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ORIGINAL ARTICLE

Modified Palatal Flap with a Tissue Bridge in the Closure of the Oroantral Fistulae: A Prospective Study

Suresh Vyloppilli[1] · Shermil Sayd[2] · Annamalai Thangavelu[3] · Murugan Ranganathan[3] · Sarfras Raseel[4] · Kanur Arjun Gopinath[2]

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Abstract

Introduction An oroantral fistula is by definition 'An abnormal communication between the oral cavity and the maxillary sinus.'

Aim of the study The aim of this study is to describe the acute and chronic OAFs and to evaluate the efficiency of the modified palatal flaps with tissue bridge in the closure of both acute and chronic OAFs of small to medium size.

Methodology The study sample was derived from a population of patients from January 2013 to 2018 with the complaint of pain and discharge through the socket.

Result The results of this series support the view that the use of modified palatal flap with tissue bridge is a reliable flap for the repair of both acute and chronic oroantral fistulae.

Conclusion The ease of mobilization, superior blood supply and minimal donor site morbidity make it an ideal flap and a reliable alternative when other techniques fail.

Keywords Oroantral fistula · palatal flap · Caldwell-Luc procedure with antrostomy · oroantral fistula closure

✉ Shermil Sayd
shermil12@gmail.com

[1] Department of Oral and Maxillofacial Surgery, Malankara Orthodox Syrian Church Hospital and Medical College, Kolenchery, Ernakulam, India

[2] Department of Oral and Maxillofacial Surgery and Dentistry, Kannur Dental College and Hospitals, Anjarakandy, Kannur, India

[3] Department of Oral and Maxillofacial Surgery, Rajah Muthiah Dental College and Hospital, Chidambaram, Tamilnadu, India

[4] Department of Oral and Maxillofacial Surgery, KMCT Dental College and Hospitals, Mukkam, Calicut, India

Introduction

An oroantral fistula is by definition, 'An abnormal communication between the oral cavity and the maxillary sinus'. In the eighteenth century, Mr John Hunter observed that the dental infection can spread to the neighbouring area and predicted the possible relationship between dental pathology and antral infection. Since then considerable interest emerged, resulting in the overlap between the borderland of ENT and dental specialities.

The reported incidence of oroantral communication (OAC) is as high as 11% [1]. The palatal root of the maxillary first molar is most commonly implicated in OAC development [2]. The presence of maxillary sinusitis and osteitis at the communication margins will prevent spontaneous healing and will result in chronic fistula formation [3]. Different surgical and non-surgical techniques have been described for the closure of oroantral fistula (OAF) [4]. Despite this, the success rate of secondary repairs of chronic OAF's is as low as 67% [5]. Various palatal flap procedures based on the Greater palatine vessel have been constantly used. The modified palatal flap technique along with tissue bridge had been described by Choukas [6]. To compensate for the decreased elasticity, the thickness and increased vascularity in the palatal tissues promote satisfactory healing. Adequate tissue bridge was left for the placement of flap underneath with minimal tension.

The aim of this study is to describe the management of acute and chronic oroantral fistulae using, and to evaluate the efficiency of the modified palatal flaps with tissue bridge in the closure of both oroantral fistulae of small to medium size.

Materials and Methods

Study Design and Sample

Pertaining to the purpose of the study, the authors designed a prospective case series study. The study sample was derived from a population of patients who attended the Department of Oral & Maxillofacial surgery, from January 2013 to 2018 with chief complaint of pain and discharge through the socket. Study was initiated after getting approval from the institutional ethics committee and followed the STROBE guidelines. All the patients were informed about the procedure and protocol—those who were willing to provide written informed consent were included in the study. All 12 patients who were diagnosed with oroantral fistulae were categorized into chronic and acute fistulae and were taken up for closure with modified palatal flap. It was either done alone or in combination with Caldwell-Luc procedure and nasal antrostomy.

Inclusion and Exclusion Criteria

Patients included in this study were those with chronic or recurrent OAF secondary to tooth extraction. The exclusion criteria included patients who had systemic diseases that affect wound healing such as uncontrolled diabetes, collagen diseases and OAF's that resulted from ablative surgery.

Data Collection

The demographical and clinical data were abstracted from the patient's charts: age, gender, signs and symptoms of sinusitis, nasal discharge, previous surgical interventions, site and size of OAF and complications. Radiographic examination included orthopantomogram, paranasal sinus view, intraoral periapical radiograph and occlusal view to evaluate the sinus pathology, exclude the presence of foreign bodies, root stumps and determine the size of the bony defect at the fistulae site.

Variables

Predictor variables were surgical tissue and the difficulties encountered during surgery. The clinical outcome variable was the success of the surgical closure of fistulae.

Data Analysis

The incidence of each variable was determined and statistically analysed. The descriptive statistics were analysed with the Pearson X^2 test, the means and proportions were compared with an independent sample test, and p values lower than 0.05 were considered statistically significant.

Surgical Techniques

Modified Palatal Flap Closure

The procedures were performed under local anaesthesia using a greater palatine nerve block and buccal infiltration of the adjacent areas of fistulae for a total of 10 cases. The incisions were made with Bard-Parker No. 15 blade reckoning the direction of the greater palatine vessel. Two parallel incisions—one on the midline and the other 5 mm away from the free gingival margin—were placed. Depending on the length of the flap, both incisions were converged anteriorly. The mucoperiosteal flaps were raised carefully since the survival of the flap entirely depended on the vascularity. Mobilization of the flap was immediately followed with the placement of stay sutures. An incision was made around the fistulous tract, at least 2 mm away from the epithelialized surface. Care is taken to remove some of the mucoperiosteum on the buccal aspect of the fistulae ensuring that the suture line moves more buccally, resting on the buccal bone. The palatal mucoperiosteum remaining between the fistulae and the lateral flap incision is raised with a periosteal elevator to allow the passage of the palatal flap underneath. The flap is rotated buccally with the greater palatine foramen as the centre of rotation to the extent needed to cover the fistulae. An instrument is then passed underneath the elevated mucoperiosteum from the fistulae to the lateral incision of the flap (Fig. 1). The tie suture is then clamped and the haemostat retrieved and pulled back gently so that the flap passes underneath the mucoperiosteum and reaches over the fistula (Fig. 2). Interrupted sutures are placed between the tip of the palatal flap, the circumference of the palatal flap and the alveolar

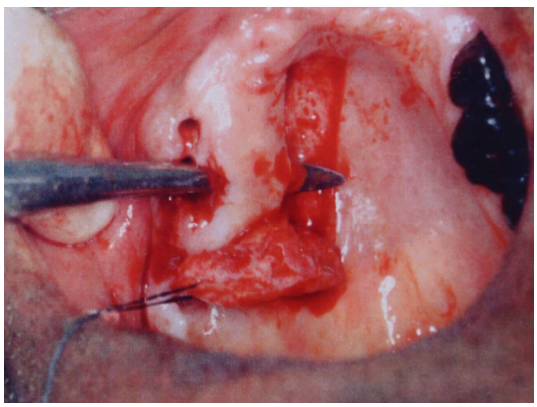

Fig. 1 Instrument is passed underneath the elevated mucoperiosteum from the fistulae to the lateral incision of the flap

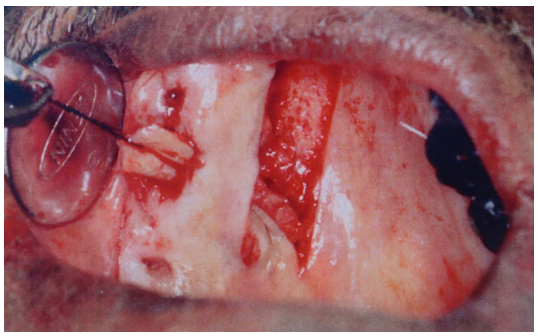

Fig. 2 Flap passing underneath the mucoperiosteum and reaching over the fistula

tissue bridge using 3-0 Vicryl sutures. The raw area was covered with tincture benzoin gauze that was kept in place with 3-0 Mersilk. Post-operative healing was satisfactory (Fig. 3).

Caldwell-Luc Procedure and Nasal Antrostomy with Modified Palatal Flap Closure

The procedure was performed on two cases of sinus pathology under general anaesthesia. An incision was made inferior to the gingivobuccal sulcus extending from the lateral incisor to the second molar region. A subperiosteal dissection was carried out to expose the anterior wall of the maxillary antrum. The anterior wall of the antrum was then fenestrated in the canine fossa region using a drill. The antrostomy was widened until the entire contents of the maxillary antrum were visualized. The chronic hyperplastic sinus mucosa was curetted and removed taking care not to injure the orbital contents (Fig. 4).

A suitable vasoconstrictor agent was placed in the inferior meatus and along the under-surface of the inferior turbinate. The inferior meatus was exposed by in-fracturing the inferior turbinate using either a periosteal elevator or knife handle. Once the initial opening is created, it is enlarged to a dimension of approximately 2 cm in length and 1 cm in height by a combination of forward and

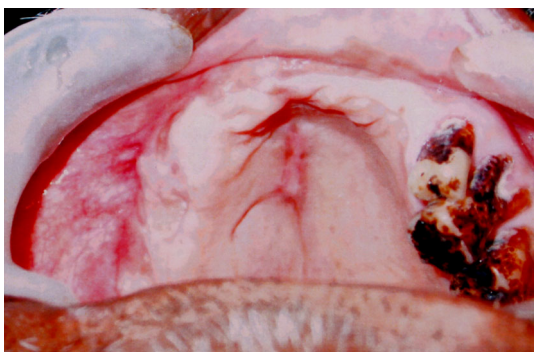

Fig. 3 Entire surgical site post-healing

Fig. 4 With Caldwell-Luc approach and antrostomy

backbiting bone forceps. Then, a betadine gauze (roller) was passed into the inferior meatus with an artery forceps and sinus was gently packed leaving the tip of the roller gauze through the meatus. Incision over the buccal surface was closed with interrupted 3-0 Vicryl sutures.

Post-operatively, a palatal splint was placed for 3 days to avoid slumping of the palatal tissue owing to the effects of haematoma and gravity. All patients received intraoperative and post-operative antibiotics (amoxicillin and clavulanic acid) for 5 days along with nasal drops containing phenylephrine HCL, chlorhexidine gluconate 0.2% mouth rinses for 2 weeks. Non-steroidal anti-inflammatory drugs were prescribed for pain control. Soft diet was advised, and the patients were warned against any manoeuvre that caused negative pressure in the paranasal sinuses, including sneezing, coughing, sucking, etc., for 1 month. The patients were reviewed systematically at the end of 1st month, 3rd month, 6th month and 1 year.

Case Reports

In all 12 cases, modified palatal flap tissue bridge was used to close the fistulae. Two cases of chronic oroantral fistulae were treated with Caldwell-Luc and antrostomy along with palatal flap closure under general anaesthesia.

Descriptive Statistics and Results

The study included 12 patients (6 males and 6 females) (Table 1) (Fig. 5). The interval from fistula development to repair ranged from 2 to 15 months. Tooth extraction was the cause of the OAF in all patients. The patients were diagnosed with having either oroantral fistula with chronic maxillary sinusitis or just oroantral fistula cases (Fig. 6). The most common patient complaints were nasal regurgitation of fluids and prolapsing polyps. In addition, various

Table 1 Gender-wise distribution of the patients

Gender	*n*	%
Male	6	50
Female	6	50
Total	12	100

symptoms of chronic sinusitis were reported by the patients and included post-nasal discharge, nasal congestion, halitosis and referred pain. Radiographically, all sinuses exhibited opacification of various degrees.

Closure of the OAF was done using palatal modified flap under local anaesthesia for acute cases and combined with Caldwell-Luc procedure under general anaesthesia for chronic cases (Tables 2, 3). Relief from the signs and symptoms was attained post-operatively and remained so until the end of the review period. One patient exhibited fluid and air leakage beneath the buccal side of the flap, which stopped spontaneously in 3 days. One patient developed acute sinusitis which was controlled by parenteral antibiotics for 5 days. Transient infraorbital neuropathy was found in one case (Table 4).

The patients with previous chronic sinusitis showed resolution of symptoms. Epithelialization of the palatal bone at the donor site began during the second week and was completed at the end of the fourth week. The post-operative complications had a significant increase with the increased operating time ($p = 0.4$) (Table 5). For all the cases, the palatal modified flap was done, for both acute and chronic cases, the flap had shown a significant advantage in the study ($p = 0.015$) which is statistically significant (Table 6).

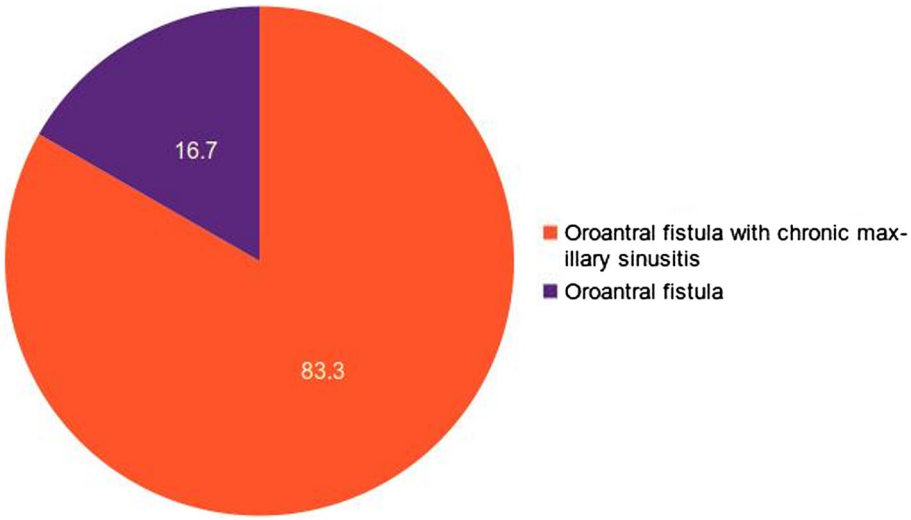

Fig. 5 Gender distribution

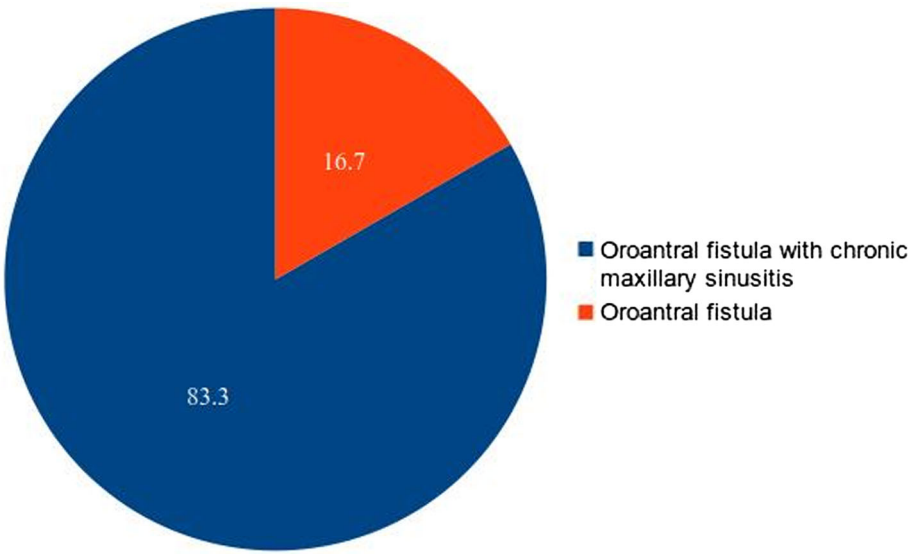

Fig. 6 Graphical representation of descriptive distribution of acute and chronic cases

Table 2 Descriptive distribution of acute and chronic cases

Diagnosis	*n*	%
Oroantral fistula with chronic maxillary sinusitis	2	16.7
Oroantral fistula	10	83.3
Total	12	100

Table 3 Descriptive analysis of the surgical procedures

Surgical management	*n*	%
Modified palatal flap with Caldwell-Luc and nasal antrostomy	2	16.7
Modified palatal flap closure	10	83.3
Total	12	100

Table 4 Summary of post-operative complication variables

Variable	*n*	%
Air and fluid escape	1	25
Acute sinusitis	1	25
Intraorbital neuropathy	2	50
Total	4	100

Table 5 Comparison of surgical time

Surgical time	Complication (min)	No complication (min)
Mean ± SD	120 ± 4	90 ± 3
t value	2.34	
p value	0.04*	

Statistically significant at $*p < 0.05$

Discussion

The OAF is a pathological communication between the oral cavity and the maxillary sinus; depending on the location classified as alveolo-sinusal, palatal-sinusal and vestibule-sinusal [7]. Oroantral communication with a subsequent formation of an oroantral fistula is a clinical complication commonly encountered by the oral and maxillofacial surgeons [8]. The principal cause of communication is attributed to the extraction of the maxillary posterior teeth due to its close anatomical relationship with the sinus floor [7]. The incidence of this complication varies from 0.31 to 3.8% after simple extraction of the related maxillary teeth [8, 9]. When an oroantral fistula develops the presence of maxillary sinusitis, epithelialization of the fistula tract, osteitis or osteomyelitis on the communication's margins or foreign bodies, will prevent spontaneous healing and will lead to the development of chronic fistula [3]. Other causes of OAF include dentoalveolar infections, destruction of a portion of the sinus by cysts, benign or malignant tumours, Paget's disease, trauma and a complication of the Caldwell-Luc procedure [5].

In the absence of sinus infection, most small acute oroantral communications, 1–2 mm in diameter, will heal spontaneously after formation of a blood clot and secondary healing. However, larger oroantral defects that are not diagnosed or are left as untreated rarely heal, and the subsequent formation of an oroantral fistula become inevitable requiring secondary surgical closure. Immediate closure of acute oroantral defects has a success rate approaching 95%, but the success rate of secondary closure of OAF has been reported to be as low as 67% [10].

The advances in computed tomographic scans and functional endoscopic sinus surgeries allow visualizing sinus pathologies more vividly than any other modalities [11]. When inflammation of the sinus is diagnosed at the beginning of the treatment, conservative treatment is performed to prepare good healing circumstances called the secondary plastic closure. Conservative treatment consists of antibiotics, nasal decongestants and betadine–saline irrigation [10].

Numerous modalities are present in the literature that are used for the closure of OAF including the autogenous grafts, allografts, synthetic materials and the soft tissue flaps including the buccal flaps, palatal flaps and distant flaps. Various double-layer closures to increase the soft tissue bulk include the combination of inversion and rotational advancement flaps, double overlapping hinged flaps, double island flaps, superimposition of reverse palatal and

Table 6 All the cases with oroantral fistula with chronic maxillary sinusitis, modified palatal flap with Caldwell-Luc and nasal antrostomy was done, and for those with the only OAF, modified palatal flap closure was done

Diagnosis/surgical management	Modified palatal flap with Caldwell-Luc and nasal antrostomy *n* (%)	Modified palatal flap closure *n* (%)
Oroantral fistula with chronic maxillary sinusitis	2 (100)	0
Oroantral fistula	0	10 (100)
Chi-square value	12.00	
p value	0.015*	

Statistically significant at $*p < 0.05$

buccal flaps, and buccal fat pad flaps [3, 10]. But none of these methods has gained wide acceptance [12].

The most common methods used for soft tissue repair in cases of OAF are the buccal flap and the pedicled palatal flap technique [3]. Borgonovo et al. [7] suggest the use of buccal flap for closure of oroantral fistula of moderate size, as long as not too posteriorly located, the palatal flap for fistula located in the premolar teeth area and buccal fat pad for fistula located in the third molar area. Nicholas Choukas first described the modified palatal flap technique for closure of small- and medium-sized oroantral fistulas, in 1974 [6]. Though described decades ago, it has several advantages over the other palatal flaps such as alveolar bridge providing protection to the pedicled flap, placement of the pedicle flap with less tension, avoiding surgical splints, and retention of the alveolar bridge ensuring more blood supply to the surgical area. Though the palatal island flap and connective tissue flaps also have a tissue bridge, both these techniques are difficult to perform. By strictly adhering to the protocols and parameters, all the cases were treated modified palatal flap with a tissue bridge. All the cases had uneventful healing. Complete granulation of the raw area in the palate was achieved with 45 days. Two cases which had chronic sinus pathology, which had been treated by Caldwell-Luc and antrostomy along with the flap, had infraorbital oedema which regressed in a week.

Conclusion

The results of this series support the view that the use of modified palatal flap with tissue bridge is a reliable flap for the repair of both acute and chronic oroantral fistulae. The ease of mobilization, superior blood supply and minimal donor site morbidity make it an ideal flap and a reliable alternative when other techniques fail.

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Compliance with Ethical Standards

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in the study.

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