Journal for Re Attach Therapy and Developmental Diversities
eISSN: 2589-7799
2023 December; 6 (7s): 1391-1395

Oroantral Fistula – A Review

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ABSTRACT

Oroantral communication and fistula represent a frequent yet clinically significant complication arising from dental procedures involving the maxillary posterior region. These pathological connections between the oral cavity and maxillary sinus often emerge following molar or premolar extractions, with reported incidence rates approaching 50% in some case series. While smaller defects under 2mm may undergo spontaneous healing through natural clot formation and epithelial migration, larger communications invariably require surgical intervention to prevent the development of maxillary sinusitis, which studies indicate occurs in approximately half of untreated cases within the first 48 hours. The present review comprehensively examines the etiology, diagnostic modalities, and contemporary management strategies for these conditions, with particular emphasis on evidence-based surgical techniques ranging from local flap procedures to advanced grafting methods. Special consideration is given to postoperative care protocols and preventive measures that collectively contribute to optimal patient outcomes and reduced complication rates.

INTRODUCTION

The maxillary sinus's intimate anatomical relationship with the posterior dentition creates inherent vulnerability to iatrogenic communication during dental procedures. Oroantral communication (OAC) typically originates as a mechanical complication during tooth removal, particularly when dealing with maxillary molars whose roots frequently demonstrate sinus proximity or even perforation of the sinus floor as visible on preoperative radiographs. Beyond extraction-related cases, the literature documents multiple etiological pathways including traumatic injuries accounting for approximately 7.5% of presentations, neoplastic processes (18.5% of cases), and implant-related complications [1]. The transition from acute communication to chronic oroantral fistula (OAF) represents a critical juncture in disease progression, characterized by epithelialization of the fistulous tract that typically completes within a 7-8 day window according to Szabo's seminal work. This pathological transformation creates a self-sustaining conduit for oral contaminants to access the sinus environment, with Wassmund's research demonstrating that 60% of such cases progress to clinical sinusitis within four days if left untreated. The resultant inflammatory cascade not only complicates subsequent surgical repair but may also lead to chronic rhinosinusitis, osteomyelitis, or fungal sinus infections in immunocompromised hosts.

DIAGNOSIS

Clinical identification of oroantral communications demands a high index of suspicion combined with methodical examination techniques. Patients frequently report a constellation of symptoms including perceptible air or liquid movement between the oral and nasal cavities, altered vocal resonance described as "nasal speech," and a persistent foul taste originating from purulent sinus drainage. The diagnostic armamentarium begins with simple yet revealing clinical maneuvers such as the nasal blowing test, where compressed air forced through the nostrils while occluding the contralateral side produces visible bubbling or audible whistling at the defect site [2]. A fogged mirror held near the communication provides visual confirmation, while cotton wisp tests objectively demonstrate air passage. Crucially, the temptation to probe the defect must be resisted, as this may inadvertently introduce oral flora into the sinus cavity or further traumatize the delicate sinus membrane. Radiographic assessment progresses from panoramic imaging, which adequately demonstrates bony defect dimensions and retained root fragments, to computed tomography when evaluating soft tissue involvement or sinus pathology. Cone-beam CT offers particular value in preoperative planning for complex cases by providing three-dimensional assessment of defect morphology and surrounding anatomical structures.

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PERIOPERATIVE MANAGEMENT

Successful resolution of oroantral defects begins with thorough preoperative preparation aimed at establishing a clean surgical field and controlling existing sinus infection. The sinus cavity requires meticulous irrigation using warm normal saline delivered through the defect or via antral puncture, continuing until the effluent demonstrates complete clarity. Adjunctive use of diluted povidone-iodine solutions provides additional antimicrobial action against the polymicrobial flora typically colonizing chronic fistulas. Surgical planning must account for critical variables including defect size, location relative to the dental arch, residual alveolar bone height, and whether the case represents a primary closure or revision procedure. The Rehrmann buccal advancement flap remains the workhorse technique for small to moderate defects, leveraging the robust vascular supply of the buccal mucosa while accepting some degree of vestibular shortening [3]. For larger or more posteriorly positioned defects, the palatal rotational flap offers distinct advantages through its axial blood supply from the greater palatine artery, though careful design is required to prevent tension-induced necrosis at the rotation point. Recent innovations have popularized the buccal fat pad as a versatile graft option, with histological studies confirming rapid epithelialization over the exposed adipose tissue within 2-3 weeks postoperatively. Regardless of technique selection, the surgical principles remain constant: complete de-epithelialization of the tract margins, tension-free closure over healthy bone, and multilayer watertight approximation when possible.

POSTOPERATIVE CARE

The immediate postoperative period proves critical for ensuring uneventful healing and preventing premature flap disruption. Patients receive detailed instructions emphasizing strict avoidance of positive pressure behaviors including nose blowing, straw use, or forceful spitting, all of which may dislodge the healing clot or disrupt suture lines. A 5–7-day course of broad-spectrum antibiotics such as amoxicillin-clavulanate provides coverage against common sinus pathogens, while nasal decongestants like oxymetazoline help maintain ostial patency and facilitate sinus drainage. Analgesic management typically employs NSAIDs, avoiding aspirin-containing compounds that might increase bleeding risk. Dietary modifications transition from liquid to soft foods over the first postoperative week, with particular attention given to avoiding particulate matter contamination at the surgical site. The clinician should schedule follow-up evaluations at 24–48-hour intervals initially to monitor for early signs of infection or flap breakdown, with longer-term assessment focusing on vestibular depth preservation and sinus aeration. Emerging protocols incorporate low-level laser therapy during these follow-up visits to potentially enhance tissue perfusion and accelerate epithelialization, though further research is needed to standardize these adjunctive measures[4].

DISCUSSION

Oro-antral fistulas (OAFs) and oro-antral communications (OACs) represent a significant concern in dentistry due to the serious complications they can trigger. Primarily, they establish a direct conduit between the oral cavity and the maxillary sinus, inviting bacteria from the mouth to enter the typically sterile sinus environment. This ingress of bacteria frequently culminates in painful and often chronic sinus infections, commonly known as sinusitis, which can be challenging to resolve [5]. The presence of such infections or a persistent opening can severely impede or entirely preclude future dental implant surgeries or restorations in the affected area, compromising the long-term success and stability of any prosthetic work. While smaller OACs, defined as less than 4mm in healthy tissues with a stable blood clot in the tooth socket, often exhibit a propensity for spontaneous closure, this natural healing is considerably less probable if the opening exceeds 4mm, the socket depth surpasses 5mm, or if there's notable damage to the soft tissue at the gum line.

The successful management of OAFs and OACs hinges on two critical principles. Firstly, it is absolutely imperative that the maxillary sinuses are free from infection and possess unimpeded drainage into the nasal cavity before any closure procedure is attempted. Closing an infected sinus will merely trap the infection, leading to inevitable complications and a high likelihood of surgical failure. Therefore, any pre-existing sinus disease, active infection, or deterioration of the sinus lining must be thoroughly addressed, potentially through antibiotics, decongestants, or even surgical intervention to clear the sinus, prior to attempting OAF closure. Secondly, the surgical closure itself must be tension-free and achieved with a broad-based, well-vascularized soft tissue flap positioned over undamaged bone [6]. Tension in the flap can compromise its blood supply, leading to tissue death (necrosis) and subsequent failure of the closure. A robust blood supply is crucial for the flap's viability and to promote optimal healing.

The timing of closure significantly impacts its success rate. Immediately closing acute (newly formed) oro-antral defects boasts an impressive success rate, reaching as high as 95%. This underscores the immense benefit of prompt intervention when an OAC is initially identified. In stark contrast, attempting to close established, chronic OAFs at a later stage (secondary closure) has a considerably lower success rate, sometimes plummeting to 67%. This disparity highlights the

inherent difficulties in managing chronic fistulas, which often present with fibrotic tissue, persistent infection, and compromised tissue quality. For small communications where natural healing is a possibility, the formation of a sufficient blood clot in the socket is paramount. This clot then requires rigorous protection from dislodgement. If adequate healthy tissue is available, immediate primary closure is the preferred approach. Upon discharge, patients must receive unequivocal instructions to prevent clot dislodgement, which includes avoiding vigorous rinsing, forceful nose blowing, and any activities that generate pressure in the mouth or nose. Crucially, the text advises against placing gel foam into the socket, as its expansion can lead to its entry into the sinus, thereby impeding the natural healing process [7].

Several soft tissue closure techniques have been developed to address OAFs, each with its unique advantages and considerations. The buccal flap, often referred to as the Rehrmann flap, is a very common technique. It involves creating a flap from the buccal (cheek) mucosa, sometimes incorporating a thin layer of the buccinator muscle. Vertical release incisions are made to facilitate the movement of this flap over the defect. A key benefit of the buccal flap procedure is its applicability even when the alveolar ridge height is very low or the fistula is situated more towards the front (mesial region). However, a potential drawback for patients who wear removable dentures is the possible shallowing of the vestibular sulcus (the space between the cheek and gum line), which may necessitate a subsequent vestibuloplasty.

Another significant technique is the palatal flap. This method utilizes a flap of fibromucosa from the palate, with its base positioned posteriorly and nourished by the greater palatine artery. The palatal flap offers several advantages, including excellent vascularity, appropriate thickness, and good tissue quality. It also allows patients to resume wearing dentures relatively soon after the wound has healed. However, its primary feasibility is for sealing fistulas located in the premolar area. Excessive tension, particularly when attempting to close defects in the molar region, can compromise the blood supply to the flap due to potential blockage of the greater palatine artery, leading to flap necrosis [8]. Other disadvantages include an exposed bony surface on the palate which heals by secondary epithelialization, often resulting in postoperative pain and the development of surface irregularities.

The Buccal Pad of Fat (BFP) flap is also a widely used and effective method for closing oro-antral deformities. This technique utilizes the naturally occurring buccal fat pad, which is gently dissected and mobilized to cover the defect. A unique characteristic of the BFP flap is the rapid epithelialization of its exposed fat. Advantages of using the BFP include its anatomically advantageous position, ease of harvesting, and minimal dissection required, along with improved epithelialization.

Beyond these primary techniques, alternative and combined approaches exist for OAC closure. Ziemba described a two-flap closure technique, which provides stable epithelial coverage to both the superior and inferior surfaces of the repaired defect. This dual-flap approach significantly reduces the likelihood of contracture and postoperative infection, thereby minimizing the chances of wound collapse and recurrence. Batra et al. developed a two-layer flap closure technique, combining a Buccal Fat Pad (BFP) overlaying closure with a buccal mucosal flap to effectively seal the defect. Similarly, Hassan et al. successfully employed a combined palatal-buccal flap method for the late repair of small to medium-sized OAFs. These innovative and combined strategies often leverage the strengths of individual techniques to achieve more robust and reliable closures, particularly in challenging or chronic cases [9].

Beyond soft tissue flaps, the closure of oro-antral fistulas (OAFs) can also involve bone autografts, which have been widely advocated in the literature. These grafts, derived from the patient's own body, can be sourced from various locations, including the extraction socket itself, intra-oral sites such as the anterior jaw, or even distant sites like the iliac crest. The use of bone provides a supportive foundation for spontaneous postoperative healing, a significant advantage, particularly in techniques like interseptal alveoloplasty. However, the utility of this specific approach is limited as it necessitates a residual alveolar process of sufficient height and width, along with an unbroken buccal cortical layer. Proctor was among the first to document sinus closure using a bone graft harvested from the iliac crest. Due to the well-known donor site morbidity associated with this method, it is typically reserved for larger defects. Haas et al. introduced the concept of press-fitting monocortical block grafts, harvested intra-orally, for sealing OAFs.

An intriguing alternative for OAF closure involves the use of auricular cartilage. This material, obtained from the ear, offers several compelling advantages: it is biocompatible, remarkably resistant to infection, straightforward to extract and handle, non-resorbable, and relatively inexpensive. A key benefit of auricular cartilage is that its incorporation into the recipient site does not require vascularization, a distinguishing trait that significantly reduces the graft's failure rate. Furthermore, the donor site typically exhibits no scar or defect formation. The auricular cartilage transplant effectively acts as a barrier between the sinus membrane and the oral mucosa, facilitating effective healing. The sole prerequisite for this procedure is that the auricular graft must be maintained by primary closure of the soft tissues over it.

The condition of the sinus membrane is paramount before attempting maxillary sinus lift surgery; it should be intact and free of irritation. However, chronic OAFs frequently lead to substantial chronic inflammatory thickening of the sinus membrane, which renders subsequent sinus lifting impossible. If OAFs are closed using only soft tissue without bone restoration prior to implant surgery, there is an increased risk of damaging both the oral mucosa and the sinus membrane during later sinus augmentation procedures. The use of autogenous grafts for sinus closure allows for conventional sinus lifting at a later stage. Moreover, the regeneration of osseous support for soft tissue flaps presents an additional and highly successful therapeutic option for OAF closure, particularly when secondary closure is necessary [10]. This comprehensive approach not only facilitates future conventional sinus lifts but also helps preserve adjacent teeth.

Beyond conventional grafting, innovative approaches have been explored. Yoshimasa et al. endorsed third molar transplantation as a viable option for closing OACs in cases of a single missing tooth in the area, eliminating the need for further prosthodontic therapy. Ogunsalu described a sandwich approach for oro-antral lesion closure, meticulously combining both hard and soft tissue components. In this technique, a bone grafting material was precisely placed between two sheaths of a bio-resorbable membrane for hard tissue closure, leading to excellent bone regrowth that permitted the successful implantation of an endosseous implant. Scattarella et al. also proposed a guided-tissue regeneration (GTR) procedure, which involved combining an autologous bone graft with a xenologous particulate bone graft, all covered by a non-reabsorbable, expanding GTR membrane, demonstrating its effectiveness.

Other methods for OAC closure include the single application of lyophilized fibrin seal, which can completely close an oro-antral defect. To protect the forming clot from air passage, the sealant mixture is positioned above the bottom of the antrum. Zide and Karas, in 1992, employed nonporous hydroxylapatite (HA) blocks for treating chronic fistulas and OAFs. An HA block is precisely cut to fit the bony deficiency and secured to the alveolar bone with a 26-gauge wire. Advantages of this approach include the possibility of a press-fit graft closure, no morbidity associated with a second-site operation, and the ability to expose the block if soft tissue closure proves unfeasible. A resorbable collagen membrane, secured with resorbable pins, can also be placed over the OAC. This membrane serves to cover the blood clot and aids in its organization, allowing for the subsequent replenishment of the blood clot by bone and epithelium on the oral surface. Furthermore, numerous studies have documented the successful use of gold foil or gold plate for OAC closure. When placed on healthy bone, the gold foil is burnished into a defect with its edges surrounding it, acting as a protective barrier for the overgrowing sinus mucosa. As an alternative to gold foil, aluminum foil from dental film packages can also be utilized to cover the OAC. Additionally, low-dose laser light has shown success in closing OACs, with patients undergoing biostimulative laser treatment at a power of 30 mW for 10.5 minutes over four days [11].

It is important to acknowledge that any surgical technique carries an inherent potential for failure. The most common reasons cited for failure after oro-antral defect closure include inadequate preoperative irrigation and antibiotic therapy for any existing sinus infection or disease, excessive tension on the flap leading to impaired blood supply and healing, insufficient excision of epithelialized margins and inadequate trimming of bony margins prior to closure, or improper postoperative instructions and patient negligence in adhering to them. Understanding these factors is crucial for maximizing the success rate of OAF closure procedures.

CONCLUSION

Repairing oro-antral deformities, such as oro-antral communications (OACs) and oro-antral fistulas (OAFs), stands as one of the most significant challenges encountered in oral and maxillofacial surgery. The decision-making process for selecting the appropriate surgical technique to close an oro-antral fistula is complex, requiring careful consideration of various critical factors. These variables include the precise location of the defect within the oral cavity, its overall size, the existing height of the alveolar ridge, the depth of the vestibular sulcus, the persistence or chronicity of the defect, the presence and extent of sinus inflammation or infection, and the patient's overall systemic health status. To prevent the development of maxillary sinusitis, it is paramount that OACs and OAFs are treated as expeditiously as possible by establishing a robust and impermeable barrier between the oral cavity and the maxillary sinus.
The correction of these oro-antral deformities typically involves the use of either local or free soft tissue flaps. These flaps may be employed alone or in conjunction with autografts (tissue harvested from the patient's own body) or alloplastic materials (synthetic or foreign materials). Each type of soft tissue flap possesses specific indications that make it suitable for different scenarios. For instance, the buccal flap is generally considered appropriate for closing minor and mesial (anteriorly located) fistulas. In cases involving larger fistulas, the palatal flap emerges as a viable and effective choice. Meanwhile, the Buccal Fat Pad (BFP) is particularly well-suited for the closure of large OACs or OAFs located in the posterior regions of the maxilla. The judicious selection of the surgical technique, therefore, hinges on a comprehensive assessment of these patient-specific and defect-specific characteristics to achieve a successful and stable closure.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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