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Relationship Between Maxillary Sinus And Maxillary Posterior Teeth

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بسم الله الرحمن الرحيم

"يَرْفَعِ اللَّهُ الَّذِينَ آمَنُوا مِنكُمْ وَالَّذِينَ أُوتُوا

الْعِلْمَ دَرَجَاتٍ وَاللَّهُ بِمَا تَعْمَلُونَ خَبِيرٌ"

صدق الله العظيم

"سورة المجادلة-ايه 11"

Dedication

Our study trip has reached its end after exhaustion and hardship

And we are concluding the research of our graduation with all

vigor and vigor .We are grateful to everyone who has been

credited with our journey ,and help us ,even with ease. Parents,

family , friends , and esteemed teachers. We present to you a study

of our graduation.. . And do not forget the greatest credit to our

research supervisor (Dr. Afrah Adil Hassan), by providing us with

valuable and useful information. Thank you very much doctor....

Supervisor Certification

This is to certify that this undergraduate dissertation entitled" The Relationship Between Maxillary Sinus And Maxillary Posterior Teeth" was prepared by the undergraduate students Haider Muhammed And Narjes Maher under my supervision at the College of Dentistry / University of Maysan as partial fulfillment of the requirements for B.D.S degree.

Supervisor’s signature

Dr. Afrah Adel

MSc Human Anatomy

Declaration

we declare that this dissertation was prepared, written, and entirely the result of our own work and we have faithfully and properly cited all sources used in the dissertation.

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Introduction

The maxillary sinus is the largest of the paranasal sinuses, located within the maxilla on either side of the nasal cavity. It plays a critical role in various physiological processes, including respiration, filtration, and vocal resonance, while its proximity to the maxillary teeth highlights its importance in dental and maxillofacial health.

The maxillary sinus is a paired, air-filled cavity shaped like a pyramid, with its base oriented medially toward the lateral wall of the nasal cavity and its apex directed laterally toward the zygomatic bone. It is lined by respiratory mucosa composed of pseudostratified ciliated columnar epithelium, which is responsible for mucociliary clearance (Kennedy & Adappa, 2015). The sinus has distinct boundaries: the roof is formed by the orbital floor, the floor lies above the maxillary alveolar process, and the medial wall is adjacent to the nasal cavity and houses the maxillary sinus ostium, the primary drainage point into the middle meatus (Marquez et al., 2008).

The sinus varies in size and shape among individuals, with an average volume of 15–30 mL in adults. It continues to grow until early adulthood, with its expansion influencing the surrounding anatomical structures, such as the orbit and maxillary teeth (Fagundes et al., 2017). The thin bony floor of the sinus often comes into close contact with the roots of the maxillary premolars and molars, a relationship that has significant clinical implications.

The maxillary sinus plays a vital role in respiratory function by conditioning inhaled air. The pseudostratified ciliated epithelium produces mucus that traps

particles, pathogens, and debris, while the cilia facilitate mucociliary clearance toward the nasal cavity. This filtration process prevents contaminants from reaching the lower respiratory tract (Kennedy & Adappa, 2015). Additionally, the sinus warms and humidifies inspired air, optimizing its condition for gas exchange in the lungs (Marquez et al., 2008).

Another important function of the maxillary sinus is to reduce the weight of the skull. By creating air-filled cavities within the bone, the sinus minimizes the load on the cervical spine and muscles while maintaining structural integrity (Marquez et al., 2008). This design improves biomechanical efficiency and allows for better balance and mobility.

The maxillary sinus's floor is closely associated with the alveolar process of the maxilla, where the roots of the maxillary premolars and molars often protrude into the sinus cavity. In some cases, only a thin layer of bone or sinus membrane separates the tooth roots from the sinus, making this area prone to complications following dental or surgical procedures (Kennedy & Adappa, 2015).

Tooth extraction, implant placement, or pathological conditions involving the maxillary molars and premolars may compromise the integrity of the sinus floor, resulting in oroantral communications or sinus perforations (Fagundes et al., 2017).

Furthermore, odontogenic infections, such as periapical abscesses, can spread into the sinus, leading to sinusitis of dental origin. These anatomical considerations necessitate a thorough understanding of the relationship between the sinus and the teeth to minimize complications and ensure effective treatment.

The maxillary sinus is an essential anatomical structure involved in respiration, filtration , and craniofacial function. Its close relationship with the maxillary teeth

highlights its clinical significance, particularly in dentistry and otolaryngology. Understanding the anatomy and physiology of the maxillary sinus, as well as its interactions with surrounding structures, is critical for managing sinus-related conditions and preventing complications in dental and surgical procedures.

Review of Literature

1. Embryology and Anatomy

The maxillary sinus was first described in 1651, by Nathaniel Highmore Therefore, it is also known as antrum of Highmore. Maxillary sinuses are two in number (Fig. 1) one on either side of the maxilla, and they are the largest of the paranasal air sinuses (maxillary, ethmoid, frontal, and sphenoid).The communicate with the other paranasal sinuses through the lateral wall of the nose. They may be identical or asymmetrical in size and shape. The average dimensions of the sinus are approximately 3.5 (anteroposterior) x 3.2 (height) x 2.5 (width) cm. Its volume is 15 to 30 ml. The ostium (3 to 6 mm diameter) opens into middle meatus (Malik, 2012

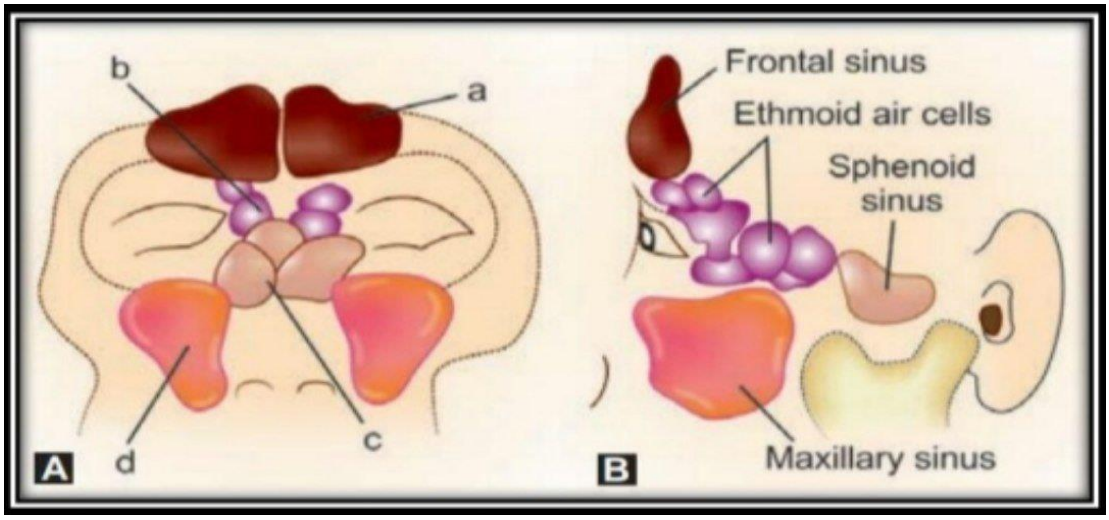


FIGURE (1) A and B: (A) Frontal view of paranasal sinuses: (a) frontal sinus, (b) ethmoid air cells, (c) sphenoid sinus, (d) maxillary sinus(B) Lateral view of paranasal sinuses(Malik, 2012).

In early stages, maxillary sinus is high in maxilla. Later gradually grows downward, by a process of pneumatization (Tab. 1). The expansion of the sinuses normally ceases after eruption of permanent teeth and extend into the residual alveolar process after removal of one or more of maxillary posterior teeth(Malik, 2012).

TABEL (1): Stages of the growth of maxillary sinus (Malik, 2012).

Time	*Growth*	*Shape*
3/12 IU	Outpouching in middle meatus	—
Birth	Tubular: 2 cm × 1 cm × 1 cm	
	3 mm per year × 2 mm × 2 mm	Tubular
9 years	60% of adult size	Ovoid
12 years	Antral floor parallels nasal floor	—
18 years	Adult size	Pyramidal

- Bony walls

The antrum lies in the body of the maxilla; and therefore one on each side. They are hollow, pyramidal in shape (Fig. 2) with the apex at the root of zygomatic bone and the base being formed of the lateral nasal wall. The four walls of the pyramid 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 .

The bony walls of the sinus are thin except for the anterior wall and the alveolar ridge in dentate individuals. In the edentulous, the alveolar bone is frequently atrophied and may be only 1mm to 2 mm thick(Garg& Mugnolo, 2017).

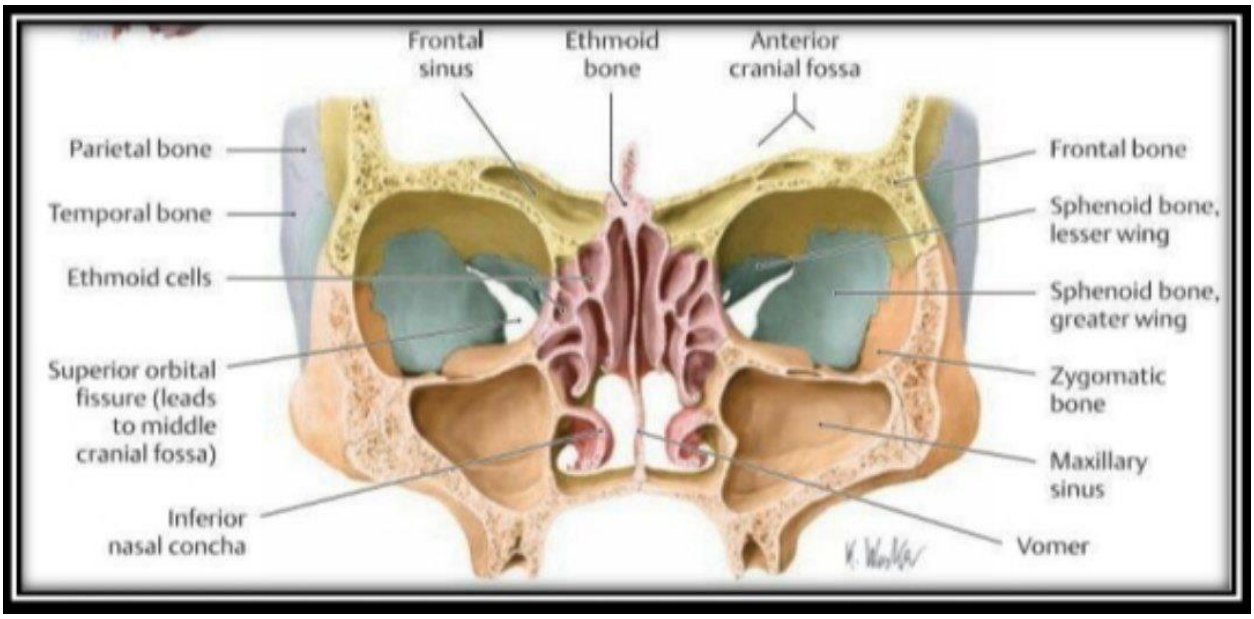


FIGURE (2): The maxillary sinus and surrounded bony structures (Mitra, 2009).

- Nerve supply

The nerve supply to maxillary sinus (Fig. 3) is from superior dental nerves (anterior, middle and posterior), and the greater palatine nerve . These are branches of maxillary division of trigeminal nerve(Malik, 2012).

The posterior superior alveolar nerve supplies most of the sensation of the maxillary sinus. The anterior superior alveolar nerve innervates the anterior

portion of the maxillary sinus and the middle superior alveolar nerve contributes secondary mucosal innervation whereas the maxillary ostium receives its innervation via the greater palatine nerve(Larrabee et al, 2003).

-Vascular supply

Blood supply to the mucous membrane of maxillary sinus is from arteries which

pierce the bone, and are derived from facial, maxillary, infraorbital and greater palatine arteries.The veins accompany the arteries, and drain into anterior facial vein and then to pterygoid plexus of veins(Malik, 2012).

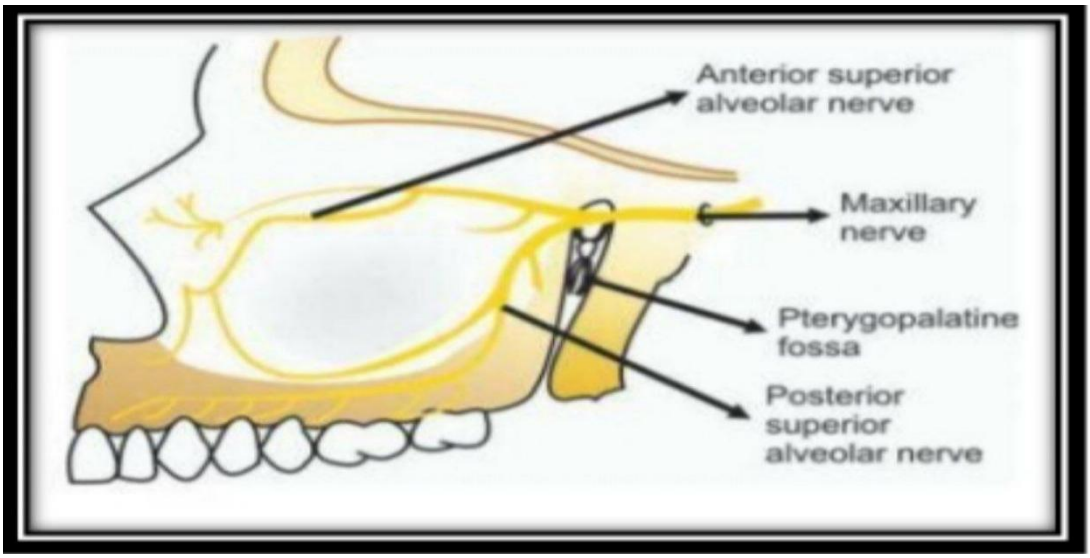


FIGURE (3): Nerve supply of maxillary sinus(Mitra, 2009).

2. -Physiology of Maxillary Sinus

The maxillary sinus is lined with a pseudostratified columnar epithelium, also

called the Schneiderian membrane. Beneath the surface epithelium is a loosely

cellular but highly vascular thin tissue and Beneath this is a periosteum(Garg & Mugnolo, 2017).

The mucociliary mechanism is useful means for removal of particulate matter, bacteria, etc. The cilia move the mucus and other debris towards the ostium, and subsequently discharged in the middle meatus(Malik, 2012).

3. Odontogenic Sinusitis

Definition

Odontogenic sinusitis is the inflammation of mucosa of any of the paranasal sinuses. Inflammation of most or all of the paranasal air sinuses simultaneously is known as pansinusitis. Sinusitis may be due to :

(1) Infectious causes: Bacterial, viral or fungal.

(2) Noninfectious causes: Allergic, nonallergic, implant related.

(3) Due to disruption of mucociliary drainage: Surgery or trauma.

Odontogenic sinusitis accounts for 10–12% of cases of maxillary sinusitis, because of its close proximity with the maxillary teeth. The condition, if not treated, may spread to involve other sinuses.

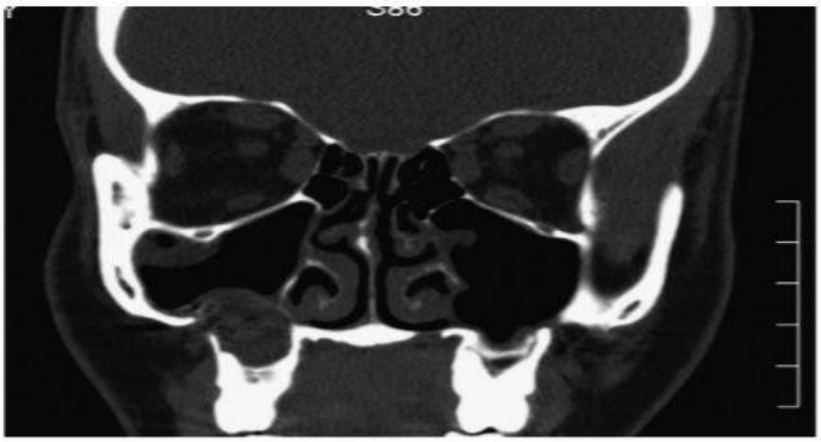


FIGURE (4): Perforation of the lateral wall of the right sinus as a result of an odontogenic infection associated with a molar tooth. The abscess has expanded into the floor of the sinus and eroded the lateral wall of the sinus.

4. Etiology

An odontogenic source for causing sinusitis should be considered for the patients, who give history of odonto- genic infection or dentoalveolar surgery or those who are resistant to standard common sinusitis treatment.

5. Common Causes of Odontogenic Infections Leading to Sinusitis

Several dental conditions and procedures are implicated in the development of odontogenic sinusitis:

1. Periapical Infections

Periapical infections result from bacterial invasion of the tooth's pulp, typically due to untreated dental caries or trauma. The infection progresses to the apex of the tooth, where it may erode through the thin bone separating the tooth roots from the maxillary sinus floor. Once the infection breaches the sinus floor, inflammation and bacterial colonization of the sinus occur.(Shahbazian et al. (2015)).

2. Periodontal Disease

Periodontal diseases, such as periodontitis, involve inflammation and infection of the tissues supporting the teeth, leading to bone loss. Severe cases may result in direct communication between the oral cavity and the maxillary sinus, providing a pathway for pathogens to enter the sinus cavity.(Froum et al. (2011)).

3. Dental Extractions

Tooth extractions, particularly of the maxillary molars and premolars, can inadvertently create an oroantral communication (OAC), a direct opening between the oral cavity and the maxillary sinus. If left untreated, OACs act as a conduit for oral flora and debris to contaminate the sinus, resulting in sinusitis.(Chrcanovic et al. (2011)).

4. Dental Implants

Placement of dental implants in the posterior maxilla can result in sinus membrane perforation if the implant is placed too close to or within the maxillary sinus. This can introduce bacteria and foreign material into the sinus cavity, leading to infection and sinusitis. (Chan et al. (2014)).

5. Root Canal Treatment (Endodontic Procedures)

Incomplete or overextended root canal treatments can lead to periapical infections that spread into the sinus. Overfilling of root canal material into the sinus cavity may also provoke an inflammatory reaction and infection.(Giacomini et al. (2018)).

6. Foreign Body Reactions

Foreign materials, such as broken instruments, dental filling materials, or bone graft particles, introduced into the sinus during dental procedures, can cause irritation and serve as a nidus for infection.(Longhini et al. (2020)).

7. Oroantral Fistula Formation

Chronic oroantral fistulas, often a result of trauma, surgery, or untreated OACs, allow continuous communication between the oral cavity and the sinus. This provides a pathway for bacterial migration, resulting in chronic maxillary

sinusitis.(Visscher et al. (2017)).

Odontogenic infections leading to sinusitis primarily arise from disruptions in the structural integrity of the maxillary sinus floor. Early identification and management of dental infections, along with careful planning of dental procedures, are critical to preventing the development of sinusitis.

6. **Maxillary sinusitis** can be classified into:

1 Acute—present for <2 weeks.

2 Subacute—present for 2 weeks to 3 months.

3 Chronic—present for more than 3 months.

The organisms which are thought to be responsible are:

In acute sinusitis: Streptococcus pneumoniae and Haemophillus influenzae

In chronic sinusitis: Bacterial flora is polymicrobial anaerobes and microaerobic streptococci, staphylococci and Gram -ve organisms.

Acute Maxillary Sinusitis

Acute maxillary sinusitis may be suppurative or nonsuppurative inflammation of the antral mucosa.

Signs

Extraoral Examination

(1) Tenderness over the cheek.

(2) Anesthesia of the cheek in the area of distribution of infraorbital nerve.

(3) Severe infection may lead to mild swelling of the cheek.

Percussion of maxillary teeth, related to maxillary sinus show tenderness.

Intraoral Examination

(1)Existence of OAF with or without polypoid mass extruding from the orifice into the socket.

(2) Patient complains of fetor oris, especially when blowing the nose.

(3) Discharge of pus into the mouth from fistula; if opening is obstructed by polyps, the discharge is prevented.

Symptoms

(1) Heavy feeling in the head.

(2) Constant throbbing pain in upper part of cheek or entire side of the face, which is exacerbated by lowering or bending down. Pain is more severe in the morning and evening.

(3) Maxillary teeth in relation with maxillary sinus on the affected side may be painful. Pain in the teeth often precedes pain in the cheek.

(4) Unilateral foul nasal discharge, which becomes more profuse with lowering down of head.

(5) Unilateral nasal obstruction on affected side.

(6) The generalized constitutional symptoms are present but in milder form, such as chills, fever, sweating, nausea, difficulty in breathing. Anorexia may be due to swallowed pus.

Radiography:

Water's view (OM 15°) is the most valuable radiograph.

The affected antrum shows uniform opacity. Sometimes, a fluid level is discernible.

Management

The extraction of the offending teeth carries a risk of perforation and a persistent fistula. In cases of extraction, some authors recommend that the socket be covered with complete soft tissue closure.

(1) **Classical antral regimen includes**—bed rest, plenty of fluids, maintenance of oral hygiene. The regimen should be carried out for at least 5–7 days.

(2) **Antimicrobials**: The most suitable against common antral pathogens are: (1) Macrolides: Erythromycin 250–500 mg 6 hourly for 5 days, (2) Broad-spectrum group: Amoxicillin 250–500 mg 8 hourly for 5 days. Augmentin 625 mg BD for 7 days. Culture sensitivity test should be carried out, if there is no response within 72 hours.

(3) **Decongestants**: In the forms of nasal inhalations and drops. These take care of nasal congestion. These drugs reduce the excessive vascularity of lateral nasal wall, thereby improving the opening of the ostium.

(4) **Nonsteroidal anti-inflammatory analgesic agents**: Analgesic and anti-inflammatory regime can be started when required: (1) Aspirin, (2) Paracetamol, and (3) Ibuprofen.

Chronic Maxillary Sinusitis

Chronic maxillary sinusitis may be due to a persistent dental focus, chronic rhinitis, chronic infection in the frontal or ethmoidal sinuses, allergic conditions, etc. It is a sequalae of an acute infection that fails to resolve by 3 months. Dental causes account for 40% of cases of chronic maxillary sinusitis.

Pathophysiology

The mucous membrane of the maxillary sinus, due to chronic inflammation may undergo changes, such as hyperplasia or atrophy. Multiple polyps formation or degeneration of epithelium, where the cilia are lost can be seen. The ostium shows edematous changes causing a complete blocking. The drainage of the sinus will be affected.

Signs and Symptoms

The condition sometimes is asymptomatic, but following signs and symptoms may be present:

1 Pain and tenderness in the area of antrum is found usually in acute exacerbations.

2 Unilateral foul discharge through posterior nares.

3 A fetid odor with bad taste in the mouth.

4 Chronic nasal obstruction and headache

5 Dull ache and heaviness over sinus.

Radiography

The findings are:

(1) Presence of fluid level.

(2) Thickened lining membrane.

(3) Opaque air space may enclose polyps associated with mucosal thickening.

(4) In case of presence of tooth or root, the characteristic outline is seen within the sinus.

FIGURE (5): CT scan shows chronic sinusitis and partial opacity in right maxillary sinus, yellow arrow indicating the OAF.

Management

The management requires eradication of related dental complications. If the chronic sinusitis is caused by chronic periapical infection, then affected tooth must be extracted and the socket closed surgically completely as there is a risk of OAF formation. If there is already a communication with maxillary sinus; if the blood clot fails to organize; and the socket gets infected, then there will be persistent chronic maxillary sinusitis. There are some factors to be considered in

management of chronic maxillary sinusitis, or OAF:

- The longer the management is deferred, the greater is the risk of inflammatory changes in lining membrane. The transition to chronic form occurs after a period of 2 weeks. At this stage, the condition is curable, belated therapeutic intervention adversely affects the prognosis.
- In case, the cause is the foreign body, such as tooth or root in the sinus, it is necessary to retrieve these foreign bodies prior to considering any other form of treatment. Concurrent presence of antral polyps should also be removed. The antral air space is gently irrigated and closure of wound is affected. Routine postoperative treatment with an antibiotic, decongestant and analgesics to be given.
- Antral lavage: The presence of a chronic pyogenic sinusitis subsequent to an OAF requires surgical closure of fistula. The polyps found at operation should also be removed. Preoperatively, if the antrum isfound to be full of pus: (1) It should be irrigated through the fistula, on a daily basis, with a warm normal saline or betadine, or (2) In certain circumstances, the fistulous orifice needs to be enlarged surgically to enable efficient antral lavage. When the antral washouts appear to be clear, the fistula should be repaired and routine postoperative measures instituted, (3) In cases, where there is no OAF present, but there is chronic maxillary sinus nonresponsive to other conservative regime, then a surgical drainage or Caldwell-Luc surgery should be considered.

Oroantral Communication and fistula

OAC is an unnatural communication between the oral cavity and maxillary sinus whereas, OAF is an epithelialized, pathological,unnatural communication between these two cavities(Malik, 2012).

which can occur following the extraction of a tooth, this communication happens as the roots of the posterior teeth are very close to the floor of the maxillary sinus coupled with the bone in this area being thin. In some patients the roots of the posterior teeth can actually be in the maxillary sinus. If an infection, cysts or other pathology is present it will weaken the bone around the roots of the tooth being extracted, making a communication more likely to occur(Rogers & Pickett, 2017).

Risk factor

The extraction of posterior teeth associated with periapical disease for example

acute periapical abscess, chronic granuloma, or periapical sclerosis is at risk of causing oroantral perforation, Forceps extraction of solitary isolated posterior teeth in an edentulous arch is also at risk of causing disruption of floor of sinus, surgical removal of impacted teeth(e.g. maxillary third molar, supernumerary), submerged, geminated, hypercementosed and divergent root teeth also carries risk of inadvertent breach in continuity of antrum(Malik, 2012).

Etiology

OAC/OAF can result from several causes: (Malik, 2012; Borle, 2014)

• Traumatic extraction of maxillary molars or premolars teeth.

• Accidental dislodgement of a root in the maxillary sinus.

• Malignant tumors of sinus or oral cavity.

• Following the resection of the cysts and tumors of the maxilla.

• Chronic infection of maxillary sinus, such as osteomyelitis.

• Destruction of the portion of the floor of the sinus by periapical lesions.

• Perforation of the floor of the sinus and sinus membrane with injudicious use of Instruments.

• Extensive trauma to face.

• Teratomatous destruction of maxilla, such as gumma involving palate

• Infected maxillary implant dentures.

Signs and symptoms

The symptoms of an OAC/OAF can vary from purulent discharge through the fistula to the patient's subjective feeling entry of oral liquids into the nostril on the same side of the maxillary sinus(Borgonovo et al, 2012).

When the patient's nostrils are compressed and he is asked to blow through the nose it produces frothing or bubbling in the blood present in the socket of the extracted tooth, also abnormal leakage of the air in the oral cavity due to escape of air into the oral cavity through OAC/OAF. 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).

Diagnosis

The diagnosis of an oroantral communication can be made in several ways: The first is to examine the tooth once it is removed. If a section of bone is adhered to the root ends of the tooth, the surgeon should assume that a communication

between the sinus and mouth exists. If little or no bone adheres to the molars, a communication may exist anyway. Some advocate using the nose-blowing test to confirm the presence of a communication, it involves pinching the nostrils together to occlude the patient's nose and asking the patient to blow gently through the nose while the surgeon observes the area of the tooth extraction, If communication exists, there will be passage of air through the tooth socket and bubbling of blood in the socket area. If there is no communication, forceful blowing like this poses the risk of creating a communication(Hupp, 2014). Periapical film or panoramic radiography can aid in diagnosis through give idea about the bony defect size of the OAC and OAF, also they reveal bone discontinuity of the floor of the maxillary sinus, disruption border of sinus and presence of foreign body within the antrum(Koenig & grace, 2017).

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, OAC can cause sinus contamination leading to infection, impeded healing, and chronic sinusitis (Borgonovo et al, 2012). After the diagnosis of oroantral communication has been established or a strong suspicion exists, the surgeon should guess the approximate size of the communication because the treatment depends on the size of the opening.(Hupp, 2014).

However, If the communication is small (≤2 mm in diameter), no additional surgical treatment is necessary, If the opening between the mouth and sinus is of moderate size (2 to 6 mm), additional measures should be taken . If the sinus

opening is large (≥7 mm), the surgeon should consider having the sinus communication repaired with a flap procedure. The OAC must be closed within 24–48 has its persistence increase the possibility of maxillary sinusitis (Hupp, 2014).

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(Rey-Santamaria et al, 2006).

Cases where OAC is recent and formation of fistula is not established. Ideal treatment is immediate surgery repair to achieve primary closure, and simultaneous antibiotic prophylaxis to prevent sinus infection. The immediate primary closure is done by a simple reduction of the buccal and palatal socket walls, to allow adaptation of buccal and palatal soft tissue flaps to close over the defect(Malik, 2012).

Postoperative procedures the patient is instructed to use nasal precautions for 10 to 14 days, these include opening the mouth while sneezing, not sucking on a straw or cigarettes, and avoiding nose blowing and any other situation that may produce pressure changes between the nasal passages and oral cavity(Tucker & Bauer, 2019). The patient is placed on an antibiotic, analgesics (e.g., non-steroidal anti-inflammatory drugs (NSAIDS) and nasal decongestants are recommended postoperatively(Khandelwal & Hajira, 2017).

Buccal flaps

It was originally described by Von Rehrmann in 1936, It is the most satisfactory

method of closing oroantral fistula. This is according to the principle of periosteal release described by Berger in 1939(Malik, 2012).

This flap with its simplicity, reliability, and versatility is the most commonl surgical treatment used method for OAC/OAF closure(Falci & Santos, 2015).

The disadvantage of this operation is that it may reduce the depth of the buccal sulcus opposite the socket concerned, but this is usually only temporary(Moore, 2011). Other disadvantages include postoperative pain and swelling as a result of the reflection of a mucoperiosteal flap(Parvini et al, 2018).

In this technique (Fig. 6) a broad-based trapezoid mucoperiosteal flap is created after excising the epithelialized margins and giving two vertical release incisions to develop a flap with adequate dimensions to be sutured over the defect. Its broad base enables a better blood supply to the flap. Flap coverage is improved by horizontal periosteal incisions(Falci & Santos, 2015).

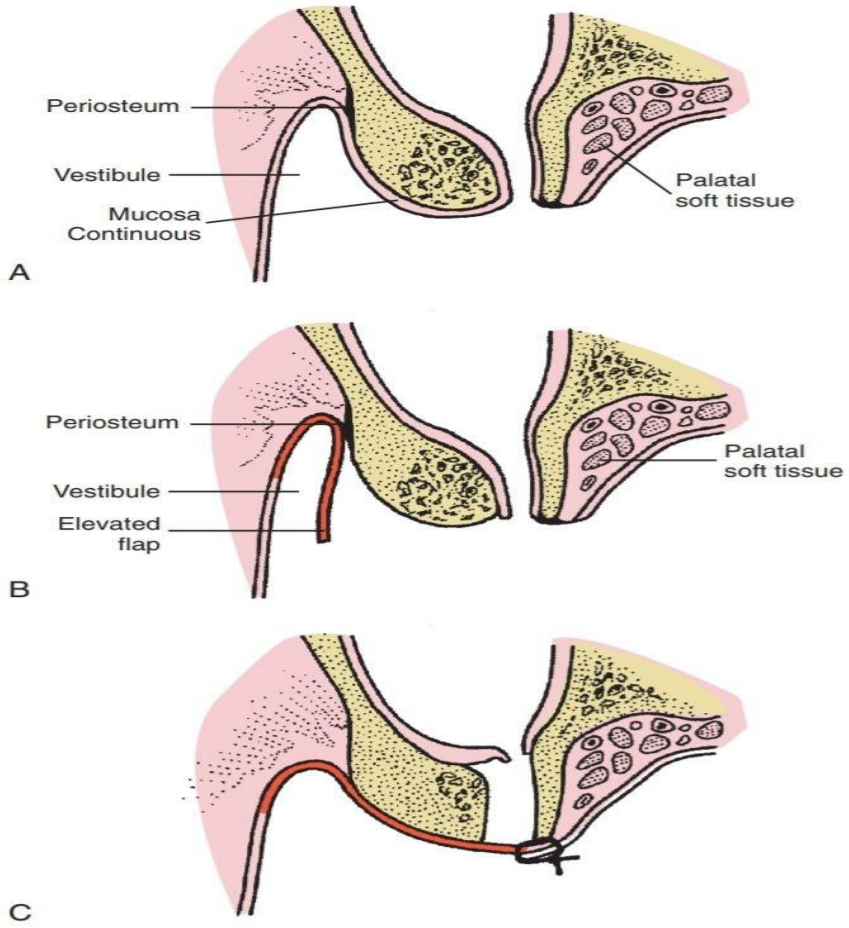


FIGURE (6): Buccal flap closure of oroantral fistula(Tucker & Bauer, 2019).

Modified Rehrmann's Buccal Advancement Flap (Fig. 7):

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).

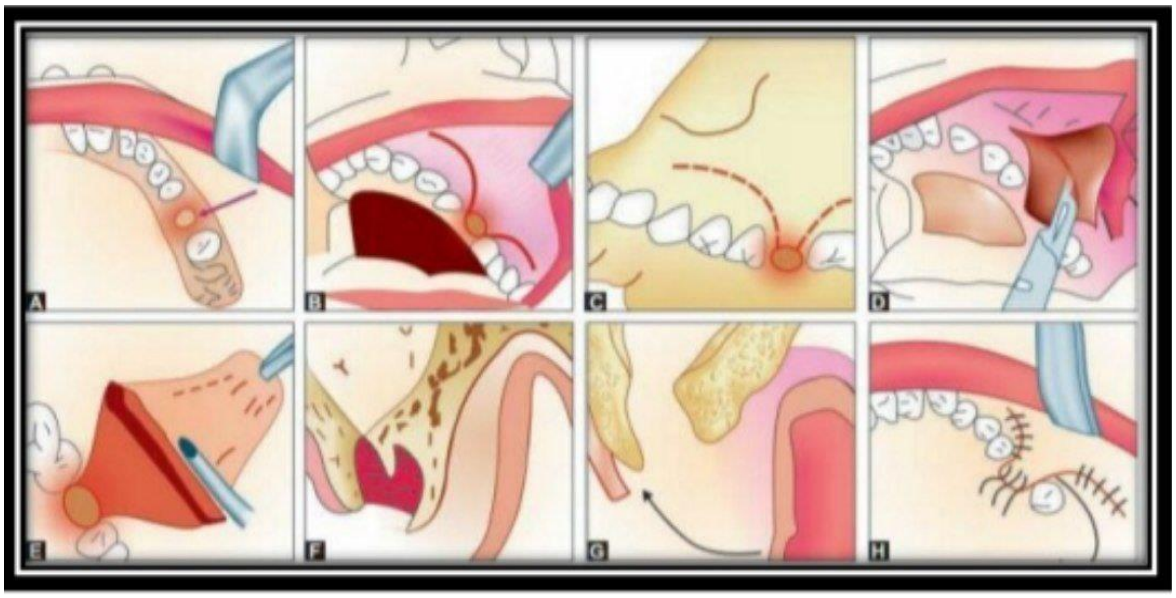


FIGURE (7): Diagram of oroantral fistula closure by buccal advancement flap,Modified Rehrmann's procedure (Malik, 2012)

Palatal flaps

The first description of a technique for closing oroantral fistula using a full-thickness palatal flap based on greater palatine artery dates back to Ashley1939(Malik, 2012).

The technique consists of excising the epithelium from its edges and incising the palatal fibro-mucosa so as to create a flap with a posterior base, supplied by the greater palatine artery. The anterior extension of the flap must be wide enough to exceed the diameter of the bony defect and long enough to allow lateral rotation. Tension-free suturing should be performed (Anavi et al, 2003). Furthermore, they concluded that an appropriate length–width ratio is the most important factor

determining the clinical outcome of palatal flaps(Visscher et al, 2010).
The advantages of using a full-thickness palatal flap are that a large amount of tissue can be elevated with sufficient blood supply from the palatal vessels and that the thickness and keratinized nature of palatal tissue more closely resemble crestal ridge tissue than the thinner, less keratinized tissue in the buccal vestibule ,whereas, The most important disadvantage is the necrosis of the palatal flap ,also large area of exposed bone resulting from elevation of the flap,pain and development of surface irregularities as a result of secondary epithelialization post operatively (Borgonovo et al 2012; Tucker & Bauer,2019).

The palatal straight advancement flap (fig. 8B):

Is of limited use due to the inelastic nature of the palatal tissue, which reduces its lateral mobility. For the same reason, it is suitable for the closure of minor palatal or alveolar defects(Awang, 1988).

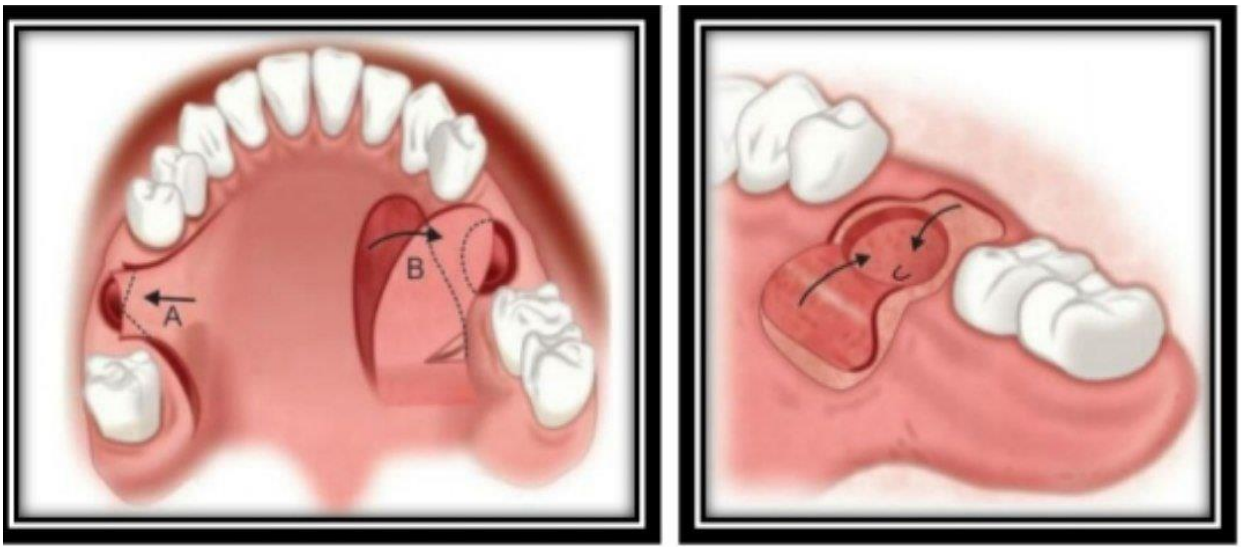
Palatal rotational-advancement flap (fig. 8A):

Provides adequate mobility and tissue bulk to the flap. However, it requires the mobilization of large amount of palatal tissue, and it often kinks following the rotation of the flap, which may predispose to venous congestion, Kruger 1984, suggested a V-shaped excision of the lesser curvature of the flap to minimize folding(Malik, 2012).

The palatal hinged flap (fig. 8C):

Has been used successfully to close small fistula of the hard palate, those less than

2 cm in diameter in a one-stage operation(Hynes, 1957).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 OAC/OAF(Parvini et al, 2018).



FIGURE(8) : Ashley's palatal flap (A)Straight advancement flap Palatal,(B) rotational-advancement flap ,(C) : Palatal hinged flap (Borle, 2014).

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 (fig. 10). All these procedures preserve the buccal ve).stibular height(Borle, 2014).

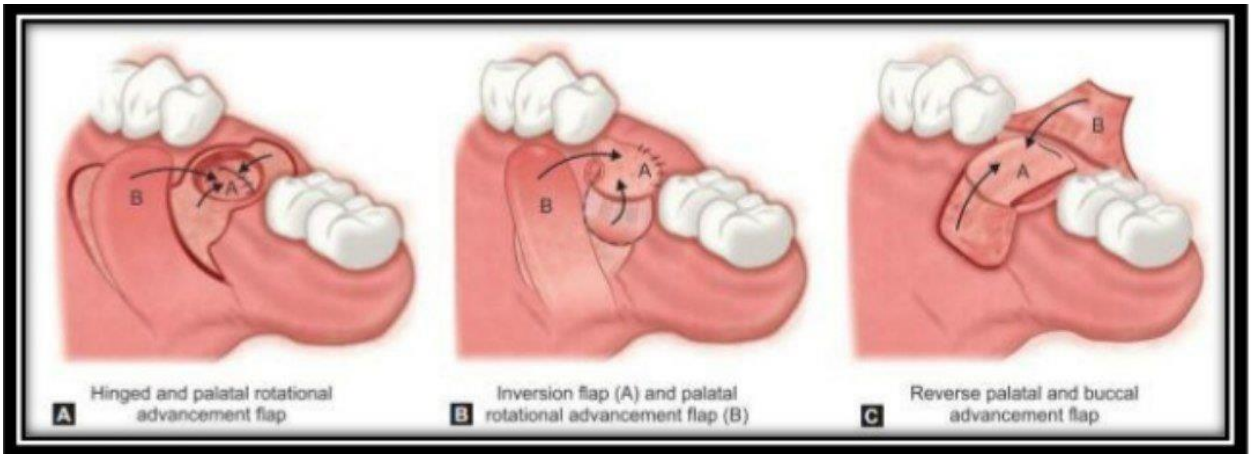


FIGURE (9): Combined Local Flaps(Borle, 2014).

Conclusion

The relationship between the maxillary sinus and maxillary posterior teeth is a critical factor in dental and maxillofacial treatments. Due to the close proximity between the sinus floor and the roots of maxillary premolars and molars, dental procedures such as extractions, root canal treatments, and implant placements can have direct implications on sinus health. Anatomical variations, including the degree of sinus pneumatization and root protrusion into the sinus cavity, increase the risk of complications such as oroantral communication, maxillary sinusitis of odontogenic origin, and challenges in implant placement (Jang et al., 2019).

Advanced imaging modalities, particularly cone-beam computed tomography (CBCT), have significantly improved the understanding and assessment of this anatomical relationship, allowing for better risk evaluation and surgical planning (Maillet et al., 2011). Proper diagnosis and careful treatment planning are essential in minimizing complications and ensuring successful outcomes in dental procedures. When performing extractions or implant surgeries in the posterior maxilla.

Overall, understanding the anatomical and clinical interactions between the maxillary sinus and maxillary posterior teeth is crucial for preventing complications and improving patient care in dentistry. Continued research and technological advancements in imaging and surgical techniques will further enhance the ability to diagnose and treat conditions associated with this relationship effectively.

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