ORIGINAL ARTICLE

FREQUENCY AND FACTORS RESPONSIBLE FOR THE FORMATION OF OROANTRAL COMMUNICATION DURING EXTRACTION OF THE MAXILLARY POSTERIOR TEETH

[1]MUHAMMAD ASIF KHAN
[2]MUHAMMAD ADNAN
[3]FAISAL MANSOR

ABSTRACT

The objective of this study was to determine the frequency of oroantral communication (OAC) during extraction of the maxillary posterior teeth and to find out the risk factors responsible for this iatrogenic abnormal communication. The tract epithelizes with time and become a fistula then (oroantral fistula, a non self healing condition with disastrous complications.

Two hundred patients requiring maxillary posterior teeth extractions and having age range from 20 to 60 years were included in this study. Patients having any pathology in maxillary sinus or requiring prophylactic extraction before radiotherapy were excluded from the study. Name, age, gender, occupation, quadrant in which extraction was done, extracting tooth and technique of extraction (open or closed) were recorded. Data were analyzed using Statistical Package for Social Sciences (SPSS) version 20.0. Descriptive statistics were calculated. Chi- square test was applied to see the effect of risk factors on oroantral communication.

In general females were more in number than males in this study. The mean age was 33.7±8.96 years. The mean sinus proximity to the extracting tooth was 1.46±2.03mm. In 18(9%) of patients sinus perforation occurred. The most common tooth involved in sinus perforation was maxillary 1st permanent molar(n=16, 8%) followed by maxillary 2nd permanent molar (n=2, 1%) (p value=0.012). The effect of extraction technique (open or closed) was not statistically significant (p value=0.065). The effect of root morphology and age on formation of oroantral communication was statistically significant (P<0.05). More males (n=12) than females (n=6) were affected by oroantral communication (OAC) (p value=0.031).

Increase in age, male gender, abnormal root morphology (increased length, excessive bulbosity or divergent roots), sinus proximity to root apices and upper first molar are the responsible factors for OAC formation.

Key Words: *Oroantral communication, extraction, upper first permanent molar, sinus perforation.*

INTRODUCTION

The maxillary sinus varies in its extension. It is essential to understand the anatomic relationship between the maxillary sinus floor and the root of the maxillary molar for planning preoperative treatments for maxillary posterior teeth.[1] The close relationship of the maxillary sinus and the roots of the maxillary molars can lead to accidental oroantral communication.[2] The topographical relationship of the roots of the posterior maxillary teeth and the maxillary sinus floor is an important determinant in the prognosis of orthodontic tooth movement.[3] Sinusitis can result from the spread of a periapical or periodontal infection to the sinus or iatrogenic perforation of the sinus floor.[4]

Detection of root fenestration or bony destruction of the buccal side using conventional X -ray radiography is challenging. Although root fenestration or bony destruction has been studied using dry human skulls in the past[5,6], this method has limitations such as the limited number of skull samples available for study and low reliability and accuracy of the findings because of the suboptimal storage conditions of skulls.[7] Cone-beam computed tomography (CBCT) is useful for the evaluation of tooth morphology and relationship of teeth with adjacent anatomical structures. CBCT is also

[1] Muhammad Asif Khan, BDS, FCPS, Demonstrator, Oral and Maxillofacial Surgery, Khyber College of Dentistry, Peshawar Email: drasifk@hotmail.com Cell: 0321-9093036 **Correspondence:** House-164, Street-3, Sector J-4, Phase 2, Hayatabad, Peshawar Cell: 0321-9093036
[2] Muhammad Adnan, BDS, Demonstrator, Oral and Maxillofacial Surgery
[3] Faisal Mansor, BDS

Received for Publication: August 18, 2017
Revised: September 20, 2017
Approved: September 21, 2017

a valuable technique for the evaluation of periapical lesions related with endodontic pathosis and it also aids surgical planning and assessment of treatment outcomes because of its outstanding resolution and three- dimensional (3D) volumetric data output.[8]

Oro-maxillary sinus perforation occurs occasionally at the extraction of a maxillary tooth, and it may be a cause of maxillary sinusitis or antro-oral fistula.[9] Removal of wisdom teeth in maxilla is one the reason for oroantral communication. Operations to remove wisdom teeth are done for therapeutic and prophylactic reasons but are still controversial.[10-12]

Hirata et al[9] investigated that which was the most frequent site of perforation, and to understand the clinical course of patients after perforation. They reported the perforation rate was significantly higher in males. Perforation occurred most often with extraction of an upper first molar, and in the third decade of life. The perforation rate gradually decreased with higher age. Ok et al[13] conducted study on Turkish population on the relationship between the maxillary posterior teeth and the sinus floor using CBCT. They reported that the maxillary first premolars have no relationship with the maxillary sinus floor, but the maxillary second molars are closer to the sinus floor. Also the second decade and males were most susceptible to undesirable results.

To our knowledge no local study had been conducted on this subject. Due to genetic, ethnic and environmental variation in bone and dentition the incidence and risks factors for oroantral communication may be different. So the objective of this study was to determine the frequency and to know the responsible factors for this iatrogenic communication during extraction of the maxillary posterior teeth. This in turn will help oral surgeons to modify treatment options in patients with these risk factors and to rationalize decision making in managing this accidental occurrence to avoid future oroantral fistula and its complications.

METHODOLOGY

This cross sectional descriptive study was conducted at the department of Oral and Maxillofacial Surgery, Khyber College of Dentistry, Peshawar. A total of 200 patients were included in this study. Patients referred from out patients department fulfilling the inclusion criteria were invited to participate in the study. The purpose, procedure, risks and benefits were explained to the patients and informed consent was taken regarding their willingness and participation in the study.

A detailed history and clinical examination was done for each patient. Those requiring extraction of maxillary posterior teeth for periodontal, carious lesions or orthodontics reasons, and having age range from 20 to 60 were included. Patients having any pathology in maxillary sinus like tumors or maxillofacial trauma or requiring prophylactic extraction before radiotherapy were excluded from the study. Any medical condition affecting bone physiology like osteoporosis and diabetes were also excluded.

Name, age, gender, occupation, quadrant in which extraction was done, extracting tooth and technique of extraction (open or closed) was recorded. Orthopantomogram (OPG) and periapical radiographs were used to assess the root morphology, density of the surrounding bone, pre-extraction condition of maxillary sinus and frequency of oroantral communication was recorded. Sinus proximity was measured in millimeter from radiograph in those cases in which sinus was above root apex of the tooth to be extracted. Those cases were considered as high risk where maxillary sinus lining was overlaping the roots of the posterior teeth (buccal fenestration). The bone surrounding the tooth was categorized as dense, porous and normal from radiograph on the basis of clinical experience. The presence of oroantral communication was confirmed clinically by nose blowing test and also radiographically.

Data were analyzed using Statistical Package for Social Sciences (SPSS) version 20.0. Mean and standard deviation was calculated for age of the participants. Frequencies and percentages were calculated for categorical variables i.e. gender, occupation, quadrant of extraction, technique of extraction, root morphology, thickness/density of surrounding bone, sinus proximity, and pre-extraction condition of maxillary sinus. Chi-square test was applied to see the effect of responsible factors (gender, occupation, site, technique of extraction, root morphology, thickness/density of surrounding bone, sinus proximity, and condition of maxillary sinus) on oroantral communication. P-value of less than 0.05 was considered significant.

RESULTS

Two hundred patients participated in this study in which the females (n=86, 43%) were more than males (n=114, 57%). The age ranged from 21 to 57 years

TABLE 1: ROOT MORPHOLOGY OF EXTRACTED TEETH

Root morphology	Frequency	Percent	Cumulative Percent
Divergent	20	10.0	10.0
Normal	120	60.0	70.0
Curved	26	13.0	83.0
Fused	18	9.0	92.0
Resorbed	6	3.0	95.0
Long cylindrical root	10	5.0	100.0
Total	200	100.0	

TABLE 2: EFFECT OF EXTRACTED TOOTH/TEETH ON THE FORMATION OF OROANTRAL COMMUNICATION (N=18)

Tooth extracted	Oroantral communication				Chi-square	Df	Sig.
	Yes		No				
	n	%	n	%			
1st premolar	0	0.0	14	7.0	10.993	3	0.012
2nd premolar	0	0.0	42	21.0			
1st molar	16	8.0	90	45.0			
2nd molar	2	1.0	36	18.0			

TABLE 3: EFFECT OF ROOT MORPHOLOGY OF THE EXTRACTED TOOTH/TEETH ON THE FORMATION OF OROANTRAL COMMUNICATION (N=18)

Root morphology of extracted tooth	Oroantral communication	
	N	%
Divergent	8	44.4
Normal	4	22.2
Curved	4	22.2
Fused	0	0.0
Resorbed	0	0.0
Long cylindrical root	2	11.2

*X^2=33.318, df=5, p-value=0.000

TABLE 4: EFFECT OF AGE ON THE FORMATION OF OROANTRAL COMMUNICATION (N=18)

Age Group (year)	Oroantral communication	
	N	%
21-30	14	22.3
31-40	0	0.0
41-50	4	77.7
51-60	0	0.0

*X^2=19.63, df=3, p-value=0.000

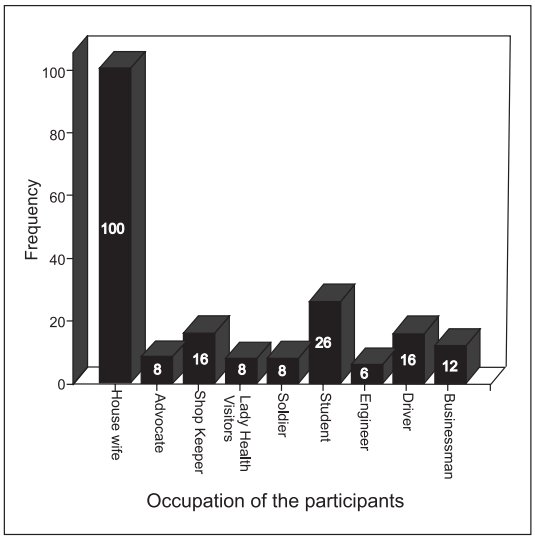

Fig 1: Distribution of the occupation of the participants

and mean age was 33.7±8.96 years. The mean sinus proximity to the extracting tooth was 1.46±2.03mm and had a range from -2 to 5 mm. The most common occupation among the participants was house wife (50%) followed by student (13%) and shopkeeper (8%) respectively. The details are shown in Fig 1. The most common abnormal morphology of the root was curved (13%) followed by divergent roots (10%). The details are depicted in Table 1.

The most common extracting tooth was upper 1st permanent molar (n=106, 53%) followed by 2nd permanent premolar (n=42,21%), 2nd molar (n=38,19%) and 1st premolar (n=14,7%) respectively. In 14% of cases the surrounding bone of the extracted teeth was more porous (spongy) while in 9% cases it was thick and dense (sclerosed). The nature of surrounding bone was assessed on the basis of clinical experience. Rest of the cases had normal bone density (77%). Of all, 15% cases had roots within the maxillary sinus. Only 4% cases have periapical infection in the extracting tooth/teeth. In 62(31%) cases extraction was done by open while in 138(69%) cases by closed technique.

In 18(9%) cases oroantral communication was formed during extraction. The most common tooth involved in oroantral communication was maxillary 1st permanent molar (n=16, 8%). In only two cases (1%) in which oroantral communication was formed the maxillary 2nd permanent molar was involved. The difference was statistically significant (p value=0.012) (Table 2). The effect of extraction technique (open or closed) was not statistically significant (p value=0.065).

The common root morphology of oroantral communication cases was divergent (44.4%) followed by curved (22.2%) and long cylindrical (11.2%) respectively. The effect of root morphology on formation of oroantral communication was statistically significant (p value=0.000) (Table 3). More males (n=12) than females (n=6) were affected by oroantral communication and the difference was statistically significant (p value=0.031).

Fifth decade was the most common age of oroantral communication formation (77.7%) followed by third decade (22.3%). With advancing age, the incidence of oroantral communication was more. The effect of age on oroantral communication formation was also statistically significant (p value=0.000) (Table 4).

DISCUSSION

Oro-antral communications and fistulas (OAC/OAF) are complications frequently encountered by oral and maxillofacial surgeons. Oro-antral communication is an unnatural communication between the oral cavity and the maxillary sinus. These complications occur most commonly during extraction of upper molar and premolar teeth.[14] The major reason is the anatomic proximity or projection of the roots within the maxillary sinus. Other causes of OAC/OAF include tuberosity fracture, dentoalveolar/periapical infections of molars, implant dislodgement into maxillary sinus, trauma (7.5%), presence of maxillary cysts or tumors (18.5%), osteoradionecrosis, flap necrosis, dehiscence following implant failure and sometimes as a complication of the Caldwell-Luc procedure.[15]

In our study the occurrence of sinus perforation was 9% which shows the importance of examining the extraction socket. Rothamel et al[10] in a prospective multicentre study reported 13% incidence of sinus perforation. The incidence by Rothamel et al[10] is high than our study. It may due to the fact that in our study we included all posterior teeth (premolars and molars) while in Rothamel et al[10] study they includes only third molars.

The current results are comparable to the retrospective findings of Wachter and Stoll[16] though in some retrospective studies a much lower incidence was found. This contradiction may be explained by the assumption that in daily clinical work the perforation of the maxillary sinus after extraction of a tooth is regarded as clinically minor, not tested, or not appropriately documented. In a retrospective evaluation, this may lead to a low-rated incidence, and emphasises the advantage of a prospective approach and the need for multicentre, prospective studies.

However, Punwutikorn et al[17] reported a much lower rate oroantral communication(0.31%) during extraction of upper posterior teeth. This may due to the reasons in our department most of the extractions are performed by the house surgeons which are less experienced. So the incidence of oroantral communication(OAC) is much higher than by Punwutikorn et al.[17]

In current study, in 62 (31%) cases extraction was done by open while in 138(69%) cases by closed technique. The incidence of OAC was more in closed technique (n=16) than open technique (n=2). The effect of extraction technique (open or closed) was not statistically significant (p value=0.065). However, the p-value is closure to significant level (0.05). In open technique the extraction procedure is more predictable and less force is applied, so the incidence of OAC was less.[18]

Four upper last maxillary teeth are the main cause of OAC but the tooth most often related varies depending on sample consulted.[19,20] Upper first molar was the most important offending tooth in the current study. Similar results are reported by Hernando et al[21] in a retrospective analysis of oroantral communication on Spain population. They reported that the most commonly tooth in OAC was the upper first molar.[21]

The current study showed that the divergent and curved root was involved in the formation of oroantral communication. During extraction of teeth with such abnormal root morphology can lead to fracture of bone and hence formation of OAC.[6]

The result of this study shows that OAC was predominantly common in males than females ($P<0.05$). In a study performed by Larbi MS, 70% male who suffered from oroantral communication.[22] The study of Hirata and his coworkers show that the rate of oroantral fistula is significantly higher in males with a male to female ratio of 1.7:1.6 The study of Delgado shows higher ratio in males.[9]

Our results showed that third decade was the most common age of oroantral communication formation (77.7%) followed by fifth decade (22.2%). With increasing age, the incidence of OAC was more. The effect of age on oroantral communication formation was statistically significant (p value=0.000). The maxillary sinus reaches its greatest size during the third decade of life consequently, the incidence of OAC should be higher after that age.[23] Similar results are reported by Hernando et al.[21]

CONCLUSION

Oroantral communication occurs in much higher patients than reported in previous studies. The responsible factors for oroantral communication were; advanced age, male gender, abnormal root morphology, sinus proximity and upper first molar.

REFERENCES

1 Kilic C, Kamburoglu K, Yuksel SP, Ozen T. An assessment of the relationship between the maxillary sinus floor and the maxillary posterior teeth root tips using dental cone-beam computerized tomography. Eur J Dent 2010;4(4):462.

2 Hauman C, Chandler N, Tong D. Endodontic implications of the maxillary sinus: a review. Int Endod J 2002;35(2):127-41.

3 Fuhrmann R, Bücker A, Diedrich P. Radiological assessment of artificial bone defects in the floor of the maxillary sinus. Dentomaxillofac Radiol 1997;26(2):112-16.

4 Jung Y-H, Cho B-H. Assessment of the relationship between the maxillary molars and adjacent structures using cone beam computed tomography. Imag Scie Dent 2012;42(4):219-24.

5 Nimigean VR, Nimigean V, Bencze MA, Dimcevici-Poesina N, Cergan R, Moraru S. Alveolar bone dehiscences and fenestrations: an anatomical study and review. Rom J Morphol Embryol 2009;50(3):391-97.

6 Jang J, Kwak S, Ha J, Kim H. Anatomical Relationship of Maxillary Posterior Teeth with the Sinus Floor and Buccal Cortex. J Oral Rehabilitation 2017;1:1-6.

7 Pan H, Yang H, Zhang R, Yang Y, Wang H, Hu T, et al. Use of cone-beam computed tomography to evaluate the prevalence of root fenestration in a Chinese subpopulation. Int Endod J 2014;47(1):10-19.

8 Leung CC, Palomo L, Griffith R, Hans MG. Accuracy and reliability of cone-beam computed tomography for measuring alveolar bone height and detecting bony dehiscences and fenestrations. Am J Orthod Dentofacial Orthop 2013;137(4):S109-S19.

9 Hirata Y, Kino K, Nagaoka S, Miyamoto R, Yoshimasu H, Amagasa T. A clinical investigation of oro-maxillary sinus-perforation due to tooth extraction. J Stomatol Soci 2001;68(3):249-53.

10 Rothamel D, Wahl G, d'Hoedt B, Nentwig G-H, Schwarz F, Becker J. Incidence and predictive factors for perforation of the maxillary antrum in operations to remove upper wisdom teeth: Prospective multicentre study. Br J Oral Maxillofac Surg 2007;45(5):387-91.

11 Berge TI. Incidence of infections requiring hospitalization associated with partially erupted third molars. Acta odontol Scand 1996;54(5):309-13.

12 Kunkel M, Morbach T, Wagner W. Weisheitszähne—Stationär behandlungsbedürftige Komplikationen. Mund-, Kiefer-und Gesichtschirurgie 2004;8(6):344-49.

13 Ok E, Güngör E, Çolak M, Altunsoy M, Nur BG, Ağlarci OS. Evaluation of the relationship between the maxillary posterior teeth and the sinus floor using cone-beam computed tomography. Surg Radiol Anatom 2014;36(9):907-14.

14 Hassan O, Shoukry T, Raouf AA, Wahba H. Combined palatal and buccal flaps in oroantral fistula repair. Egypt J Ear Nose-Throat Allied Sci 2012;13(2):77-81.

15 Khandelwal P, Hajira N. Management of Oro-antral Communication and Fistula: Various Surgical Options. World J Plast Surg 2017;6(1):3.

16 Wachter R, Stoll P. Komplikationen nach operativer Weisheitszahnentfernung im Oberkiefer. Eine klinische und rontgenologische Studie an 1013 Patienten mit statistischer Auswertung. Fortschritte der Kiefer und Gesichtschirurgie 1995;40:128-33.

17 Punwutikorn J, Waikakul A, Pairuchvej V. Clinically significant oroantral communications—a study of incidence and site. Int J Oral Maxillofac Surg 1994;23(1):19-21.

18 Visscher SH, van Roon MR, Sluiter WJ, van Minnen B, Bos RR. Retrospective study on the treatment outcome of surgical closure of oroantral communications. J Oral Maxillofac Surg 2011;69(12):2956-61.

19 Yilmaz T, Suslu AE, Gursel B. Treatment of oroantral fistula: experience with 27 cases. Am J otolaryngol 2003;24(4):221-23.

20 Abuabara A, Cortez A, Passeri L, De Moraes M, Moreira R. Evaluation of different treatments for oroantral/oronasal communications: experience of 112 cases. Int J Oral Maxillofac Surg 2006;35(2):155-58.

21 Hernando J, Gallego L, Junquera L, Villarreal P. Oroantral communications. A retrospective analysis. Med Oral Patol Oral Cir Bucal 2010;15(3):499-503.

22 Elarbi M. The management of an Oroantral fistula-A clinical study of 30 case Pak Oral Dent J 2006;26:55-58.

23 Anavi Y, Gal G, Silfen R, Calderon S. Palatal rotation-advancement flap for delayed repair of oroantral fistula: a retrospective evaluation of 63 cases. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2003;96(5):527-34.

CONTRIBUTIONS BY AUTHORS

1 Muhammad Asif Khan: Topic selection, Write-up of paper.

2 Muhammad Adnan: Data collection and Data analysis.

3 Faisal Mansor: Data collection.