Imaging Science in Dentistry 2021; 51: 307-11
https://doi.org/10.5624/isd.20210035

Oroantral communication, its causes, complications, treatments and radiographic features: A pictorial review

Rama Shahrour[1], Priya Shah[1], Thimanthi Withana[1], Jennifer Jung[1], Ali Z Syed[1,*]

[1]Department of Oral and Maxillofacial Medicine and Diagnostic Sciences, CWRU School of Dental Medicine. Cleveland, OH, USA

ABSTRACT

Purpose: An oroantral communication (OAC) is an abnormal space between the maxillary sinus and oral cavity. The causes, complications, treatment, and radiographic features of OAC in 2-dimensional and 3-dimensional imaging modalities are discussed.

Materials and Methods: This pictorial review presents a broad spectrum of imaging findings of OAC. Representative radiographs depicting OAC were chosen from our database. PubMed was used to conduct a comprehensive literature search of OAC.

Results: Characteristic features of OAC include discontinuity of the maxillary sinus floor, thickening of the maxillary sinus mucosa, or a combination of both. Two-dimensional imaging modalities are the method of choice for identifying discontinuities in the maxillary sinus floor. However, 3-dimensional imaging modalities are also essential for determining the status of soft tissue in the maxillary sinus.

Conclusion: The integration of 2-dimensional and 3-dimensional imaging modalities is crucial for the correct diagnosis and comprehensive treatment of OAC. However, the diagnosis of OAC must be confirmed clinically to prevent unnecessary mental and financial burdens to patients. ***(Imaging Sci Dent 2021; 51: 307-11)***

KEY WORDS: Maxillary Sinus; Oroantral Fistula; Tooth Extraction; Diagnostic imaging; Cone- Beam Computed Tomography

Introduction

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. If left untreated, an OAC can develop into an oroantral fistula (OAF) or chronic sinus disease.[1,2] Currently, the standard preoperative imaging modality is panoramic radiography.[1] However, there is no proven method to predict the possibility of OAC formation.[1] Figure 1 illustrates an OAC at the palatal root of the left maxillary first molar.

Causes of OAC

There are many causes of OAC. The most common cause is the extraction of maxillary posterior teeth.[1] This may be due to the proximity of the roots to the maxillary sinus floor, which is exacerbated by thin sinus floors.[1] Maxillary second molar extractions cause 45% of OACs, third molars cause 30%, first molars cause 27.2%, and first premolars cause 5.3%.[3] Additionally, 2.2% of first molar apices and 2% of second molar apices perforate the maxillary sinus floor.[3] OAC has a slight male predilection with a female-to-male ratio of 1 : 1.52.[4] To avoid trauma or perforation of the maxillary sinus, caution should be taken when removing teeth with bulbous roots or periapical abnormalities.[3] Enucleating tumors and cysts, orthognathic surgery (e.g., LeFort osteotomy), trauma, pathological lesions,[1] and implant surgery[3] can lead to the formation of OACs. Failure of external sinus floor elevation and augmentation can also lead to the formation of an OAC.[3] To avoid the aforementioned complications, the surgical closure of OACs within 48 hours is recommended.[2] If left untreated, OAC can act as an avenue for bacte-

Received February 11, 2021; Revised April 6, 2021; Accepted April 6, 2021
*Correspondence to : Prof. Ali Z Syed
Department of Oral and Maxillofacial Medicine and Diagnostic Sciences, CWRU School of Dental Medicine, 10900 Euclid Avenue, Cleveland, OH 44106, USA
Tel) 1-216-368-6802, E-mail) azs16@case.edu

Imaging Science in Dentistry · pISSN 2233-7822 eISSN 2233-7830

ria into the maxillary sinus, causing infections, sinusitis, or delayed healing.[2]

Treatment of OACs

The treatment of OACs varies depending on the size of the opening access. Communications less than 2 mm in diameter can close spontaneously,[3] and therefore treatment is not necessary. However, if larger than 2 mm, OACs may require surgical interventions.[3] Techniques for surgical closure include but are not limited to gingival suturing, soft tissue grafts and flaps, metal plates, hemostatic gauze, and reimplantation of molars.[5,6] Some common soft tissue grafts include palatal rotational flaps, palatal transposition flaps, buccal advancement flaps, as well as a combination of buccal and palatal flaps.[6] Examples of surgical graft techniques used to treat OACs include xenografts (with flap closure), allogenous grafts, and autogenous grafts from areas such as the chin, retromolar area, and septal cartilage.[6] It has been reported that xenografts have been completed using porcine collagen membrane, bovine bone, and guided tissue regeneration using bovine barrier membranes.[6] Non-surgical interventions for OAC that have been attempted include allogenous materials (without flap closure) such as fibrin glue, synthetic bone graft materials, prolamine occlusion gel, and absorbable polyglactin/polydioxanone implants.[6] Other treatment methods include root analogues, acrylic splints,[6] and tissue biostimulation using power laser light after surgically closing the communication.[7] Pharmacological interventions range from antibiotics to nasal decongestants.[6] Antibiotic therapies such as amoxicillin, clindamycin, and moxifloxacin have been prescribed to individuals experiencing OACs, while nasal decongestants have been used as adjuvants in patients experiencing sinus infection.[6]

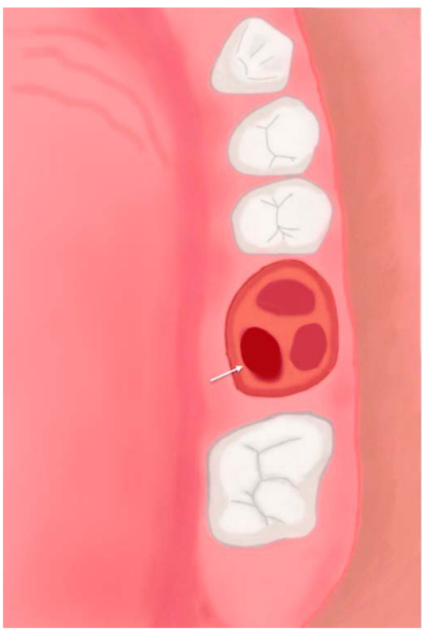

Fig. 1. An illustration shows an oroantral communication through the palatal root of the left maxillary first molar (white arrow).

Two-dimensional versus three-dimensional imaging in diagnosing OAC

Two-dimensional intra-oral and extra-oral radiographs can be used to diagnose OAC, particularly periapical, panoramic, and occipitomental (or Waters') radiographs.[3] Two-dimensional imaging modalities illustrate the discontinuity of the maxillary sinus bony floor, the size of a bony defect, and the disruption of the sinus border. Periapical radiographs can be particularly useful for the identification of foreign bodies dislodged into the maxillary sinus.[3] Panoramic and occipitomental radiographs aid in the visualization of the maxillary sinus and the oroan-

Fig. 2. Panoramic radiograph of a 73-year-old woman. An oroantral communication can be noted in the upper right quadrant in the right maxillary first molar extraction site (white arrow). Note the discontinuity of the maxillary sinus floor.

tral communication path.[3] A limitation of 2-dimensional imaging, however, is the superimposition of anatomical structures.[3,8] Figure 2 is a panoramic radiograph of a 73-year-old man who came in for a routine dental check-up. After the clinical exam was performed, a panoramic image was obtained. The panoramic radiograph shows an OAC in the upper right quadrant at the first molar's extraction site. The soft tissue thickening noted in the maxillary sinus is suggestive of sinusitis. The loss of cortical plate and the consequent mucosal thickening are a sign of oroantral communication. Additionally, a periapical radiograph of the upper molar view (Fig. 3) confirms the aforementioned radiographic findings. A clinical correlation confirmed the diagnosis.

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[3] and to identify sinus pathology (i.e., chronic sinusitis).[9] They are useful in determining sinus abnormalities and the thickening of the Schneiderian mucosal membrane in the maxillary sinus.[9] CT and CBCT are considered adjunct tools in OAC diagnosis.[3] 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.[3] Three-dimensional imaging modalities identify sinus pathologies more accurately and precisely than is the case with 2-dimensional radiographs.[9] Figure 4 is a multipla-

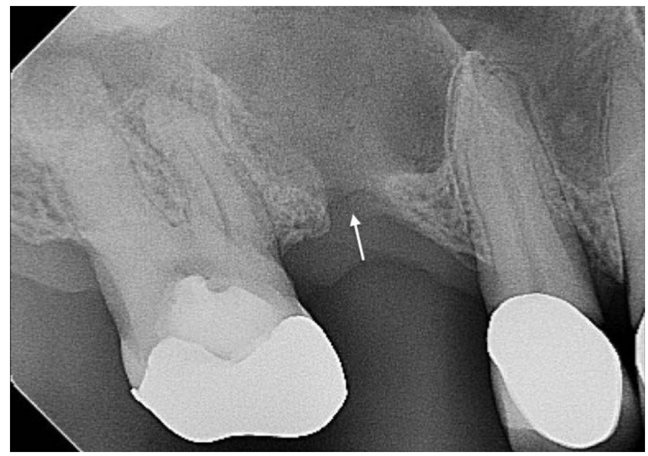

Fig. 3. Periapical radiograph of a 73-year-old man. Note the loss of cortical plate in the extraction site of the right maxillary first molar (white arrow).

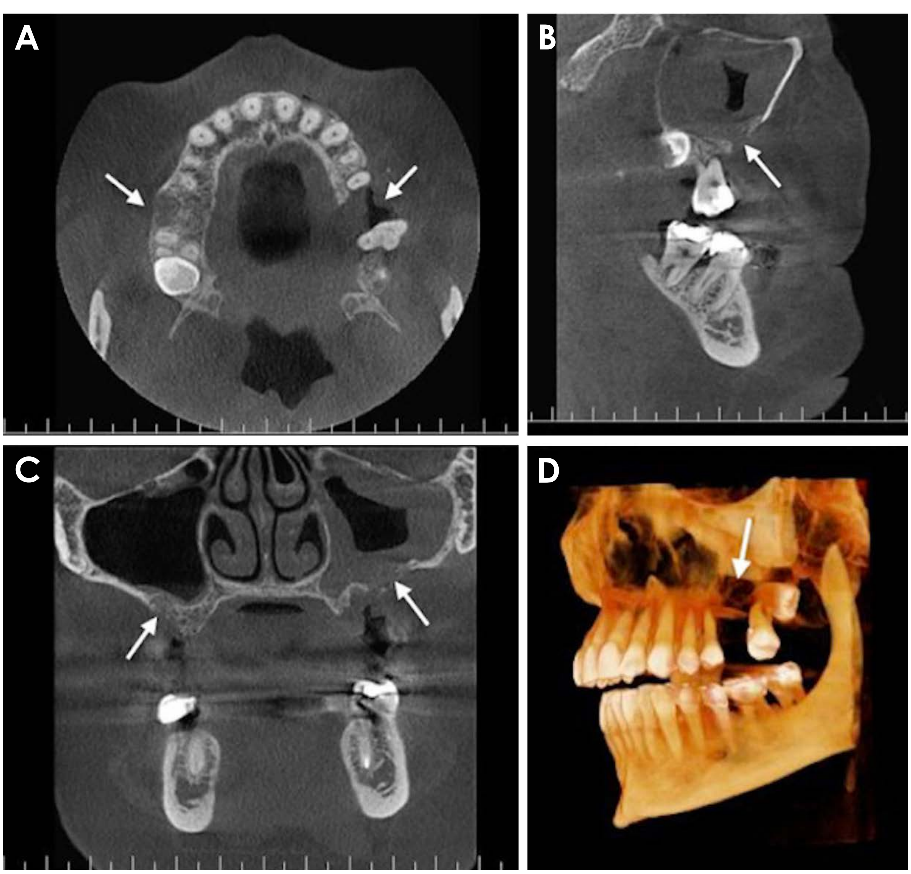

Fig. 4. Multiplanar reformatted cone-beam computed tomographic images of a 63-year-old woman. A. An axial image shows loss of the buccal cortical plate in the right maxillary first molar extraction site (white arrow) and loss of both buccal and lingual cortical plates in the left maxillary first molar 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 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).

Fig. 5. A. An axial image shows a breach in the posterior wall of the left maxillary sinus and polypoidal mucosal thickening in the right maxillary sinus (white arrow). B. A coronal image shows polypoidal mucosal thickening in the right maxillary sinus (white arrow).

nar reformatted image of a 63-year-old woman. The axial image shows the loss of buccal cortical plate at the right maxillary first molar extraction site and the loss of both the buccal and lingual cortical plates in the left maxillary first extraction site molar. The sagittal image shows the loss of the cortical plate in the left maxillary sinus. The coronal image shows the extraction sockets. On the right side, one can note the loss of both the buccal cortical plate and floor of the maxillary sinus and the presence of mild mucosal thickening at the floor of the sinus. On the left side, one can see the loss of the buccal and lingual cortical plates and the circumferential soft tissue thickening of the maxillary sinus. Additionally, findings such as calcified material (antrolith) can be noted in the left maxillary sinus. The volume-rendered image shows the loss of the cortical plate at the left maxillary first molar's extraction site.

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 (Fig. 5) 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.

Fig. 6. Volumetric scan superimposed on a volume-rendered scan of a 56-year-old man. Note the breach of the posterior wall of the left maxillary sinus and the consequent narrowing of the sinus (white arrow).

Based on the various utilities of 2-dimensional and 3-dimensional radiographs, it can be concluded that these imaging modalities should be used in conjunction to diagnose and treat OAC and monitor potential OAC-associated soft tissue complications in the maxillary sinus. An appropriate diagnosis will ultimately prevent unnecessary mental and financial burdens to patients.

Conflicts of Interest: None

References

1. Dym H, Wolf JC. Oroantral communication. Oral Maxillofac Surg Clin North Am 2012; 24: 239-47.
2. Demetoglu U, Ocak H, Bilge S. Closure of oroantral communication with plasma-rich fibrin membrane. J Craniofac Surg 2018; 29: e367-70.
3. Parvini P, Obreja K, Begic A, Schwarz F, Becker J, Sader R, et al. Decision-making in closure of oroantral communication and fistula. Int J Implant Dent 2019; 5: 13.
4. Abuabara A, Cortez AL, Passeri LA, de Moraes M, Moreira RW. Evaluation of different treatments for oroantral/oronasal communications: experience of 112 cases. Int J Oral Maxillofac Surg 2006; 35: 155-8.
5. Alonso-González R, Peñarrocha-Diago M, Peñarrocha-Oltra D, Aloy-Prósper A, Camacho-Alonso F, Peñarrocha-Diago M. Closure of oroantral communications with Bichat's buccal fat pad. Level of patient satisfaction. J Clin Exp Dent 2015; 7: e28-33.
6. Kiran Kumar Krishanappa S, Eachempati P, Kumbargere Nagraj S, Shetty NY, Moe S, Aggarwal H, et al. Interventions for treating oro-antral communications and fistulae due to dental procedures. Cochrane Database Syst Rev 2018; 8: CD011784.
7. Jovanović G, Burić N, Tijanic M. Stimulation of mucoperiostal slice epithelization by small power laser after the primary plastic of oroantral communication. Med Pregl 2010; 63: 188-93.
8. Lewusz-Butkiewicz K, Kaczor K, Nowicka A. Risk factors in oroantral communication while extracting the upper third molar: systematic review. Dent Med Probl 2018; 55: 69-74.
9. Nedir R, Nurdin N, Paris M, El Hage M, Abi Najm S, Bischof M. Unusual etiology and diagnosis of oroantral communication due to late implant failure. Case Rep Dent 2017; 2017: 2595036.