforation of fat	Because of non availability of adequate buccal tissues, BFP may have to be undertaken
Edentulous Rt. molar area (isolated defect with already resorbed alveolus and shallow vestibular depth)	Buccal fat pad GROUP 2	Can close bigger defects. No vestibular obliteration	Careful surgical technique is desired to avoid perforation of fat	Since dentures are to given later, prefer buccal fat pad technique to avoid vestibular obliteration
Max. Rt. 1st molar (large isolated defect, other molars present)	Buccal fat pad GROUP 1 – Failure case GROUP 2- Secondary procedure	BPF was available to take care of previously failed Buccal advancement flap	Buccal flap had failed and a second surgery was needed with BPF	Suture dehiscence with buccal advancement Since, BPF was available as reserve option after the failure of the previous closure using buccal flap alone.
Max. Rt. 2nd premolar, Other molars present	Buccal flap GROUP 1	Simple, less time consuming	Vestibular obliteration not a problem since distal tooth exists	Distal tooth exists, buccal advancement flap can be done if FPD is the future restorative option

is perforated. We would also like to mention that the local flaps like palatal and tongue flaps and other distant flaps and grafts, should be restrained from use as far as possible because of surgical morbidity associated with these if above mentioned flaps are available.

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