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Research Review of Oro Antral Communication

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بسم الله الرحمن الرحيم

يَرْفَعِ اللَّهُ الَّذِينَ آمَنُوا مِنكُمْ وَالَّذِينَ أُوتُوا الْعِلْمَ دَرَجَاتٍ ۚ وَاللَّهُ بِمَا تَعْمَلُونَ خَبِيرٌ ﴿١١﴾

سورة المجادلة - الآية 11

Dedication

We would like to dedicate our paper to the major scientist and our inspirator in science imam Jaafar al Sadiq (peace upon him), to our lovely parents and family, their presence and their souls, also to all the fans of our positive environment.

Acknowledgment

I would like to thank dr. Khaled, dr. zahraa for guiding me to his important publications and for the stimulating questions on everything about oroantral communication pathosis. The meetings and conversations were vital in inspiring me to think outside the box, from multiple perspectives to form a comprehensive and objective critique.

Supervisor Certification

I certify that the dissertation entitled “Oroantral communication” was prepared under my supervision at the Department of Surgery/ College of Dentistry/University of Babylon, by the students of Group (B) as partial fulfillment of the requirements for Group Project Subject.

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Date: 17/4/2024

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Abstract

THIS SCIENTIFIC PAPER DISCUSSES THE PREVALENCE OF OAC, ETIOLOGY AND ITS COMPLICATIONS, HOW TO PREVENT THIS CONDITION AND DIFFERENT TREATMENT MODALITIES.

Introduction

Aetiology

An oroantral communication (OAC) is an unnatural space that forms between the maxillary sinus and oral cavity following extraction of antral teeth, infection, or several different complications.

complication

If left untreated, an OAC can develop into an oroantral fistula (OAF) or chronic sinus disease. **(Dym H, Wolf JC. 2012);(Demetoglu U, Ocak H, Bilge S. 2018)**. it constitutes a gate for the mucosal infection in the maxillary sinus **(S. Yalçın *et al. 2011)***. If OACs are not treated, maxillary sinusitis develops in 50% of patients within 48 hours and 90% within two weeks **(Del Junco R, Rappaport I, Allison GR. 1988)**. The term "Communication" describes a non-anatomical path between the oral cavity and the maxillary sinus (oroantral, OAC) or between the oral cavity and the nasal cavity (oronasal, ONC).

How to diagnose

In most cases, Valsalva maneuver is sufficient for clinical diagnose of OAC or ONC communications. **(Skoglund LA, Pedersen SS, Holst E. 1983).**

Occurrence of the condition

The frequency of this condition is between 0.31% and 4.7% **(Gacic 2009)**. Thus, it is a relatively rare complication seen during dentoalveolar and maxillofacial surgery. the incidence of OAC has been reported to be as high as 11% **(Wächter R., Stoll P.1995); (Rothamel D., Wahl G., d'Hoedt B., Nentwig G.H., Schwarz F., Becker J.).**

How the OAC exist

The most common cause of OAC is often the extraction of the maxillary posterior teeth, the anatomically close relationship between the root tips of the premolars and molars and the maxillary antrum, and the thinness of the bone in this region **(Abuabara A, Cortez AL V, Passeri LA, De Moraes M, Moreira RWF.2006)**, The proximity of the maxillary sinus floor to the apices of posterior maxillary teeth depends on various factors like the age of the patient,

period of edentulism, maxillary sinus pneumatization, etc. **(Kwak HH, Park HD, Yoon HR, Kang MK, Koh KS, Kim HJ2004)**, in addition to the iatrogenic causes OAC may also form following the removal of maxillary cysts, tumors, facial trauma or during dentoalveolar and implant surgery **(Logan RM, Coates EA 2003), (Nezafati S, Vafaii A, Ghojazadeh M 2012),(Parvini P, Obreja K, Sader R, Becker J, Schwarz F, Salti L 2018)**. it depends on numerous factors, such as the anatomical structure of the maxillary sinus and its relationship with maxillary molar and premolar roots **(S. Yalçın *et al.2011),(* Y. Anavi *et al.2003)** ; bone resorption secondary to tooth loss due to periodontitis **(Y. Anavi *et al.2003)*** ; the presence of the maxillary cysts and tumors; as a result of osteomyelitis and trauma; implant surgery and/or sinus augmentation procedures; radiation treatment; orthognathic surgeries or pathologic entities; the enucleation of these cysts and tumors may lead to OAC **(K. Bilginaylar 2018)**.

The clinical sequelae of OAC

If not diagnosed early and treated promptly, OACs can cause chronic sinusitis, oroantral fistulas, and severe complications. Oroantral fistula (OAF) develops if the OAC remains open and epithelialized, therefore, an OAF is a pathological unnatural canal lined by epithelium that may be filled by granulation tissue or by polyposis of the sinus membrane and for this reason the definitive diagnosis and treatment of OAC is critical to prevent complications and ensure recovery.

The gold time of intervention

Immediate closure of OACs, preferably within 24 to 48 hours, is recommended to minimize the risk of maxillary sinusitis and fistula development **(Haanaes HR, Gilhuus-Moe O.1972)**. ***Figure 1*** illustrates an OAC at the palatal root of the left maxillary first molar. The closure of (OAC) is essential to prevent food and saliva contamination that could cause bacterial infection, chronic sinusitis, and impaired healing, In the absence of sinus infection.

Figure 1 : An illustration shows an oroantral communication through the palatal root of left maxillary first molar (white arrow).

Factors affecting healing and treatment

Size of opening and clot formation

OACs can close spontaneously if the defect is up to 3–5 mm in diameter and if the blood clot remains stable in the post-extraction alveolus during initial healing as it acts as a scaffold for epithelial cells to grow

from the mucosal margins towards the center of the defect, Larger OACs require surgical intervention. Clinically, it is complicated to determine the size of an OAC. Therefore, it is difficult to predict whether an OAC will heal without intervention. Another prognostic factor is the timing of treatment to tooth extraction.

Time of closure

Considering current opinions, OAC should be closed in 24 h. In this regard, the success rate associated with primary closure of an OAC is up to 48 h after its occurrence is 90–95%, after which time the risk of chronic sinusitis increases as does the risk of oroantral fistula (OAF) **(K. Bilginaylar 2018) ;(B. Agarwal *et al.2016)* ;(Y. Anavi *et al. 2003) ;(* R. Haas *et al. 2003) ;(* M.F. Zide *et al. 1992)*.**

Aims of Study

This paper aims to capture the frequency of oroantral communication among different patients and the best treatment modality of this condition

Chapter One: Review of The Literature

Diagnosis

1- The Valsalva maneuver:

It is highlighting the presence of bubbles in the bottom of the tooth socket.it is a breathing method performed by moderately forceful attempted exhalation against a closed airway, usually done by closing the mouth, pinching the nose shut. 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. It is worth noting that the detection of small perforations is not always possible (figure2) ;(figure3) **(Kretzschmar DP, Kretzschmar JL. Rhinosinusitis 2003)**.

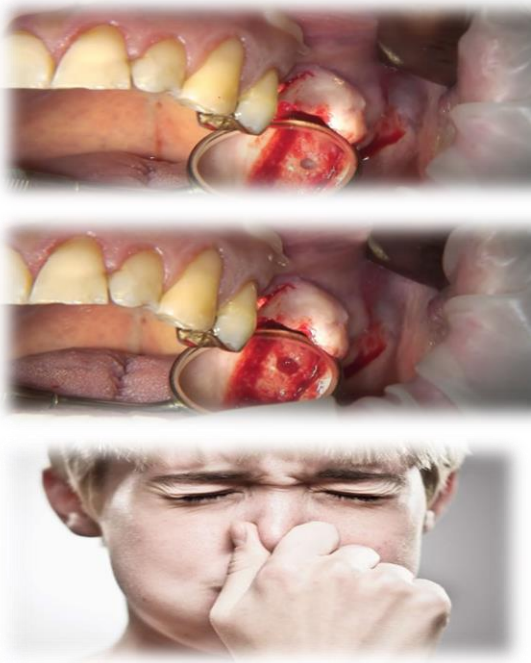

Figure 2,3: The Valsalva maneuver

2-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 (figure 4)

Figure 4: Cheek-blowing test

3-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.

Figure 5: Dental probe

4- 3 -DIMENSIONAL RADIOGRAPH (CT,CBCT)

Three-dimensional radiographs, such as computed tomography (CT) and cone-beam computed tomography (CBCT), can be used to identify OAC, to determine the status of the soft tissue in the maxillary sinus and nasal cavity and to identify sinus pathology (i.e., chronic sinusitis). They are useful in determining sinus abnormalities and the thickening of the Schneiderian mucosal membrane in the maxillary sinus. CT and CBCT are considered adjunct tools in OAC diagnosis. They depict the discontinuity in the floor of the maxillary sinus, the size of the OAC, foreign bodies, the bone and mucosa surrounding the OAC, and the status of the sinus mucosal lesion. Three-dimensional imaging modalities identify sinus pathologies more accurately and precisely than is the case with 2-dimensional radiographs. **(Parvini P, Obreja K, Begic A, Schwarz F, Becker J, Sader R, et al 2019).**

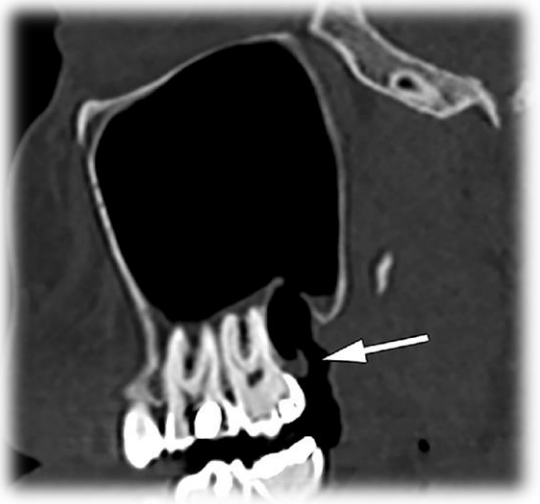

Figure 6: CT Scan

To explain the aspects that CBCT show's we'll handle these two cases:Multiplanar reformatted conebeam computed tomographic images of a 63-year-old woman. A. An axial image shows loss of the buccal cortical plate in the right maxillary first molar extraction site (white arrow) and loss of both buccal and lingual cortical plates in the left maxillary first molar extraction site (white arrows). B. A sagittal image shows loss of cortication in the left maxillary sinus (white arrow). C. A coronal image shows the

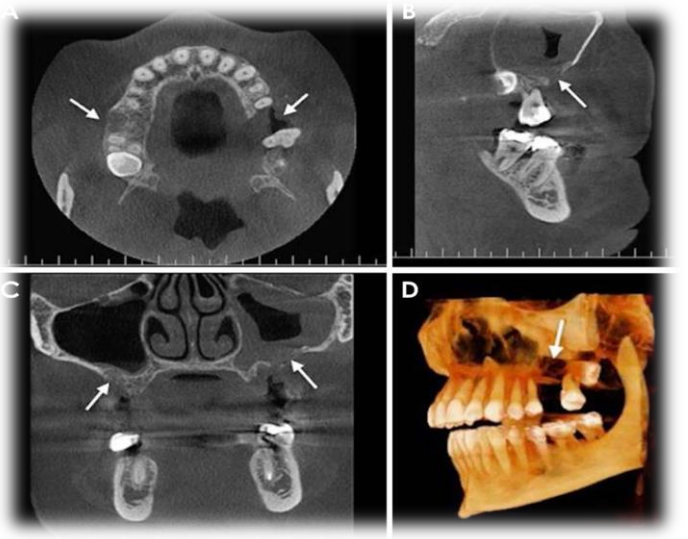

Figure 7: Case 2

extraction sockets (white arrow). On the right side, note the loss of both the buccal cortical plate and floor of the maxillary sinus and the presence of mild mucosal thickening (white arrow) at the floor of the sinus. On the left side, note the loss of buccal and lingual cortical plates and circumferential soft tissue thickening of the maxillary sinus (white arrow). Calcified material (antrolith) can be noted in the left maxillary sinus. D. A volume-rendered image shows the loss of the cortical plate at the left maxillary first molar's extraction site (white arrow). **(Nedir R, Nurdin N, Paris M, El Hage M, Abi Najm S, Bischof M. 2017).**

A 56-year-old man with a history of nasal trauma presented to a dental clinic. After a clinical examination, 3-dimensional imaging was obtained. The axial and coronal images show the discontinuity of the maxillary sinus's posterior lateral wall. This case is an example of an OAC caused by trauma rather than extraction. An axial image shows the loss of cortication in the posterior lateral wall of the left maxillary sinus. Polypoidal mucosal thickening can be noted in the contralateral maxillary sinus. A coronal image shows polypoidal mucosal thickening of the right maxillary sinus. The left maxillary sinus shows a loss of cortication in the lateral wall. The normal architecture of the sinus has changed due to trauma, causing narrowing of the sinus. An OAC can be noted at the trauma site. Figure 6 is a volumetric scan superimposed on a volume-rendered scan of the same patient **(Parvini P, Obreja K, Begic A, Schwarz F, Becker J, Sader R, et al 2019).**

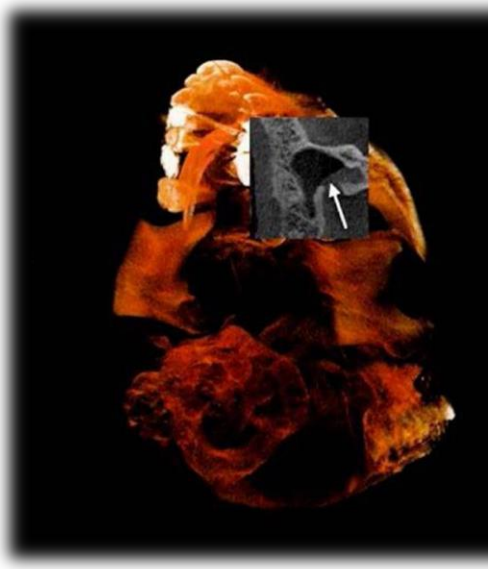

Figure 8: Case 2

Causes of OAC's

The vast majority of OAC's are created when upper molars and premolars are removed (almost 50%), tumors (18.5%), bone infections (osteomyelitis) (11%), operations to access the maxillary sinus (Caldwell-Luc procedures) (7.5%), trauma (7.5%), dentigerous cysts (3.7%), correction of septal perforations (3.7%), perforation of the sinus floor from the tooth socket when trying to remove an upper tooth and (HIV-related periodontitis) or tooth-tip infections (chronic apical infection).

Signs and symptoms in general

Patients can diagnosed with Oro-antral Communication (OAC) with the help of presenting signs and symptoms such as:

1. bleeding from the nostril,
2. escape of air through the socket during expiration
3. frothing or bubbling of blood in the socket
4. escape of fluids from the mouth through the nostril.
5. In addition to these, fistulas were also presenting with halitosis, nasal discharge, salty taste and dull pain in the maxillary region. **(Khandelwal P, Hajira N. 2017)**.

Predictive Factors

As a very broad generalization, the following may be thought to predispose to an OAC being formed:

- Proximity of sinus floor / tuberosity
- Thickened tooth cement (hypercementosis) / tooth fused to jaw bone (ankylosis)
- Infected teeth / long-standing decay
- Marked periodontitis / gum disease
- Previous history of OAC's.

How to Recognize the Chronic OAC / OAF?

The OAC is likely to become chronic if:

- OAC is greater than 5mm in diameter
- Gingival tissues / gums around the socket can't be approximated
- Post-op régime is not followed
- Wound dehiscence / breakdown
- Enucleation of a dental / dentigerous cyst
- May develop 4 – 6 weeks post-extraction

- Problems with smoking, eating or drinking
- Cacogeusia / foul taste
- Chronic maxillary sinusitis
- Antral polyp herniating into the mouth
- Purulent (pus) discharge from nose

Signs and symptoms of acute and chronic OAC

Symptoms have been classified based on whether the OAC is acute or chronic (OAF) **(Malik 2008).**

Symptoms of acute OAC:

- epistaxis
- escape of fluid from mouth to nose;
- excruciating pain in and around the region of affected sinus;
- escape of air from mouth to nose on sucking, inhaling or puffing the cheeks
- enhanced column of air causing alteration in vocal resonance and subsequently change in the voice.

Symptoms of chronic OAF:

- negligible pain as the fistula becomes established and allows the free escape of fluids
- development of an antral polyp seen as a bluish red lump extruding through the fistula;
- postnasal drip accompanied by unpleasant taste, nocturnal cough, hoarseness of voice, ear ache or catarrhal deafness;
- persistent mucopurulent, foul, unilateral nasal discharge from the affected nostril especially when head is lowered

Complication of chronic (OAC)

1. Chronic communication between oral cavity and maxillary sinus can act as a pathway for further bacterial and fungal penetration **(Borgonovo 2012).**

2. Sinusitis has been reported to occur in 60% of cases on the fourth day after sinus exposure **(Watzak 2005).**
3. Long-standing OAF can cause a general systemic toxaemic condition leading to fever, malaise, morning anorexia, frontal and parietal headache, anosmia and cacosmia **(Malik 2008).**

Treatment of (OAC)

Clinical decision-making about how to treat an OAC/OAF depends on multiple factors that include the **size of the communication**, **time of diagnosis** and **presence of infection**. Furthermore, the selection of treatment strategy is influenced by the amount and condition of tissue available for repair and the possible placement of dental implants in the future **(Visscher 2010; Dym 2012).** The immediate closure of an acute oroantral defects has been associated with a high success degree approximately 95%. However, a secondary closure has reported a success rate of 67% **(Yalçın, S., Öncü, B., Emes, Y., Atalay, B., & Aktaş, İ.2011).**

Two important factors should be considered during the closure of OAF.

- ✓ Firstly, the maxillary sinus should be free of infection with proper nasal drainage.
- ✓ Secondly, the closure should be a healthy vascularized, wide-base, tension-free, soft tissue flap above the intact bone **(Khandelwal, P., & Hajira, N. 2017).**

According to the size of OAC

Communications of 1 to 2 mm diameter **(Liversedge 2002)** and up to 3–5 mm in diameter **(K. Bilginaylar 2018)** heal spontaneously by the formation of blood clot in the absence of any infection. If the size is larger then surgery required. A small OAC can be closed immediately by suturing the gingiva with a figure-of-eight suture but when this does not provide adequate closure, a soft tissue flap is indicated **(Visscher 2010; Dym 2012)**.

According to the presence of infection and severity of the condition

Acute infection

Antibiotics are needed to control infections of the sinus thereby helping with better healing of the oro-antral communication **(Von Wowern 1982)**. Nasal decongestants or nasal sprays (steroidal and non-steroidal) or a combination of these should be used preoperatively to reduce

the inflammation of the sinus mucosa thereby aiding a tension-free closure of soft tissue flap over intact bone **(Kamadjaja 2008; Borgonovo 2012).** a combination of antibiotics such as amoxicillin and clavulanate potassium 875 mg, clindamycin 300 mg 4 times daily, or moxifloxacin 400 mg) have been used in treatment of OAC. Nasal decongestants can be used as adjuvants to healing of OAC/OAFs if the patient has any sinus infection **(Dym 2012).**

Chronic infection and the presence of fistula

In case of fully developed fistulae, the epithelium lining must be removed in order to facilitate healing **(Moore 1991)**.

Surgical interventions are mostly based on mobilizing the tissue and advancing the resultant flap into the defect **(Batra 2010)**.

I. A buccal advancement flap
II. The palatal rotational flaps
III. A modified palatal flap
IV. The use of autogenous, allogenous or xenografts
V. Cryoplatelet gel and GTR

Non-surgical interventions promote closure of OAC without the need for a soft tissue flap **(Grzesiak-Janas 2001; Buric 2013)**. These interventions involve minimum tissue handling, hence reducing post-surgical trauma during healing **(Choi 2006; Buric 2012; Buric 2013)**. Glues, adhesives and sealants have the structural ability to enhance the coagulation process and to create a mechanical barrier at the site of tissue breakdown that aids the closure of OAC **(Buric 2013)**.

i. Synthetic absorbable implants: are press fitted directly into the defect to obtain the direct closure of the OAC **(Buric 2012)**.
ii. Acrylic splints: act as mechanical barriers in people who are immunocompromised to facilitate healing of OAC. Splints may also be appropriate in cases of large defects that do not respond to other treatment modalities.
iii. Proline occlusion gel: is directly injected into the perforation, which hardens to form a barrier **(Visscher 2010)**.

iv. Biostimulation with laser light: has also been used for closure of OAC **(Grzesiak-Janas 2001).**

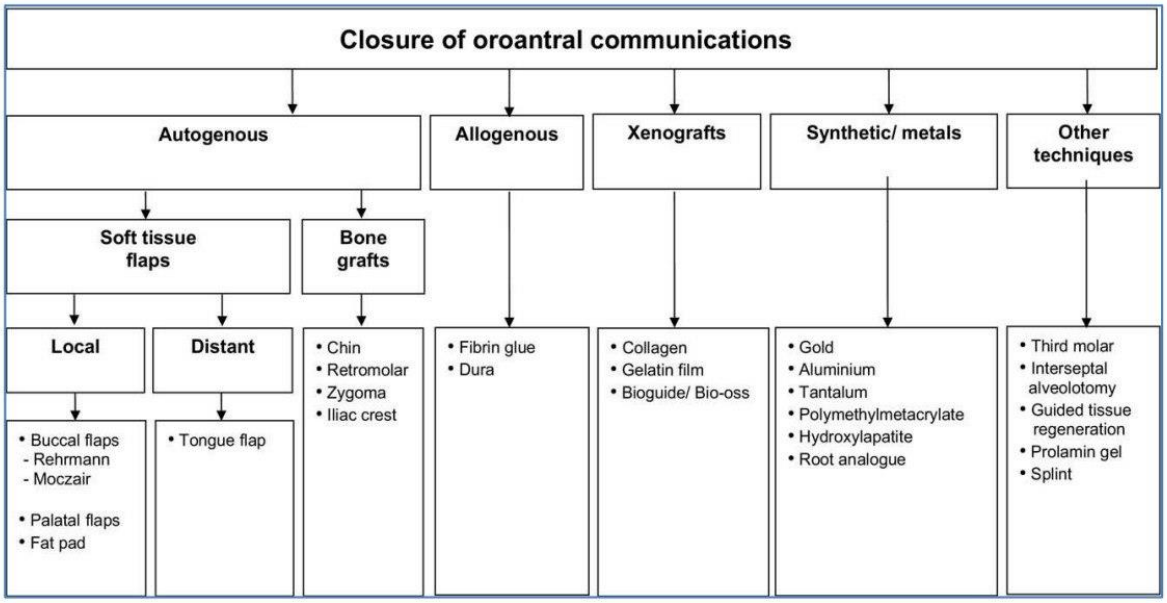

Figure 9: Different Treatment Modalities to Close OAC

Autogenous

Soft tissue flaps

1-Buccal flaps

The buccal flap was described by Axhausen in 1930 for the closure of small to moderate fistula **(Parvini, P., Obreja, K., Begic, A. (2019)**. This flap requires a buccally vertical incision with a thin layer of buccinator muscle to cover the fistula **(Gheisari, R., Zadeh, H. H., & Tavanafar, S. (2019)**. Although these flaps are simple to perform, it also requires careful manipulation as they are thin **(Awang, M. N. (1988)**. One of the advantages of this flap that it can be used in patients with severe alveolar resorption **(Gheisari, R., Zadeh, H. H., & Tavanafar, S. (2019)**. Different buccal mucoperiosteal flaps have been introduced including: advancement, rotated, transversal and sliding flaps **(Awang, M. N. (1988).**

Figure 10: Buccal advanced flap

- *Buccal advanced flap (BF)*

was introduced by Rehrman in 1936. It is the oldest and the most commonly used technique in the treatment of the OAF **(Kwon, M. S., Lee, B. S., Choi, B. J., Lee, J. W., Ohe, J. Y., Jung, J. H., ... & Kwon, Y. D. (2020).** Many surgeons choose this technique as the first line of treatment for the closure of small communication or a minor fistula, which requires a simple suturing **(Awang, M. N. 1988) ;(Guhan, D., Yusuf, E., Cagrı, D., & Gokhan, G. 2016)**. This technique requires an excision of the epithelialized margins and development of 2 diverging vertical incisions extending to the buccal vestibule from the extraction site, then the broad-based trapezoid mucoperiosteal flap is elevated and placed over the defect followed by suturing the area from the buccal mucosa to the palatal mucosa using horizontal mattress sutures **(Kwon, M. S., Lee, B. S., Choi, B. J., Lee, J. W., Ohe, J. Y., Jung, J. H., ... & Kwon, Y. D. 2020);(Dym, H., Wolf, J.C. 2012); (Khandelwal, P., & Hajira, N. 2017).**

The advantages of this flap include a high survival rate and a sufficient blood supply. Even though the buccal flaps are the most commonly used technique it also poses a major disadvantage, in which the buccal sulcus depth might be reduced after surgery, resulting in decrease of retention and discomfort in patients wearing dentures **(Kwon, M. S., Lee, B. S., Choi, B. J., Lee, J. W., Ohe, J. Y., Jung, J. H., ... & Kwon, Y. D. 2020).** Weak perfusion of the flap is also considered a major disadvantage which may lead to improper closure of large defects **(Guhan, D., Yusuf, E., Cagrı, D., & Gokhan, G. 2016)**

- *The buccal slidin flap*

was introduced by Moczair, this flap is considered as an alternative technique for the closure of the alveolar fistula. This technique has the advantage that the effect of buccal sulcus depth is minimal by shifting the flap one tooth distally. However, the need for a significant amount of dentoalveolar detachment to facilitate the shift can lead to the onset of periodontal disease and gingival recession (**Kwon, M. S., Lee, B. S., Choi, B. J., Lee, J. W., Ohe, J. Y., Jung, J. H., ... & Kwon, Y. D. 2020) ;(Khandelwal, P., & Hajira, N. 2017)**. This procedure is considered more appropriate for the edentulous patient. However, Both of Rehrman and Moczair flap may result in swelling due to reflection of mucoperiosteal flap **(Guhan, D., Yusuf, E., Cagrı, D., & Gokhan, G. 2016)**.

- ***Buccal fat pad flap***

Surgical site anatomy of Buccal Pad of Fat (BFP): It is a disc-like tissue composed of fat, comprising a main body with 4 extensions namely buccal, pterygoid, and superficial temporal and deep temporal, and surrounded by microvasculature supplied by maxillary artery, facial and superficial temporal arteries. It lies beneath the buccal mucosa, extending up to the zygomatic arch, on either side. It is a glandular like, intermuscular tissue separating the muscles of mastication from each other and from their originating bone. It is made of a specialized fat termed' Syssarcosis' and consists of lobules that are yellowish white in colour. In general, the buccal extension of the buccal fat pad is the largest segment, accounting for about 30 to 40 percent of the total weight and by volume. The body is slightly smaller, representing 25 to 35 percent of the total weight. The sizes of the pterygoid and deep temporal extensions are inconsistent but are usually smaller than either body or buccal extensions. The parotid duct, zygomatic and buccal branches of the facial nerve are intimately associated with the buccal fat pad. They cross the lateral surface of the fat pad as they enter the cheek.

The site of surgery was scrubbed with betadine. The margins around the Oro-antral communication along with the epithelialized fistula was first excised with a no. 15 blade. Two divergent vertical releasing incisions from the crest of the alveolar bone up to the vestibule were placed on either side of the communication. The sinus was approached through canine fossa, to clear sinus pathologies, if any. To access the buccal pad of fat, a second horizontal incision measuring about 0.5 cm long is placed in the periosteum over the reflected mucoperiosteal flap posterior to the zygomatic buttress. BFP is loosely attached to the submucosal layer, giving it an added advantage in release and advancing. The buccal pad of fat is then accessed through that periosteal incision by gently introducing a curved haemostat in posterior-superior-lateral direction and opening the beaks of the haemostat inside to create submucosal tunnel. This manoeuvre is repeated, if necessary, until the BFP appeared into the tunnel created. Care is taken not to injure the underlying 9 vasculature. The buccal fat pad generally gets herniated to the tunnel created and then it will be eased across the desired site with as little tension as possible to the graft tissue. Once the buccal fat pad sufficiently obturates the OAC passage, it is gently sutured to the palatal mucoperiosteal tissue or gingiva. Buccally raised mucoperiosteal flap is then repositioned back to its original place and vertical releasing incisions are sutured to secure the flap in position. Resorbable (Vicryl 4- 0) suture was used to secure the flap and graft. The buccal fat pad graft was kept unlined to achieve secondary intention healing by gradual epithelisation. No barrier membrane or surgical dressing was used.

(Batra H, Jindal G, Kaur S.2010) ;(Khandelwal P, Hajira N 2017) ;(Kiran Kumar Krishanappa S, Eachempati P, KumbargereNagraj S, Shetty NY, Moe S, Aggarwal H et al 2018) ;(Adeyemo WL, Ogunlewe MO, Ladeinde AL, James O) ;(Haraji A, Zare REZA 2007) ;(Scott P, Fabbroni G, Mitchell DA 2004) ;(Nezafati S, Vafaii A, Ghojazadeh M)

Palatal flap

Straight-advancement flap is usually required for the closure of minor palatal or alveolar defect because it does not offer much greater mobility for lateral coverage. The use of the pedicle island flap has also been reported for the closure of OAF by Hendersen in 1974. A pedicle island flap is a one-stage procedure that supplies the flap with an excellent blood supply, bulk and mobility. Many surgeons choose this flap to close the oroantral fistula due to its simplicity, versatility and mobility of the palatal island flap **(Awang, M. N. 1988)**

A modified submucosal connective tissue flap has also been reported for the closure of the OAF in the second and third molar area, this flap is known by its elasticity, ease of manipulation, and adaptation which contributes in preventing the folding and dog-ear formation. In addition, this flap has the ability to prevent the problem of bone exposure at the donor site by dividing the flap into superior mucosal layer and underlying connective tissue layer This technique requires an excision of the wall of the fistula and the curette of the granulation tissue, then a development of an H-type window-like incision in the palatal mucosa about 4 mm from the gingival margins, followed by a dissection of the arterial connective tissue flap, and the positioning of the flap through the palatal tunnel maneuver and finally suturing the flap without any tension **(Guhan, D., Yusuf, E., Cagrı, D., & Gokhan, G. 2016).** the main disadvantage is the limited mobility of the flap. It forces the surgeon to create a large palatal defect with further extensive scarring. Donor site morbidity is frequent, and the discomfort of patients is considerable **(Kwon, M.S.; Lee, B.S.; Choi, B.J.; Lee, J.W.; Ohe, J.Y.; Jung, J.H.; Hwang, B.Y.; Kwon, Y.D. 2020)**

Tongue flaps

were described nearly a century ago by Guerrero-Santos, and were modified by Bakamjian and Gosset Their advantages are simplicity, efficiency, and reliability, thanks to the vascularity of the tongue, which is supplied by the two lingual arteries, which are branches of the carotid arteries, on either side. In addition, there is no morbidity at the donor site. Each lingual artery has two main branches: one dorsal and the other ventral (the ranine artery). The two dorsal arteries anastomose at the proximal part of the mobile tongue, and the two ventral arteries anastomose at the distal part of the tongue.

This double vascularization allows different types of tongue flaps: dorsal, ventral, marginal to distal pedicle, marginal pedicle and distal bipedicle (similar to the head of hammerhead sharks). The frontal tongue flap was introduced in France in the 1970s by Gosserez, it has the advantage of being reliable and easy to perform.

The lingual flap may be a distal pedicle flap vascularized by the anastomosis of the ventral arteries or a proximal pedicle vascularized by the anastomosis of the dorsal arteries. The latter is not used often because of the risk of the pedicle tearing resulting from the pull from the base of the tongue.

The disadvantages of this technique are the following: two separate surgical procedures, discomfort lasting approximately 3 weeks because of LOM, reduction of lingual mobility, speech problems, and the need for nasogastric intubation in the period between the two procedures (as recommended by some practitioners) **(Gosserez M, Stricker M, Flot F, Gola R, Malka G. 1973)** ;**(Bracka A. 1981)**.

Bone Grafts

Proctor first proposed bone grafts taken from iliac cristae to close large OACs in 1969. After placing the bone graft, soft tissue closure is performed with a Rehrmann buccal flap. In recent years demand has increased as alternative donor areas have been investigated, including bone grafts from the retromolar region, zygomatic processes, and chin. It was abandoned due to the additional costs and comorbidities associated with this technique. Haas et al. recommend using bone grafts with monoblock's for OAC closure. The disadvantages of this technique require a second surgical procedure for bone retrieval. This second procedure prolongs surgical time and improves patient morbidity, prolonged postoperative pain, and possible sensory impairment.

Due to the high recurrence rate of oroantral fistulas with soft tissue coverage techniques, particularly in large bone defects, and the ongoing need for implant rehabilitation and pre-implant surgery, such as sinus floor elevation and ridge augmentation, routine soft tissue closure of oroantral fistulas has become a major issue, as it results in matting of the oral mucosa and schneiderian membrane, which makes sinus membrane elevation impossible without tear **(Poctor B 1969)**. While there are several bone replacements, autogenous bone transplants remain the gold standard for repair. Autogenous bone has been shown to be superior in terms of shape, function, and adaptation than allogeneic bone, xenogeneic bone, bone substitutes, and alloplasts. Additionally, autogenous bone is osteoinductive, osteoconductive, and immune-compatible **(Marchac D, Sandor GKB 1994)**.. The surgeon has a variety of donor locations accessible for autogenous bone harvesting. The maxillary tuberosity, mandibular symphysis, ramus, and retromolar regions are the most often utilised intraoral locations, whereas the ilium, costochondral area, calvarium, and tibia are the most frequently used extraoral sites **(Kainulainen VT, Sàndor GKB, Clokie CML, Oikarinen KS 2002) ;(Kainulainen VT, Sàndor GKB, Caminiti MF, Clokie CML, Oikarinen KS 2002).** The primary benefits of intraoral harvesting sites are that harvesting may be performed as an outpatient surgery under local anaesthetic agent, that local donor sites provide straightforward surgical access, and that the ischaemic duration of the bone transplant is brief. Additionally, since both the donor and recipient sites are intraoral, there is no risk of morbidity associated with a secondary surgical site, such as an extraoral scar. However, the primary drawback of intraoral harvesting is the scarcity of accessible bone, which may be inadequate to treat moderate to large abnormalities **(Sindet-Pedersen S, Enemark H 1990) ;(Sindet-Pedersen S, Enemark H. Mandibular bone grafts for reconstruction of alveolar clefts 1988).**

Allogenous Materials

platelet-rich fibrin (PRF)

Recent researches showed that platelet-rich fibrin (PRF) is also a useful approach for the management of acute oroantral perforations with a diameter of 5 mm or less **(Assad, M., Bitar, W., & Alhajj, M. N. 2017)**. PRF is a second-generation platelet concentrate that was first described by Choukroun et al. It has since been widely employed in conjunction with bone

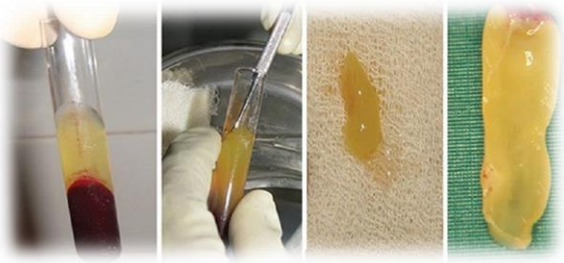

Figure 11: platelet-rich fibrin (PRF)

graft materials for periodontal regeneration, ridge augmentation, sinus lift operations for implant placement, and membrane coverage of recession defects **(Ramadan, N. 2020)**. The addition of PRF to autogenous bone transplants may promote new bone growth and aid in sinus floor mucosal closure **(Pripatnanont P, Nuntanaranont T, Vongvatcharanon S, Phurisat K 2013)**.

Clinical Procedure:

The post-extraction socket of the tooth was cleaned with a physiologic saline solution. The oroantral communication was then closed with Plateletrich fibrin (PRF) membranes. The PRF clots were collected from a blood sample taken from the patient and centrifuged immediately. A first membrane was inserted gently into the extraction socket. The extraction site was then covered with a second membrane that was sutured to the gingival margins.

Some studies have achieved closure of OAF with lyophilized fibrin glue. The preparation of lyophilized fibrin glue takes about 15 to 20 minutes. The lyophilized fibrin glue is then applied to the socket with a syringe and the collagen sheet. After that, the mouth's surface is covered with the remaining fibrin glue. After 2 hours, the glue has reached its maximum strength. The advantage of this technique is that the intraoral anatomy remains intact. The disadvantages of this technique are the small risk of transmission of viral hepatitis and the preparation time required for fibrin glue **(Visscher SH, van Minnen B, Bos RR 2010).**

A Technique with Cortico-Cancellous Graft Covered with Resorbable Collagen Membranes and Heterologous Cortical Lamina .This technique was used for the closure of defects bigger than 8 mm that required additional support for decreased bone tissue adjacent to the defect. In this treatment group, at the level of the maxillary sinus floor, a rigid heterologous cortical sheet with a thickness of 1 mm was inserted and oversized by about 2 mm in comparison to the preexisting defect. This was performed after the placement of a heterologous cortico-cancellous graft covered with resorbable collagen membranes. A thermoplastic gel (TSV gel Osteobiol®, Turin, Italy) or pins were used to support the cortical sheet **(A Lopez, M.; Manzulli, N.; Casale, M.; Ormianer, Z.; Carinci, F 2016) ;(Rossi, R.; Ghezzi, C.; Tomecek, M 2020)**.

From the symphyseal bone, a cortico-cancellous block graft was extracted. To expose the anterior aspect of the mandibular symphysis, an intraoral incision was made below the mucogingival junction and extended between the mandibular canines. Corticocancellous block

was obtained using a trephine bur of appropriate size for the extent of the bone defect at the OAF, while keeping the lingual cortex intact **(Montazem A, Valauri D, St-Hilaire H, Buchbinder D 2000)**

Xenograft

Using of lyophilized dermis porcine to close oroantral perforations or placing buccal and palatal flaps on top of pig collagen, Collagen does not have to be removed because fibrous tissue eventually replaces it. Nevertheless, it still takes quite a long time to allow mucosal overgrowth in communication. Ogunsalu has described the new surgical management. Ogunsalu used Bio-Guide *(pig collagen membrane)* and Bio-Oss *(bovine bone grafting)* to close fistulas. The mucoperiosteal full-thickness flap is then removed, and a Bio-Oss–Bio-Guide sandwich is placed underneath. Then the flap is repositioned, resulting in primary closure. The disadvantages of this technique are the need for a mucoperiosteal cover to cover the sandwich and a long time for the healing process. The advantage of this technique is that bone and soft closure can be done without surgery at the donor site **(Visscher SH, van Minnen B, Bos RR 2010)**.

Synthetic Closure

Gold foil or gold plate for OAF closure

is applied in place with edges on healthy bones. It acts as a bridge for the overgrowth of the sinus mucosa. The mucoperiosteal flaps, which are raised to expose the edges of the bones from the defect, are sewn on gold foil without attempting to perform primary closure. In general, gold foil peels off after six weeks. Solid hydroxyapatite has also been used to seal OAF. The disadvantages of using gold are a rather expensive cost and a relatively long time for closure and complete healing. The advantages of using aluminum are its malleability, softness, and low cost compared to gold **(Visscher SH, van Minnen B, Bos RR 2010) ;(Steiner M, Gould AR, Madion DC, Abraham MS, Loeser JG 2008)**

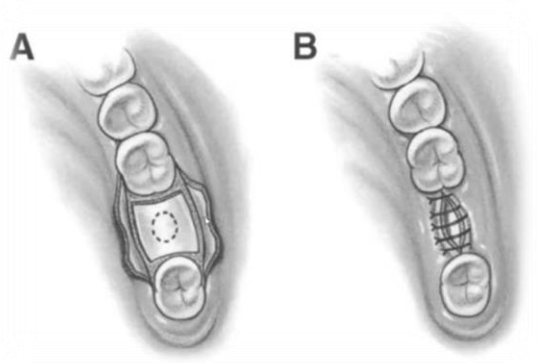

Figure 12: A: buccal and palatal mucoperiosteal flaps raised to allow adaptation gold plate B: flaps sutured over metallic scaffold without attempt to primary closure

Aluminum plates

were suggested for OAF closures **(Steiner M, Gould AR, Madion DC, Abraham MS, Loeser JG 2008)**. According to Steiner, 36-gauge pure aluminum plate is used as a protective plate to aid in closure. 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

Tantalum

is a highly biocompatible metal. It has been used for closures of OAFs by McClung and Chips **(McClung E 1951)** Along the same lines as the gold technique, tantalum foil is used as a protective plate to aid in closure. The Tantalum foil was removed after 9 weeks. They reported formation of granulation tissue following the closure.

titanium plate with transalveolar wiring fixation

was documented. The results revealed good bony and soft tissue healing. Further, the use of two different materials titanium plates and stainless-steel wires did not result complication or distaste because of galvanic current **(Ahmed WM 2015)**

polymethylmethacrylate

has been introduced as an alternative technique for closing OAFs **(Al Sibahi A, Shanoon A 1982)**. After 24 h of immersion in a sterilizing solution, the polymethylmethacrylate plate is placed over the defect. Mucoperiosteal flaps are then replaced without attempting to cover the acrylic plate. The polymethylmethacrylate plate is removed as soon as the edges become exposed. One of the common disadvantages of this technique is the required time for preparation.

otorhinolaryngological/oral approach

Recently, a dual otorhinolaryngological/oral approach was described in a patient with an OAF complicated by maxillary sinusitis **(Procacci P, Alfonsi F, Tonelli P, Selvaggi F, Menchini Fabris GB, Borgia V, De Santis D, Bertossi D, Nocini PF 2016).** The investigators used the functional endoscopic sinus surgery (FESS) technique in combination with a titanium mesh to obtain optimal reconstruction and stabilization of soft tissue. The main disadvantage

of this technique is the second surgery needed to remove the mesh. Despite this drawback, use of a titanium mesh assures predictable healing, mechanic scaffolding, and tissue stability.

Hydroxyapatite

Zide and Karas used nonporous blocks of hydroxyapatite to close oroantral fistulas by carving the blocks to fit the bony defect and encircling them with a wire for stability when needed **(Zide MF, Karas ND 1992)** The investigators reported natural extrusion of the blocks without recurrence of a fistula **(Visscher SH, van Minnen B, Bos RR 2010)** The technique offers a number of advantages, including ability to have a press-fit graft closure and no morbidity associated with a second-site surgery. Various sizes of hydroxylapatite implants have also been used to close oroantral fistulas **(Becker J, Kuntz A, Reichart P. Verschluß von Mund-Antrumperforationen durch 1987)** Further, the remaining space in the socket was filled by hydroxylapatite granules. Oral mucosa was approximated without complete closure **(Visscher SH, van Minnen B, Bos RR 2010)** Considering extrusion, the technique resulted in no cases of hydroxylapatite implant extrusion. Disadvantages include high costs and the need for various implant sizes to allow for size selection.

bioabsorbable root analog

The use of a bioabsorbable root analog made of β-tricalcium phosphate for closure of oroantral fistulas was proposed by Thoma et al. **(Thoma K, Pajarola GF, Grätz KW, Schmidlin PR 2006)** The root replicas were fabricated chair side, using a mold of the extracted tooth **(Visscher SH, van Minnen B, Bos RR 2010)** The investigators reported that the healing was uneventful. However, fragmentary roots or overly large defects prevent replica fabrication or accurate fitting of the analog. The technique is simple and fast.

Other techniques

third molar transplantation

Kitagawa et al. advocated third molar transplantation as a suitable option for closure of OAFs **(Kitagawa Y, Sano K, Nakamura M, Ogasawara T 2003)** The investigators successfully closed two cases of OAFs by immediate upper and lower third molar transplantation. The donor teeth were carefully extracted and transplanted to the prepared recipient bed. Firm finger pressure and light tapping provided good stabilization of the tooth on the recipient bed

Figure 13: Third molar transplantation

and produced a complete simultaneous closure of the OAF. Endodontic treatment was carried out after 3 weeks. The researchers reported that third molar transplantation was a simple and excellent treatment option to close small OAFs. However, third molar transplantations have some drawbacks: the requirement of a sufficiently developed third molar of an appropriate shape and size, and the risks of ankylosis and root resorption if not carried out with proper technique.

interseptal alveolotomy

Hori et al. proposed interseptal alveolotomy as one of possibilities for closure of OAFs [70]. The technique, based on the Dean preprosthetic technique, is used for the purpose of smoothing the alveolar ridge. The extended Dean technique is performed in such a way that the interseptal bone is removed, followed by the fracturing of the buccal cortex in the direction of the palate. Sutures are used for soft tissue closure. The technique offers the advantage of facilitating spontaneous postoperative healing with less postoperative swelling, supported by the bony base. The most important advantage of this technique, compared with the buccal flap technique, is that it assures closure of soft tissue without creating tension. However, limitations of this method are that it requires both a space of less than 1 cm between the adjacent teeth and adequate alveolar ridge. Moreover, there is a risk of inflammation as a result of the required buccal bone fractures due to formation of bone sequesters and possible imperfect soft tissue closure in the case of an incomplete fracture **(Hori M, Tanaka H, Matsumoto M, Matsunaga S 1995).**

guided tissue regeneration

Use of guided tissue regeneration has been documented by Waldrop and Semba **(Waldrop TC, Semba SE 1993)** This method uses an absorbable gelatin membrane, allogenic bone graft material, and a non-resorbable expanded polytetrafluoroethylene (ePTFE) membrane. After flap reflection, an absorbable gelatin membrane is placed over the OAF with its edges on the bony margins of the perforation, which serve as a barrier for the bone graft material and prevent displacement of the graft material into the antrum and sinus epithelial cell migration. A layer of allogenic bone graft material is put on the membrane. The nonresorbable ePTFE membrane is used to cover the bone graft material, and the soft tissue flap is placed over the membrane. This membrane promotes selective cell population with subsequent regeneration. Eight weeks after insertion, the barrier membrane is removed. After removal of the inner aspect of the flap adjacent to the ePTFE membrane, the mucoperiosteal flap is replaced. Closure of the OAF was

clinically confirmed by bone formation, although this was not confirmed histologically. One of the disadvantages of this technique is the need for an additional surgery to remove the non-resorbable ePTFE membrane. A further disadvantage is the need for a full-thickness flap

prolamin occlusion gel

Götzfried and Kaduk developed 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 HF, Kaduk B. Okklusion der Mund-Antrum-Verbindung durch eine 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. Additionally, the technique is less appropriate for closure of OAFs greater than 3 mm **(Thoma K, Pajarola GF, Grätz KW, Schmidlin PR 2006)**.

Biostimulation with laser light

was suggested by Grzesiak-Janas and Janas for closure of OAFs **(Grzesiak-Janas G, Janas A 2001)** In this method, 61 patients were subjected to 3 cycles of extraoral and intraoral irradiation with a CTL 1106 biostimulative laser of 30-mW power with a tip-emitting light of 830-nm wavelength for 10.5 min and for four consecutive days. The researchers demonstrated a complete closure of OAFs. This technique eliminates the need for a surgical procedure. The technique has the disadvantage of being expensive and requires many visits to accomplish complete closure

acrylic surgical splint

Logan and Coates described a procedure that provided closure of OAF in immunocompromised patients **(Logan RM, Coates EA 2003)** 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: Discussion

- Oro-antral communications, or perforations that connect the mouth and the sinus, are commonly seen in clinical dental practice, especially after extractions of maxillary posterior teeth. According to the literature, the incidence of OAC has been reported to be as high as 11% .Extraction of the palatal root of the maxillary first molar most often contributes to its formation **as in our case**.

- If OAF is suspected, a thorough clinical and radiological examination should be proceeded. OAF acts as a pathway for bacterial and fungal penetration leading to maxillary sinusitis, or pan-sinusitis in 60% of cases. Signs and symptoms may be acute or chronic. Acute symptoms include epistaxis, fluid or air passage through OAC/OAF, pain, voice alteration. Chronic symptoms include pain, free escape of fluids as in our cases, antral polyps, postnasal drip, dysgeusia, voice alterations, earache and mucopurulent nasal discharge .

- Radiographic exams such as panoramic view allow us to see an alveolar defect and Waters' view to see maxillary sinus infection. The communication between the oral cavity and maxillary sinus can be confirmed with Cone beam computed tomography or CT scan. They also permit to note a thickening of the sinus mucosa or its opacification, the aeration of the nasal meatus or the pathological state of the ethmoidal air cells or other sinuses.

- Closure of the OAF is very important to prevent any food or saliva accumulation that can cause sinus contamination leading to infection, impaired healing and chronic sinusitis. However, proper infection control must be performed prior to surgical closure of the fistula to prevent exacerbation of the infection and to permit the resolution of the case. In the case of patients with sinus infection, amoxicillin/clavulanic acid 1 g/125 mg three times per day for 10–14 days, nasal decongestants, and nonsteroidal anti-

inflammatory drugs can be prescribed to manage sinusitis. The conduct of routine sinus irrigation could be helpful alongside the use of these medications.

- Meanwhile, patients with chronic sinus disease that doesn't respond to medications will require surgical intervention such as endoscopic sinus surgery or the Caldwell–Luc procedure.

- Amongst the known techniques for closure of OAF are buccal advancement flaps, palatal advancement flaps, rotational advancement flaps, hinged flaps, island flaps, and buccal fat pad. In our reported cases, given the size (>5 mm) and the seniority of the communication, the BFP technique was chosen.

- Regular post-operative follow-up of the patient is recommended for up to one year to avoid surgical failure and recurrence. Perfect healing was noted in our cases after more than six months of follow-up.

Chapter Three: Conclusion

- ✓ OAC has a wide prevalence 11% **(Wächter R., Stoll P.1995); (Rothamel D., Wahl G., d'Hoedt B., Nentwig G.H., Schwarz F., Becker J.).**
- ✓ The most common cause of this condition is extraction of upper molars (almost 50% of cases)
- ✓ The least common cause is **dentigerous cysts (3.7%) correction of septal perforations (3.7%)**
- ✓ Sinusitis has been reported to occur in 60% of cases on the fourth day after sinus exposure
- ✓ The painless cases these have a drainage through a fistula
- ✓ The best treatment of acute oroantral is Augmentin plus clindamycin
- ✓ For the chronic infections the best treatment modality is surgery
- ✓ Treatment of choice for small OAC is suturing with figure of eight
- ✓ High failure reports were about the buccal flaps except the buccal fat pad flap which is considered the best one
- ✓ Buccal fat pat flab is used to treat failure cases with 100% of success

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