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# Treatment Modalities of Oroantral Communication and Fistula

A Project Submitted to
The College of Dentistry, University of Baghdad, Department of Oral and Maxillofacial Surgery in Partial Fulfillment for the Bachelor of Dental Surgery.

By

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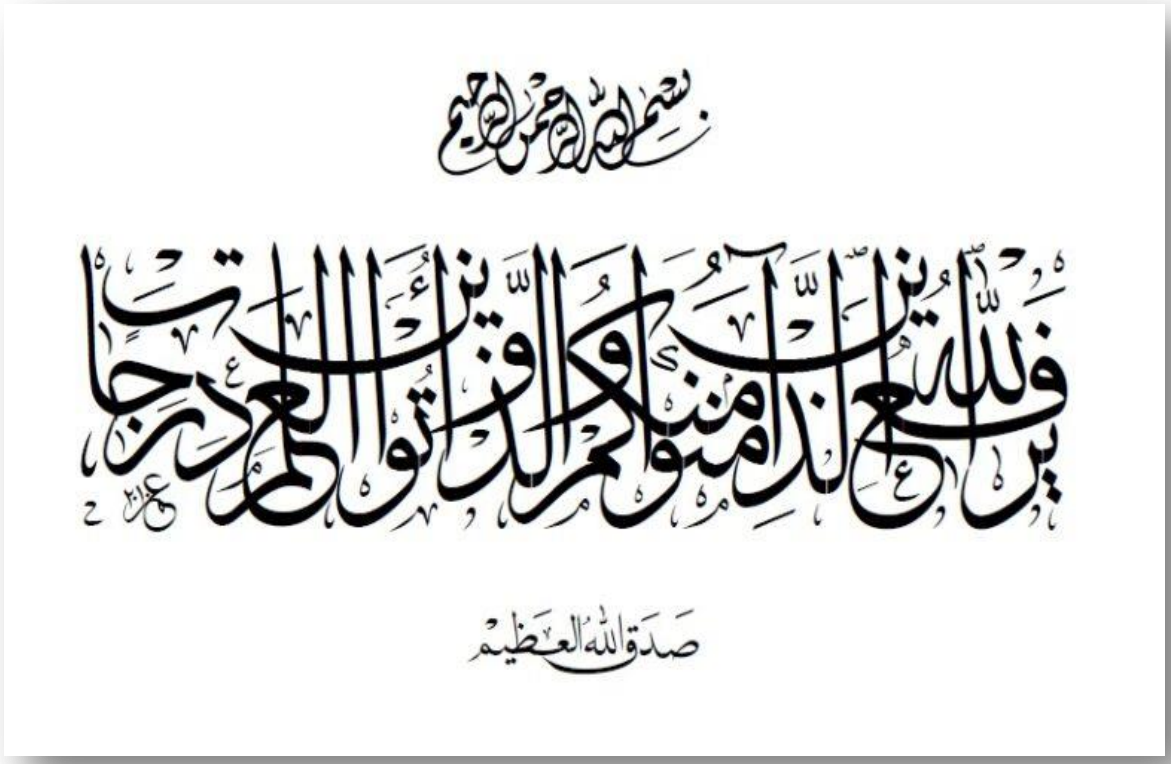
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# Certification of Supervisor

I certify that this project entitled "**Treatment Modalities of Oroantral Communication and Fistula**" was prepared by the fifth-year students **Mariam hamid raja / Mariam Thamer Fylaih** under my supervision at the College of Dentistry/University of Baghdad in partial fulfilment of the graduation requirements for the Bachelor Degree in Dentistry.

**Lecturer Dr. Mohamed Abdel Razzaq**
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# Dedication

This work is dedicated to my beloved parents, my brothers, my sister and my best friends.

Mariam Hamid

To the one who taught me the meaning of unconditional love, to the one who believed in me when I lost faith in myself, to the one who chose me in my darkness, to the one who guided me to the path less traveled, to the one who made me realize the greatness of myself, to the one who held my hand when it was torn and alone, to the one who made me know My true value, to whom words cannot describe my love for, to the one who made my world a legend, to Mum. also to my family and best friends.

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# Abstract

**Background: Oroantral communication (OAC)** is pathological space between the maxillary sinus and the oral cavity, which, if not treated, will progress to oroantral fistula or chronic sinus disease. The oroantral fistula has its origin either from iatrogenic complications or from dental infection. Several alternative modalities have been described throughout the years for the management and treatment of oroantal communication and fistula which show both advantages and disadvantage. Therefore they all need careful consideration in order to select the best approach depending on the situation.

**Aim:** evaluate the most common surgical techniques in the treatment of oroantral communication and fistula.

**Conclusions:** The treatment of oroantral defects is one of the most challenging and difficult problems in the field of oral and maxillofacial surgery. There are different treatment modalities to repair the oroantral communication and fistula. Particular emphasis should be made in choosing the most appropriate method and each having both advantages and disadvantages.

# List of Contents

# List of Figures

# List of Tables

# List of Abbreviations

| Abbreviation | Definition |
|---|---|
| OAC | Oroantral Communication |
| OAF | Oroantral Fistula |

# Introduction

Oroantral communication (OAC) is a rare surgical complication that occurs when an opening is created between the maxillary sinus and the oral cavity. If left untreated, an OAC can lead to further complications, such as the formation of an oroantral fistula (OAF) or an infection of the maxillary sinus **(Pawlik, Stanek et al. 2019)**.

These kinds of communications arise mainly after extraction of posterior maxillary teeth due to the close anatomical relationship between the root apices of the molar and premolar teeth and the sinus floor**(Borgonovo, Berardinelli et al. 2012)**.

In addition, a fistula might originate following removal of maxillary cysts, benign or malignant tumors or trauma. It must be emphasised that unlike the oro-antral communication (OAC), OAF is characterized by the presence of epithelium arising from the oral mucosa and/or from the antral sinus mucosa that, if not removed, could inhibit spontaneous healing **(Borgonovo, Berardinelli et al. 2012)**.

Oroantral communications are complex defects that involve the soft and hard tissue layers. In the absence of sinus infection, most small acute oroantral communications, 1 to 2 mm in diameter will heal spontaneously after the formation of a blood clot and secondary healing. However, larger oroantral defects that are not diagnosed or are left untreated rarely heal, and subsequent formation of an oroantral fistula (OAF) becomes inevitable **(Yalçın, Öncü et al. 2011)**.

Clinical decision-making in closure of an OAC/OAF depends on multiple factors that include the size of the communication, time of diagnosis, presence of infection, and clinician's experience. Moreover, the selection of management strategy is influenced by the quantity and quality of tissue available for closure of OAF/OAC (Parvini, Obreja et al. 2019).

# Aim of the study

The aim of the study is to evaluate the most common surgical techniques for the treatment of OAC/OAF, including their advantages and disadvantages.

# Chapter one

## Review of literature

### 1.1 Anatomy of Maxillary Sinus

The maxillary sinuses were first illustrated and described by Leonardo da Vinci in 1489 and later documented by the English anatomist Nathaniel Highmore in 1651. The maxillary sinus, or antrum of Highmore, lies within the body of the maxillary bone and is the largest and first to develop of the paranasal sinuses. The alveolar process of the maxilla supports the dentition and forms the inferior boundary of the sinus **(Whyte and Boeddinghaus 2019)**

The maxillary sinus develops embryologically at 16 weeks of gestation. The sinus is tubular at birth, ovoid in childhood and pyramidal in adulthood is composed of four walls, including a base formed by the lateral wall of the nose and an apex that extends into the zygomatic process. Maxillary Sinus pneumatization is a continuous physiological process that causes the sinuses to increase in volume then cause oroantral communication. **(Alqahtani, Alsheraimi et al. 2020)**.

### 1.1.1 Bony walls

They are hollow, pyramidal in shape with the apex at the root of zygomatic bone and the base being formed of the lateral nasal wall. The four walls of the maxillary sinus are represented as: **(Mitra, 2009)**.

• The roof is formed by the orbital plate

• The floor is formed by the alveolar process of the maxilla

• In front the anterolateral or canine fossa is the facial part of the maxilla.

• The posterior or sphenomaxillary wall is a thin plate of bone separating the antrum from the infratemporal fossa.

### 1.1.2 Blood supply

The posterior superior alveolar artery, inferior orbital artery, greater palatine artery, and sphenopalatine artery are the main branches of the maxillary artery that provide blood supply to the bony walls and membrane of the sinus (Danesh-Sani, Loomer et al. 2016).

### 1.1.3 Nerve supply

Innervation of the maxillary sinus is summarized in **Table 1.**

**Table (1)** Innervation of the maxillary sinus **(Danesh-Sani, Loomer et al. 2016)**

| Nerve | Area of coverage |
|---|---|
| Posterior and middle superior alveolar nerve | Posterior wall of the sinus |
| Anterior superior alveolar nerve | Anterior wall of the sinus |
| Infraorbital nerve | Superior wall and part of medial wall |
| Greater palatine nerve | Ostium and inferior wall of the sinus |

## 1.2 Physiology of Maxillary Sinus

The maxillary sinuses are lined by a pseudostratified columnar epithelium with numerous goblet cells supported by a vascular lamina propria containing serous and mucous glands and numerous thin-walled venules. Together, the epithelium and the lamina propria constitute the mucosa. Mucosa lining paranasal sinuses is bound to the underlying periosteum, and this mucoperiosteum is commonly referred to as the Schneiderian membrane. Mucociliary clearance is a primary defence mechanism of the respiratory tract to protect against inhaled pollutants, allergens and pathogens (Whyte and Boeddinghaus 2019).

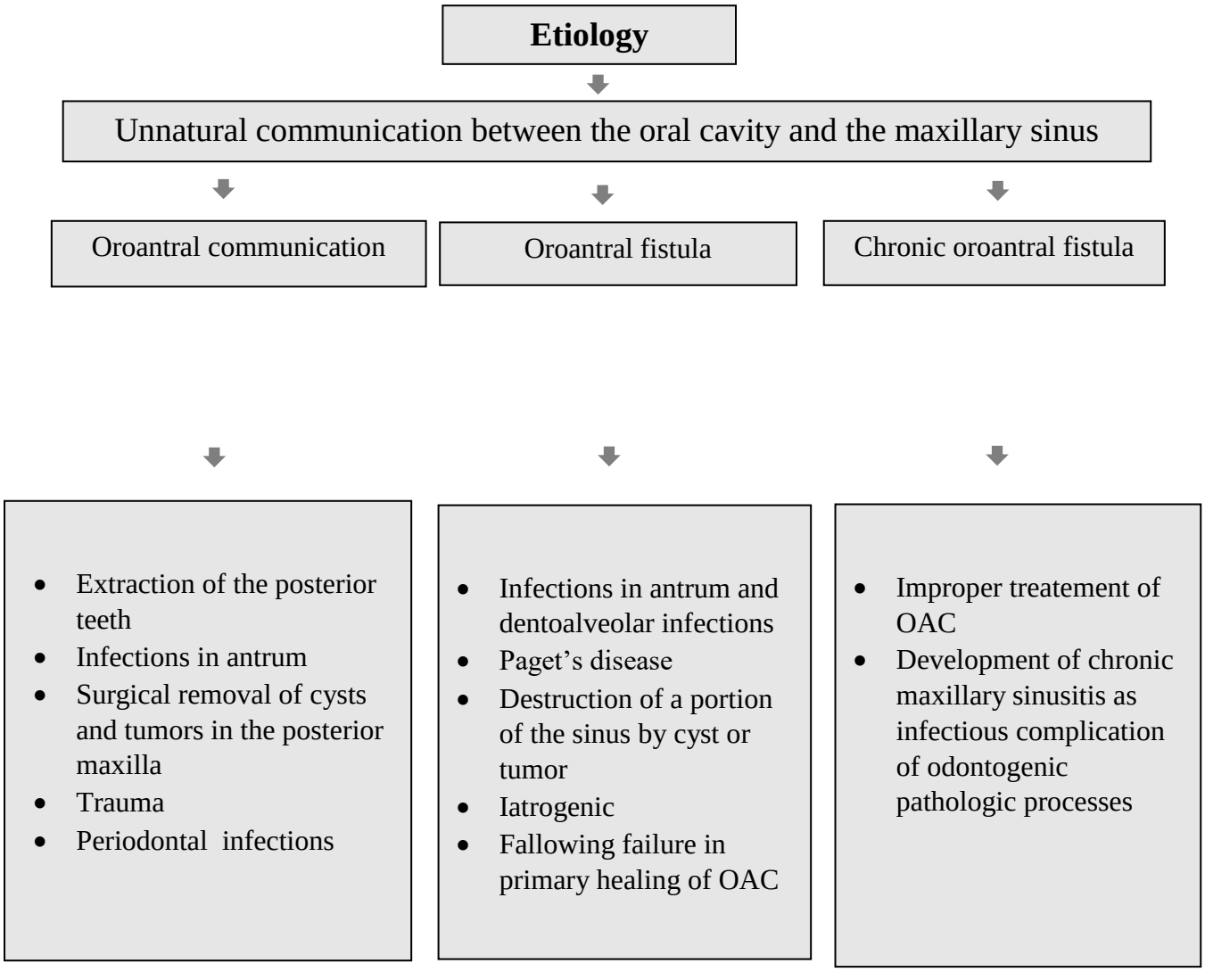
## 1.3 Oroantral Communication and Fistula

Oroantral communication (OAC) is the space created between the maxillary sinus and the oral cavity, which, if not treated, will progress to oroantral fistula (OAF) or chronic sinus disease. The most common precipitating factor of an OAC is the extraction of posterior maxillary teeth, usually the first or second molar. This post-extraction complication occurs more likely if there is preexisting periapical abnormality associated with the offending tooth near the maxillary sinus or extraction of maxillary molar teeth with widely divergent roots. If these teeth are not carefully removed by surgically sectioning the roots, the floor of the sinus may be removed along with the tooth. **(Dym and Wolf 2012)**.

## 1.4 Etiology

OAC/OAF can result from several causes summarized in **table (2)**

**Table (2)** Etiology of OAC, OAF, and chronic OAF (**Parvini, Obreja et al. 2019)**.



## 1.5 Signs and Symptoms

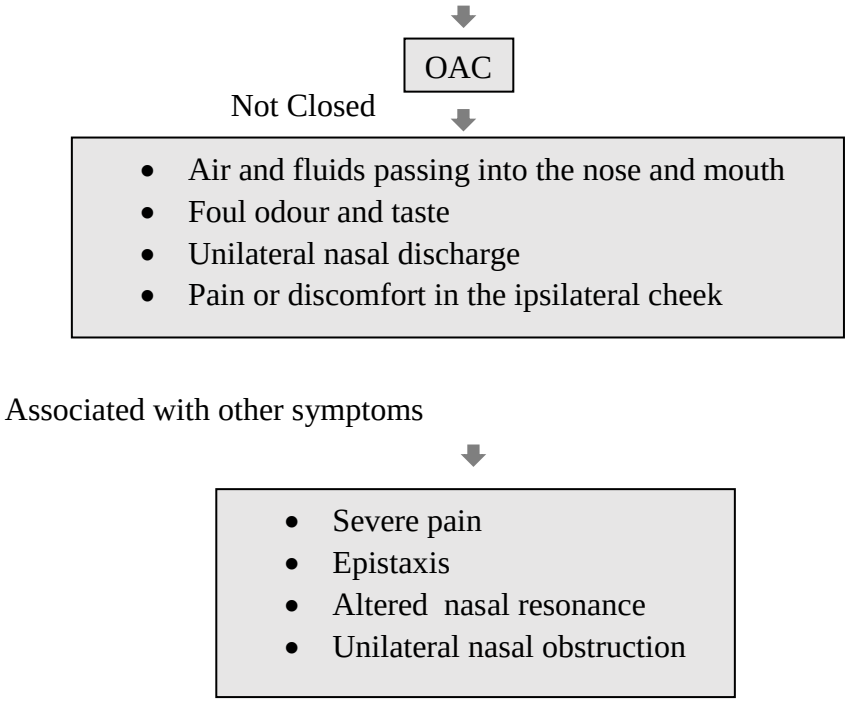
The patient may complain of fluids entering the nasal cavity while eating or drinking, nasal congestion, or sanguineous discharge. The patient may also report poorly localized discomfort around the site that radiates to the orbital area and is often perceived as an adjacent toothache **(Dym and Wolf 2012)** .

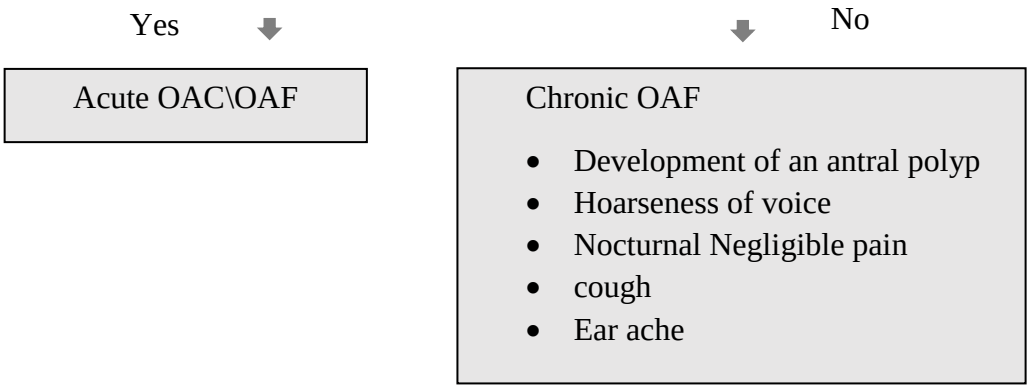
In chronic cases unilateral, foul smelling pus discharge may be present and signs of maxillary sinusitis are present due to secondary infection from the oral flora and inability to whistle **(Borle, 2014).**

**Table (3)** Steps of decision-making in symptoms of OAC, OAF, and chronic OAF

- Valsalva test results in bubbling of blood in the socket
- Blood trickling from the nostril of the affected side

**(Parvini, Obreja et al. 2019).**

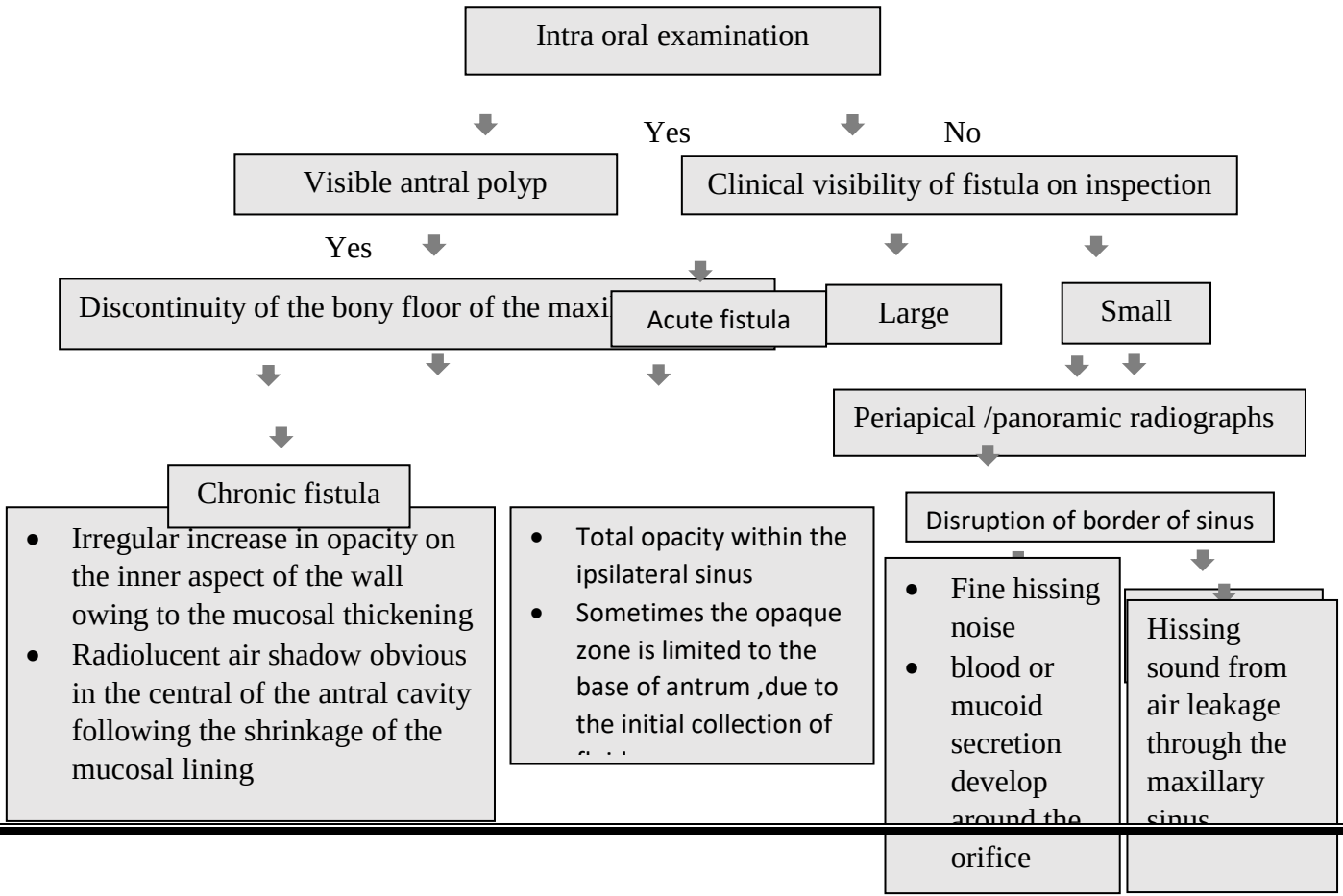





### 1.6 Diagnosis

Intraoral examination the large OAC is easily seen on the investigation. At a later stage, the antral polyp is seen through the defect.in Valsalva test the patient is instructed to try to exhale through a blocked nasal airway. However, a negative test does not exclude the possibility of antral perforation..Cheek-blowing test the patient is asked to blow air into the cheeks against a closed mouth. This test is considered a risk of antral complications due to the spread of microorganisms from the oral cavity into the maxillary sinus. Exploration of the perforation with probing Attempt of probing the fistula is likely to result in sinusitis or widening of the fistula due to pushing of foreign bodies or bacteria into the maxillary sinus. Furthermore, probing may lead to laceration of the sinus membrane, which may sometimes be intact (Parvini, Obreja et al. 2019).

**Table (4)** Steps of decision making in diagnosis of antral perforation **(Parvini,** Obreja et al. 2019).



## 1.7 Treatment

The objective of the management of OAC/OAF is the closure of the defect and prevention of oral bacteria and food debris penetrating the sinus. Oroantral communication can cause sinus contamination leading to infection, impeded healing, and chronic sinusitis **(Belmehdi and El Harti 2019).**

The choice of the appropriate treatment technique is based on a combination of several patient-related factors, such as age, medical comorbidities, sinus health, size and location of the defect, distance from adjacent tissues, and factors related to the dentist's experience and technical skills **(Krishanappa, Prashanti et al. 2016, Levine and Spivakovsky 2017).**

In general,closure of the OAF within 48 hours of onset is recommended to avoid further complications. Spontaneous closure of the fistula may occur if the fistula is smaller than 3 mm in diameter after a blood clot is formed secondary healing **(Kwon, Lee et al. 2020).**

Defects that are larger than 5 mm in diameter or those that present for more than 3 weeks rarely heal spontaneously and typically will require surgical intervention **(Parvini, Obreja et al. 2019).**

Bony defects >2 mm require adequate treatment within 24 hours, which consists of closure of the breach to ensure site tightness and avoid possible sinus infection. Larger OACs that go undiagnosed or untreated rarely heal, and when it does not close spontaneously, it remains permeable and epithelializes to develop into an oro-antral fistula **(Azzouzi, Hallab et al. 2022).**

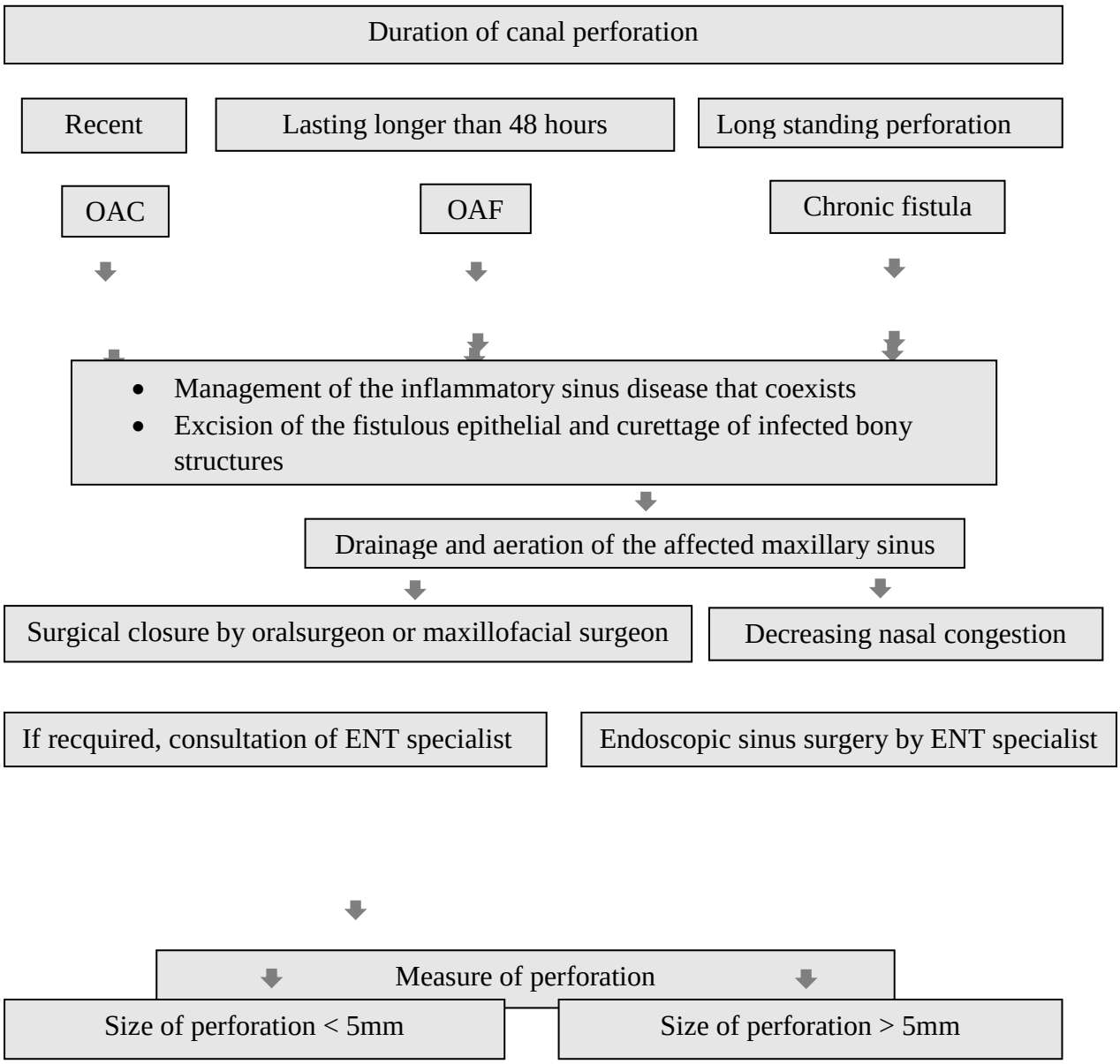
If OAF/OAC is not properly treated, approximately 50 % of patients will develop sinusitis 48 h later, and 90 % of patients will develop sinusitis after 2 weeks of no treatment (**Procacci, Alfonsi et al. 2016).**

Meanwhile, surgical treatment is usually recommended if the entrance of the fistula tract islarger than 5 mm. If suturing alone is not enough to close the fistula, a flap procedure should be considered as an alternate treatment option (**Kwon, Lee et al. 2020).**

Typically, surgical techniques for OAF repair include local autogenous soft tissue flaps from buccal or palatal tissues, use of the buccal fat pad, tongue

flaps, bone grafts, and/or alloplastic materials, such as hydroxyapatite, soft polymethylmethacrylate, resorbable collagen membranes, gold foil, and gold plates **(Azzouzi, Hallab et al. 2022).**

**Table (5)** Decision tree for the closure of OAC and OAF including suggested treatment options based upon size, location, and time of diagnosis of OAC and OAF **(Parvini, Obreja et al. 2019)**.



- Buccal flap
- Buccal advanced flap
- Pedicled subepithelial connective tissue
- Bone grafts
- Free mucous graft
- Prolamin gel
- Acrylic splint

- Palatal flap
- Buccal fat pad flap
- Distant flaps
- Autogenous bone grafts
- Allogenous bone grafts
- Palatal rich fibrin
- Bioabsorbable root analog
- Dental implants
- Synthetic materials and other techniques

Preoperatively, drainage and irrigation with saline through the OAC of the affected maxillary sinus should be achieved in cases with sinus infection and degenerated mucosa .This procedure should be performed until the lavage fluid is clear and no longer contains inflammatory exudates (Fig. 1a, b). Nasal decongestants shrink the nasal mucosa and keep the antral opening patent for drainage **(Parvini, Obreja et al. 2019).**

Postoperatively, a diet of soft foods, analgesics (e.g., non-steroidal anti-inflammatory drugs and nasal decongestants are recommended postoperatively. Further, nose blowing, sneezing with a closed mouth, and vigorous sports should be avoided **(Parvini, Obreja et al. 2019).**

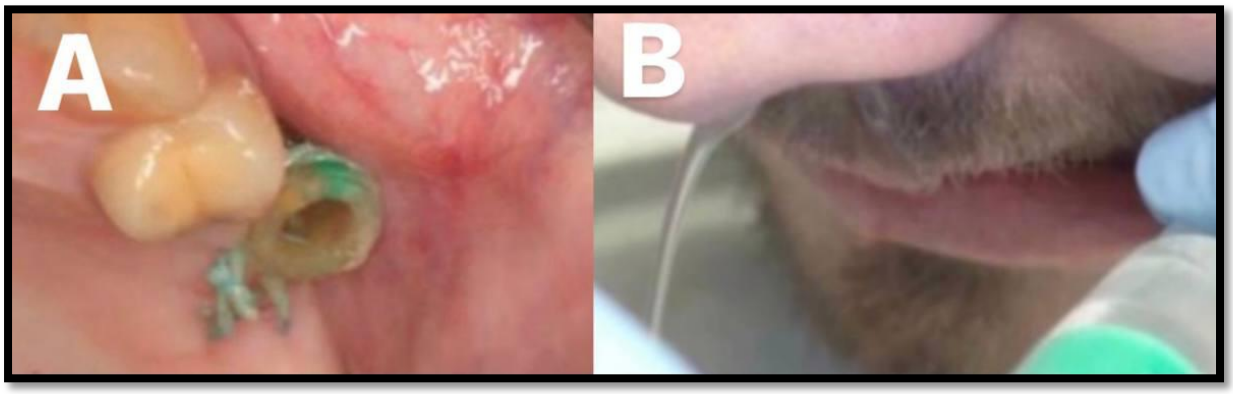



**Fig.1:** (A) Drainage through the OAC. (B) Irrigation with saline through OAC **(Parvini, Obreja et al. 2019)**.

### 1.7.1 Buccal flap

In 1930 Axhausen described the use of a buccal flap with a thin layer of buccinator muscle to close an oroantral defect **(Borgonovo, Berardinelli et al. 2012).**

It is a simple and versatile flap, which allows a simultaneous Caldwell-Luc operation. After cutting the communication edges, two vertical release incisions are made to provide a flap with dimensions suitable for closure of the antral communication. Incision removal of the epithelial lining of the palatal mucosa behind the communication might also be required. The flap, having a trapezoidal shape, consists of both epithelium and connective tissue, and it is positioned over the defect by means of mattress sutures from the buccal flap to the palatal mucosa **(Nezafati, Vafaii et al. 2012).**

#### 1.7.1.1 Advantage of buccal flap

**1.** Its possible utilization when the alveolar ridge is very resorbed and the fistula is located in a more mesial area. However the loss of the vestibule represents a serious problem requiring an additional vestibuloplasty in patients wearing removable dentures **(Borgonovo, Berardinelli et al. 2012)**.

**2.** That influence of buccal sulcus depth is minimal. However, it may provoke the onset of periodontal disease and gingival recession because of its need for a significant amount of dentogingival detachment **(Kwon, Lee et al. 2020).**

**3.** Method can be used when the alveolar ridge height is very low and the fistula is located in a more mesial area **(Khandelwal, 2017)**.

#### 1.7.1.2 Disadvantages of buccal flap

**1.** The permanent reduction of vestibular height is the most important and could be a problem for edentulous patients requiring a prosthesis **(Nezafati, Vafaii et al. 2012)**.

**2.** The buccal sulcus depth might decrease after the surgery, possibly resulting in reduced retention and increased discomfort among patients using dentures. Some researchers have suggested that implant-overdentures could be an option to overcome this issue associated with a reduction in the buccal sulcus depth. The flap distally, by about one tooth distance **(Kwon, Lee et al. 2020)**.

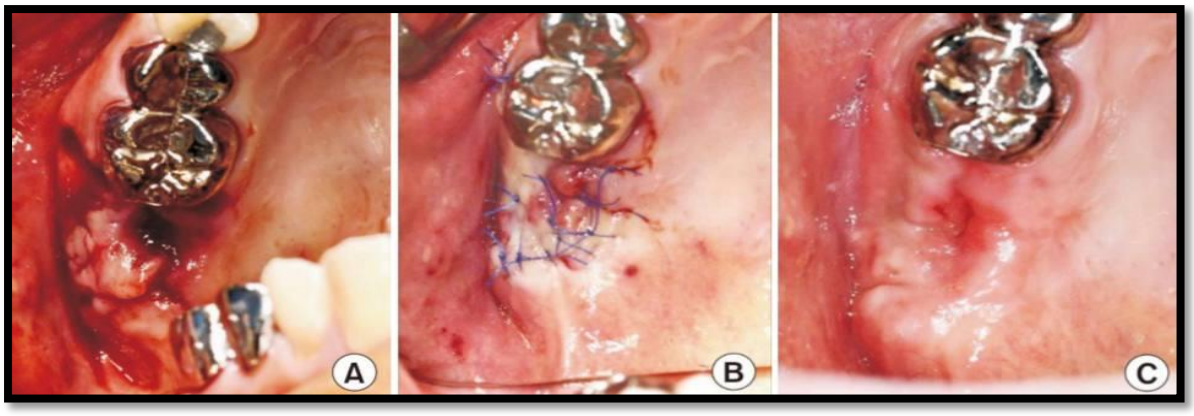



**Fig.2:** (A)shows a fistula on the second premolar region of the maxilla. (B) The buccal flap covering over the fistula and sutured with the palatal mucosa can be seen. (C) Complete healing was obtained at three weeks after the surgery **(Kwon, Lee et al. 2020).**

## 1.7.2 Modified Rehrmann's

Buccal Advancement Flap Here, after mobilization of the buccal flap and after taking the releasing periosteal incision, the free end of the flap which is to be sutured to the palatal mucosa is modified. A step is created along the entire length of the free end of the buccal flap in the submucosal area for keeping the submucosal layer intact. The flap margin is then pulled below the palatal mucosal edge by few vertical mattress sutures and the step in the submucosa will come in approximation with palatal edge, which is closed by interrupted sutures,to ensures double layer closure **(Malik, 2012).**

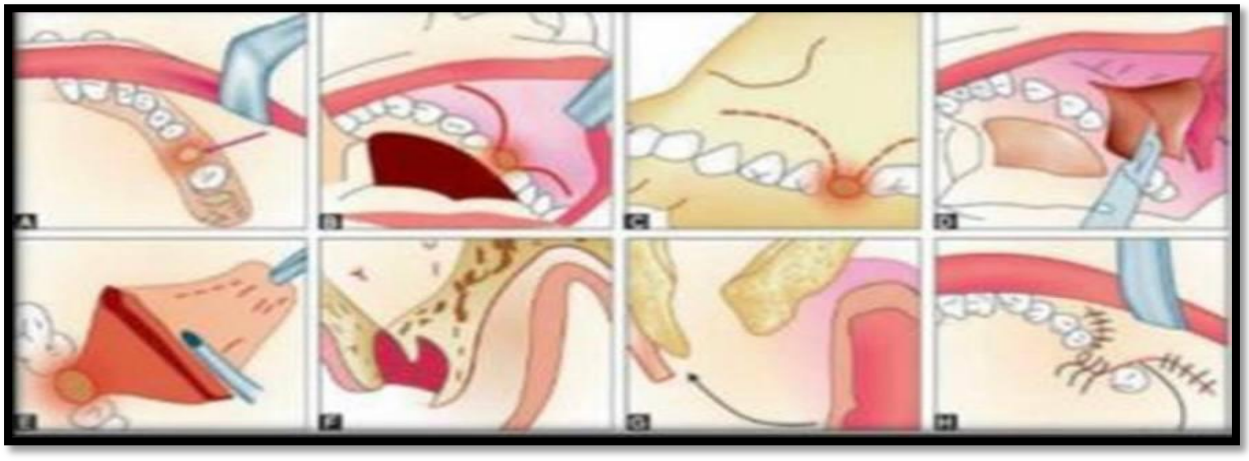


**Fig.3:** Diagram of oroantral fistula closure by buccal advancement flap,Modified Rehrmann's procedure **(Malik, 2012)**.

## 1.7.3 Palatal flap

The palatal flap with its total thickness laterally rotated must have a large base to include the greater palatine artery at the site of its exit from the foramen .The anterior extension of the flap must exceed the diameter of the bony defect and have a length sufficient to allow its lateral rotation and the replacement and the suture without exerting tension on the vestibular mucosa. However this type of flap is only indicated for closing fistulas in the premolar area since an excessive rotation required when operating in the molar region could cause ischemia of the flap due to the palatal artery occlusion and necrosis. Advantages of the palatal flap include good vascularization, adequate thickness and optimal tissue quality. However as a consequence of this technique, exposure of the bony palatal surface, pain and later surface irregularities of the surgical area due to secondary epithelialization two or three months later, are often observed The most important disadvantage is the necrosis of the palatal flap that can occur following excessive rotation of the flap **(Borgonovo, Berardinelli et al. 2012).**

### 1.7.3.1 The palatal rotation-advancement flap

It is recommended for the late repair of oroantral fistula owing to its good vascularization, excellent thickness and tissue bulk, and easy accessibility; it also allows for the maintenance of the vestibularsulcus depth. It is particularly indicated in cases of unsuccessful buccal flap closure **(Anavi, Gal et al. 2003)**.

### 1.7.3.2 The palatal hinged flap

The palatal hinged flap has been used successfully to close small fistula of the hard palate, i.e., those less than 2 cm in diameter in a one-stage operation . The procedure is based on raising a full-thickness flap directly adjacent to the fistula based along one fistula edge and turning this like a hinge over the fistula so that its buccal surface will lie uppermost in the fistula. The main advantage of this technique is that only a small raw area for granulation is left behind following closure of OAF **(Parvini, Obreja et al. 2018).**

### 1.7.3. Palatal pedicle flap

Is used to close an OAC/OAF with the advantages of preserving keratinized mucosa and buccal sulcus depth in the area of the fistula.The flap is a one-stage procedure. Preoperative procedure includes making a self-curing acrylic resin plate over the patient's cast model, the first surgical step is excision of the epithelial fistula wall, followed by division of the flap on the palatal mucosa through an incision, superficially to the periosteum. The flap is passively

positioned and thoroughly sutured.The donor site is then protected with surgical cement and held in place by the self-curing acrylic resin plate. The acrylic plate is fixed with bone screws and maintained in place for 10 days **(Marcantonio, Palmieri et al. 2015).**


**Fig.4:** Palatal flap (A) Straight advancement flap Palatal, (B) rotational-advancement flap, (C) Palatal hinged flap **(Borle, 2014)**.

## 1.7.4 Buccal fat bad

Traditional anatomic descriptions state that the buccal fat pad has a central body and 4 processes: buccal, pterygoid, pterygopalatine, and superficial and deep temporal (The blood supply tothe buccal fat pad originates from the buccal and deep temporal branches of the maxillary artery, the transverse branch of the superficial temporal artery, and branches of the facial artery **(Dym and Wolf 2012)** .

Surgically after a vestibular incision is made in the distobuccal depth of the maxillary tuberosity, the buccal flap and periosteum are raised A sharp scissors is used to cut through the periosteum, and with pressure applied to the zygomatic arch region, the buccal fat pad should easily extrude into the operative side. Blunt dissection with a Metzenbaum scissors helps to mobilize as much fat pad as needed to obtain a tension-free closure across the communication. The tissue is fixed into bone with bur holes or screws and into adjacent palatal and buccal mucosa with resorbable sutures. The exposed buccal fat pad epithelializes in 4 to 6 weeks. A surgical splint can be secured to the dentition to protect the flap during the healing phase **(Dym and Wolf 2012) .**

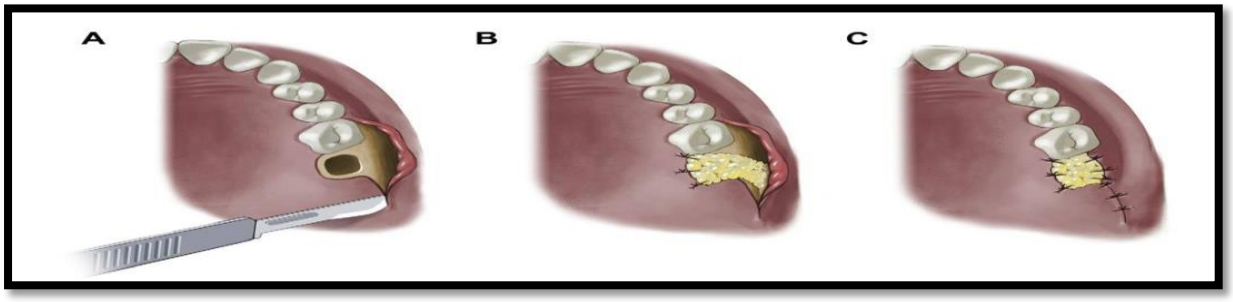



**Fig.5:** (A) Full-thickness mucoperiosteal flap elevated to expose the OAC and allow access to the buccal fat pad. (B) Buccal fat pad mobilized and secured to the palatal soft tissue. (C) Mucoperiosteal flap closure with preservation of buccal vestibule **(Dym and Wolf 2012)** .

## 1.7.5 Combined Local Flaps

These include the combination of inversion and rotational-advancement flaps, doubled overlapping hinged flaps, doubled island flaps and superimposition of reverse palatal and buccal flaps. All these procedures preserve the buccal vestibular height **(Borle, 2014)**.

## 1.7.6 Distant flaps

### 1.7.6.1Tongue flap

A tongue flap also can be used to reconstruct OACs. This flap has been used in cases in which the buccal and palatal flaps have failed and the defect is larger than 15 mm **(Bhalla, 2021)**.

Advantages to the tongue flap include rich vascularity and pliability; however, flap failure can be greater due to the mobility of the tongue during speech and swallow. To mitigate this risk, several investigators have recommended placing patients in maxillamandibular fixation (MMF) postoperatively **(Bhalla, 2021)**.

The disadvantages of this technique are the following: two separate surgical procedures, discomfort lasting approximately 3 weeks, reduction of lingual mobility, speech problems, and the need for nasogastric intubation in the period between the two procedures **(Moumine, 2018)**.

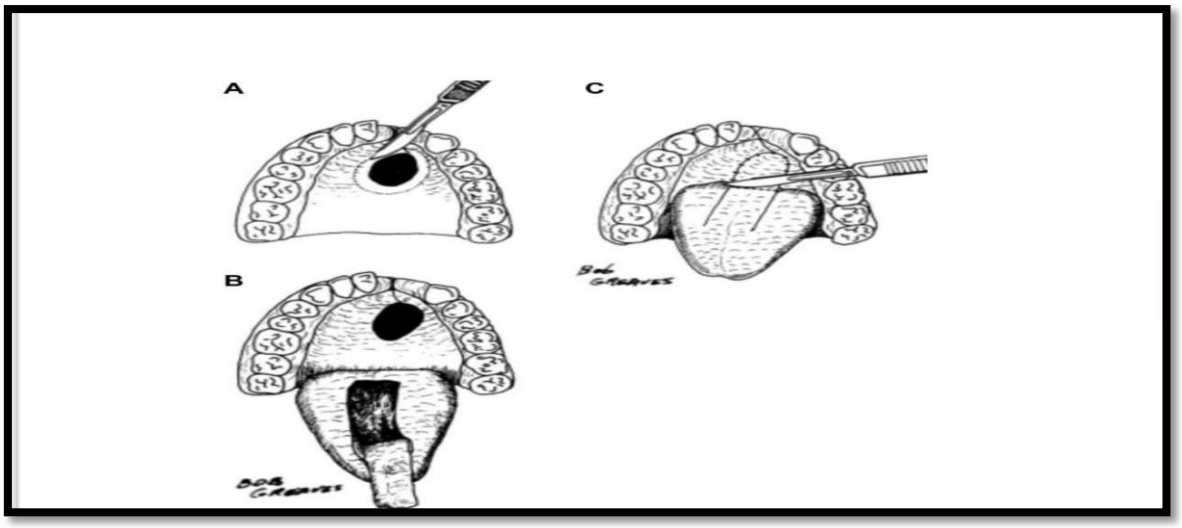



**Fig.9:** (A) Development of the defect. (B) Development of the dorsal tongue flap. (C) Elevation of the tongue flab **(Bhalla, 2021)**.

### 1.7.6.2 Temporalis muscle flap:

Is another distant flap, which can be used for closure of orofacial region defects,It has been indicated for one-stage closure of large oroantral communications ,The temporalis muscle flap is less bulky, well-vascularized, and more pliable, with minimal functional and esthetic sequelae, and in closer proximity to the oral cavity. The temporalis fascia is sectioned above the arch to permit flap rotation. It is then brought into the oroantral fistula through a tunnel created in the infratemporal fossa **(Pourdanesh, 2013)**.

## 1.7.7 Bone grafts

Bone grafts also can be used in the closure of an OAC/OAF. The recommendation has been to use bone grafts for larger defects or after failure with soft tissue closure. The placement of a bone graft may reduce the need for a sinus augmentation in the future. Bone grafts can be obtained from anterior ramus, symphysis, maxillary tuberosity, and anterior iliac crest. The morbidity with an anterior iliac crest involvement may be larger but gives one access to a larger amount of bone **(Bhalla, 2021)**.

### 1.7.7.1 Retromolar bone graft

A retromolar bone graft is a viable procedure for OAF closure. However, harvesting of a retromolar bone can occasionally be combined with removal of the third molar, which may affect acceptance of the procedure by patients.

When compared to chin bone grafts, the significant disadvantage of the retromolar donor area is the confined amount of bone available. The incision is made medial to the external oblique ridge in an anterior direction and terminated in the first molar area to avoid interference with the mental nerve branches. A mucoperiosteal flap is elevated, and the exposed bone area is evaluated in consideration of the amount of bone needed at the defect site. A microreciprocating saw is used to make the osteotomies. The bone block is carefully lifted to ensure that the inferior alveolar nerve is not trapped within the graft. Osseous irregularities are trimmed with chisels or by using a large bur. The flap is repositioned and sutured **(Parvini, Obreja et al. 2019).**

### 1.7.7.2 Zygomatic bone grafts

The technique is indicated when a modest amount of bone is needed. In this procedure, an incision is made through the alveolar mucosa about 5 mm above the mucogingival junction, starting between the first and second molars, and proceeds anteriorly to the first premolar area. A full-thickness flap is raised with a periosteal elevator. The dissection extends to the inferior aspect of the infraorbital nerve and around the inferior half of the body of the zygoma. The lateral border of the maxillary sinus is visualized, and the inferior border of the orbital rim is palpated. Bone harvesting is started just above the inferior border of the zygomatic rim and lateral from the maxillary sinus. The incision is closed with running or interrupted resorbable sutures **(Parvini, Obreja et al. 2019).**

### 1.7.7.3 Chin bone grafts

The use of chin grafts in OAF closure has been reported with successful outcomes. Haas et al. in their preliminary study showed successful results with chin grafts. It is important to note that although chin grafts have been used with successful results in numerous applications, their use in OAF closure has been scarce or may be under reported. It provides high quality bone which is easy to harvest and can be used without any significant donor site morbidity. The grafts from different origins show varied rates of mineralization. In an interesting study by Schlegel et al., chin bone grafts were found to be superior in terms of mineralization over a 6- month period **(Sharma, 2019)**.

### 1.7.7.4 Iliac bone graft

The iliac bone is large, thick and easy to handle. Moreover, the iliac bone is autogenous, which makes it more biocompatible, prolonged postoperative pain, and possible sensory disturbance **(Ahn, 2019)**.

#### 1.7.7.5 Auricular cartilage

Is biocompatible, highly resistant to infection, easy to harvest and manipulate, non-resorbable and cost-effective. This graft does not require vascularisation for the integration to the recipient site. This characteristic feature decreases the failure rate of the graft. There is no scar or defect formation at the donor site. Auricular cartilage graft act as a barrier between the sinus membrane and the oral mucosa which allows successful healing. The only requirement for this technique is that the auricular graft must be supported by primary closure **(Khandelwal, 2017)**.

## 1.7.9 Allogenous materials

Multiple techniques have been described for the closure of OAFs using lyophilized fibrin glue of human origin. In this technique, the fibrin glue is prepared and injected into the socket, together with the collagen sheet. Stressed the importance of inserting the syringe above the floor of the antrum to protect the clot from airflow. The technique is simple with few postoperative complaints. Importantly, there is no need to raise flaps; hence, the intraoral anatomy remains intact. According to the manufacturer, the major disadvantages of the procedure are the risk of transmitting viral hepatitis and the preparation time required for the fibrin glue. The use of lyophilized dura for closure of OAF was reported by Kinner and Frenkel. In this technique, the sterilized dura is placed in a saline solution to regain its pliability. Thereafter, it is cut to size to make it cover the bony margins of the defect. Sutures are placed at each corner of the graft and then it is covered with a plastic plate for protection. The dura is exfoliated after 2 weeks. The simplicity of the technique and non-surgical approach make it an attractive option for OAF closures. However, the risk of transmitting pathogens is a main disadvantage **(Parvini, Obreja et al. 2019).**

## 1.7.10 Xenografts

#### 1.7.10.1 Lyophilized porcine

The technique reported good results when the porcine graft was either exposed to the oral environment or covered with buccal and palatal sliding flaps. According to Mitchell and Lamb covering the graft by buccal and palatal flaps is not necessary. The main advantage of the collagen is potential incorporation into the granulation tissue, and thus, no need to remove it prior to complete healing **(Parvini, Obreja et al. 2019).**

#### 1.7.10.2 Bio-Oss-Bio-Gide Sandwich technique

This technique has been used to close OAF with the advantage of achieving both bony and soft tissue closure, in contrast to only soft tissue closure obtained by buccal and palatal flaps. However this technique needs watertight flap closure to completely cover the Bio-Gide membrane **(Ahmed, 2015)**.

## 1.7.11 Synthetic closure

#### 1.7.11.1 Aluminum plates

The aluminum plates were suggested for OAF closures. According to Steiner, 36-gauge pure aluminum plate is used as a protective plate to aid in closure, using the same technique as in the gold procedure. Buccal and palatal tissues are approximated by sutures. Accordingly, the aluminum plate is constantly visible. After several weeks, the aluminum plate is removed from its initial position as a result of formation reparative tissue underneath. In addition to malleability and smoothness features, aluminum is inexpensive **(Parvini, Obreja et al. 2019).**

#### 1.7.11.2 Titanium plate

Closure of OAFs by titanium plate with transalveolar wiring fixation was documented as an excellent technique for closure of OAF as it is quick, safe, straightforward, well tolerated by patients, has low costs, and results in good bony and soft tissue healing with a low complication rate **(Ahmed, 2015).**

#### 1.7.11.3 Functional endoscopic sinus surgery and titanium mesh

Recently, a dual otorhinolaryngological/oral approach was described in a patient with an OAF complicated by maxillary sinusitis. The investigators used the functional endoscopic sinus surgery technique in combination with a titanium mesh to obtain optimal reconstruction and stabilization of soft tissue,

fullthickness vestibular flap was elevated and the titanium mesh was fixed on the defect, then Mesh removal was conducted after 6 to 18 months of healing based on clinic and radiographic evidence of OAF closure. Advantages of this technique predictable healing, mechanic scaffolding, and tissue predictable healing, mechanic scaffolding, and tissue stability. Whereas disadvantage is the second surgery needed to remove the mesh **(Procacci, 2016)**.

### 1.7.11. 4 Bioabsorbable root analog

The use of a bioabsorbable root analog made of β-tricalcium phosphate for closure of oroantral fistulas. The root replicas were fabricated chair side, using a mold of the extracted tooth. The investigators reported that the healing was uneventful. However, fragmentary roots or overly large defects prevent replica fabrication or accurate fit- ting of the analog. The technique is simple and fast **(Parvini, Obreja et al. 2019).**

## 1.7.12 Others Techniques

### 1.7.12. 1 Platelet-rich fibrin

Platelet-rich fibrin is a second-generation platelet concentrate defined as an autologous leukocyte and PRF biomaterial. It was first developed by Choukroun et al. and has been used extensively in combination with bone graft materials for periodontal regeneration, ridge augmentation, sinus lift procedures for implant placement, and for coverage of recession defects in the form of a membrane. This membrane consists of a fibrin three-dimensional polymerized matrix in a molecular structure with the incorporation of some blood contents, such as platelets, leukocytes, growth factors, and circulating stem cells. The PRF clot forms a strong natural fibrin matrix, which concentrates almost all the platelets and leukocytes of the blood harvest and creates a complex architecture as a healing matrix, including mechanical properties no other platelet concentrate offers. It is an autologous biomaterial rather than a fibrin glu recently, it has been reported that PRF could stimulate cell proliferation of osteoblasts, gingival fibroblasts, pulp cells, and periodontal ligament cells but suppress oral epithelial cell growth. These cell-type-specific actions of PRF may be beneficial for tissue regeneration **(Assad, 2017)**.

### 1.7.12.2 Autogenous third molar transplantation

Autogenous third molar transplantation is a simple and excellent treatment option to close small OACs following tooth extraction, A mucoperiosteal flap was reflected to expose the donor tooth,Small amount of bone overlying the crown portion of the tooth was removed, the donor tooth was extracted atraumatically and placed at the 1st molar site tight interdental suturing was done to closely adapt the gingiva around the tooth , the donor tooth it was splinted using composite resin and stainless steel wire with the adjacent teeth. Tooth transplantations, have some limitations: requirement of sufficiently developed third molar of appropriate shape and size, risk of ankylosis and root resorption if not carried out with proper technique and the need for root canal treatment in developed donor teeth **(Nagori, 2015**).

### 1.7.12.3 Triple-layered closure of an oroantral fistula

More recently, triple-layered to repair an oroantral fistula ,this technique uses leucocytes-platelet-rich fibrin (L-PRF) membrane concomitantly with the buccal advancement flap and buccal fat pad, the platelet-rich fibrin membrane is placed over the buccal fat pad and completely covered by a buccal advancement flap. The positive feature of the L-PRF membrane is expediting the healingprocess by producing growth factors and leucocytes **(George, 2018)**.

### 1.7.12.4 Caldwell-Luc Approach:

The modified Caldwell-Luc Approach is a satisfactory method to close oroantral defects. The technique which includes endoscopic examination using the CaldwellLuc approach, the inside of the maxillary sinus is explored fully, thenThe bone graft can be harvested from the bone of the anterior wall of the maxillary sinus by accessing the surgical entry tract. The positive features of the technique include the use of autogenous grafts, easy and adequate harvesting of the graft along the surgical route, and no need for a flap, whereas disadvantages are that it requires endoscopic surgical equipment and experience **(Aladag, 2018)**.

### 1.7.12.5 Dental implant

A new technique in which a dental implant was the ultimate therapy for the treatment of an oroantral communication (OAC) that was created subsequent to the extraction of a maxillary first molar is described **(Ogunsalu, 2005) .**

### 1.7.12.6 Prolamin gel

Götzfried and Kaduk in 1985 they suggested an alternative procedure to close OAFs without surgical intervention According to the investigators, prolamin occlusion gel is directly injected into the perforation and hardens within a few minutes to form a barrier. One week later, granulation tissue is formed and the prolamin gel completely dissolves after 2 to 3 weeks **(Götzfried & Kaduk, 1985)**.This technique proved to be well tolerated by patients and results in fewer postoperative complaints compared with other procedures,the disadvantage of this technique is chiefly its high material cost, also the technique is less appropriate for closure of OAFs greater than 3mm **(Thoma et al, 2006)**.

### 1.7.12.7 Palatal splint

Logan and Coates in 2003described a procedure that provided closure of OAF in immunocompromised patients. The oroantral fistula was de-epithelialized under local anesthesia, and the patient wore an acrylic surgical splint continuously for an 8-week period. The acrylic surgical splint covered the fistula and the edentulous area including the hard palate. The investigators reported complete healing of the oroantral fistula after 8 weeks, the technique is considered a very useful option when a surgical intervention is contraindicated because of immunosuppression.

# Chapter two

## Conclusion

1. The treatment of oroantral defects is one of the most challenging and difficult problems in the field of oral and maxillofacial surgery.
2. There are different Treatment modalities to repair the oroantral communication and fistula. Particular emphasis should be made in choosing the most appropriate method and each having both advantages and disadvantages.

3. The clinical and radiographic examination and consideration of the patient history serve to assess the severity of the OAC and the patient's treatment needs.
4. The criteria of severity of closure of OAC / OAF include the size, time of diagnosis of OAC/OAF, improper treatment of sinus infection preoperatively, epithelialization of the fistulous tract and excessive tension on the flap impeding blood supply for healing to a combination of hard tissue grafts, which can be useful with the increased demand for implant restorations.

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