Original Article

FREQUENCY AND FACTORS RESPONSIBLE FOR THE FRACTURE OF TUBEROSITY DURING EXTRACTION OF THE MAXILLARY 3RD MOLAR

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ABSTRACT

Objective: *The objective of this study was to determine frequency and factors responsible for the fracture of maxillary tuberosity during extraction of the maxillary 3rd molar.*

Material and Methods: *A detailed history, clinical and radiographic examination was carried out for 200 patients requiring upper 3rd molar extraction. Patients having age range from 20 to 60, and any medical condition affecting bone physiology 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. Factors responsible for maxillary tuberosity fracturen like age, gender, occupation, general medical condition, root morphology, thickness/density of surrounding bone, and pre-extraction condition of upper 3rd molar 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 responsible factors on maxillary tuberosity fracture. P value <0.05 was considered significant.*

Results: *Males outnumbered females with a mean age of 30.39±7.54 years. The frequency of maxillary tuberosity fracture during upper third molar extraction was 5%. The effect of root morphology, age and surrounding thickness/density of bone on the fracture of maxillary tuberosity was statistically significant (p-value <0.05). The effect of pre-extraction condition of the upper third molar crown and patients' occupation on the fracture of maxillary tuberosity was not statistically significant (p-value >0.05).*

Conclusions: *Overall frequency of maxillary tuberosity fracture is higher than reported in earlier studies. The responsible factors for maxillary tuberosity fracture were the old age, root morphology, and thickness of surrounding bone..*

Key words: *Third molar, maxillary tuberosity fracture, extraction, root morphology*

INTRODUCTION

Extraction of teeth requires that the adjoining alveolar bone be expanded to allow a resistance free removal of the indicated teeth. However, sometimes a piece of bone also comes out with the tooth with resultant gross deformity of the residual ridg[1]. Fracture of a large fraction of bone in the maxillary tuberosity region need special concern in this regard. The maxillary tuberosity has a paramount importance in the stability of upper complete denture[2]. Large maxillary tuberosity fracture should be considered as a serious complication. The most important curative objective of management is to recoup the fractured bone back in place and to grant the best possible healing environment[3].

The incidence of tuberosity fracture during upper molar extraction is relatively low. In a study conducted to investigate and compare the prevalence of complications of simple exodontia, 0.15% prevalence of tuberosity fractures was found[4]. In a retrospective study conducted to analyze pre- and postoperative complications associated with third molar extraction, the tuberosity fracture was 0.08%[5].

Management of the large maxillary tuberosity fractures is to stabilize the mobile bone with one of rigid fixation techniques for 4 to 6 weeks. Subsequently after proper healing, a surgical extraction be done. In case, if the tooth is infected/symptomatic at the time of the tuberosity fracture, the extraction should be continued by loosening the gingival cuff and removing

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as little bone as possible while avoiding separation of the tuberosity from the periosteum[6,7]. If this procedure is failed and the infected tooth is delivered with the attached tuberosity, the tissues should be closed with sutures to prevent clinical oroantral communication. Grafting the area for 4 to 6 weeks to heal and postoperative antibiotic therapy is another option. If there is no frank signs of infection the surgeon may elect to attempt to use the attached bone as an autogenous graft[6,8].

Factors responsible for maxillary tuberosity fracture during upper molars removal are; large and thin walled maxillary sinus due to its excessive pneumatization, a tooth having divergent roots, multiple roots and bulbous roots, dental anomalies such as dilaceration, tooth isolation, ankylosis, and hypercementosis. A chronic periapical infection of the tooth can lead to bone sclerosis and hence tuberosity more predisposed to fracture[9].

The aim of this study was to determine frequency and factors responsible for the fracture of maxillary tuberosity during extraction of the maxillary 3rd molar.

METHODS AND MATERIALS

This cross sectional study was conducted at the department of Oral and Maxillofacial Surgery, Khyber College of Dentistry, Peshawar from January 2016 to August 2017. A total of 200 patients who requires upper third molar extraction were included in the study. Patients referred from out patients department fulfilling the inclusion criteria were invited to participate in the study. Informed consent was taken from the patients regarding their willingness and participation in the study.

A detailed history and clinical examination was done for each participant. Radiographs (periapical or Orthopantomogram) were taken for all patients who required upper third molar extraction. Patients requiring extraction of maxillary third molar for periodontal, carious lesions or orthodontics reasons, having age range of 20 to 60, and any medical condition affecting bone physiology like osteoporosis and diabetes 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.

Name, age, gender, occupation, general medical condition, technique of extraction (open or closed), and reasons for extraction was recorded. Orthopantomogram (OPG) and periapical radiographs were used to assess the root morphology, thickness/density of surrounding bone, and pre-extraction condition of upper 3rd molar. The assessment of maxillary tuberosity fracture was done clinically.

Data was analyzed using Statistical Package for Social Sciences (SPSS) version 20.0. Mean and standard deviation were calculated for age of the participants. Frequencies and percentages were calculated for categorical variables. Chi square test was used to find out association between dependent variables i.e maxilla and independent variables like gender, occupation, general medical condition, technique and reason for extraction, root morphology, density of surrounding bone, and pre-extraction condition of upper 3rd molar crown. P value < 0.05 was considered significant.

RESULTS

Out of 200 participants 132 (66%) were males while 68 (34%) were females. Age range was from 23 to 58 years with a mean age of 30.39 ± 7.54 years. (table 1) The frequency of maxillary tuberosity fracture during upper third molar extraction was 5%. The most common reason for extraction of upper third molar was caries (44%) followed by impaction (33%) and periapical infection (11%). Malpositioning was the least reason for extraction (2%). (Table 2). Most of the upper third molars roots were fused (40%) followed by normal root form (22%). Divergent roots were found in 16% and multiple roots in 11% cases. 10 % had resorbed roots . (Table 3). In 25 % the bone surrounding upper third molar was dense and in 11% the bone was thin and porous. Most of the cases had normal bone (64%). Only in 12% cases the upper third molar was removed by open technique.

The effect of root morphology on the fracture of maxillary tuberosity was statistically significant (p-value <0.05). The effect of pre-extraction condition of the upper third molar crown on the fracture of maxillary tuberosity was not statistically significant (p-value=0.56). (Table 4) The surrounding bone thickness and density of upper third molar had affected the fracture of maxillary tuberosity statistically significantly (p value <0.05). (Table 5) The fracture of maxillary

tuberosity was more in old age than earlier. This difference was statistically significant (P value =0,00). (Table 6) The effect of occupation on the fracture of maxillary tuberosity was not statistically significant (p-value=0.999). (Table 7)

Table 1: Age distribution of the study participants

Age groups (years)	Frequency	Percent
21-30	144	72.0
31-40	20	10.0
41-50	30	15.0
51-60	6	3.0
Total	**200**	**100.0**

Table 2: Reasons for extraction of upper third molars

Indication for extraction	Frequency	Percent
Pulpitis	20	10
periapical Infection	22	11
Grossly carious	88	44
Impaction	66	33
Malposed	4	2
Total	200	100

Table 3: Root morphology of upper third molars

Morphology	Frequency	Percent
Fused	80	40
Normal	44	22
Divergent	32	16
Multiple roots	22	11
Resorbed	20	10
Curved	2	1
Total	200	100

DISCUSSION

Extraction of teeth (Exodontia) is the most common minor oral surgical procedure performed. Complications of extraction ranges from periodontal injury to fracture of jaw in the mandible and fracture of tuberosity and oroantral communication in the maxilla[10]. Upper third molar lies just within the maxillary tuberosity. The fracture of a large portion of bone in the maxillary tuberosity area is a situation of special

Table 4: Effect of Pre-extraction condition of the upper third molar crown on the fracture of maxillary tuberosity

Pre-extraction condition of the third molar crown				**Total**	**p-value**
		sound and normal	**grossly carious**		
Fracture of maxillary tuberosity	Yes	6	4	10	0.557*
	No	108	82	190	
Total		**114**	**86**	**200**	

*Non significant, chi-square test

Table 5: Effect of thickness and density of surrounding bone of the upper third molar on the fracture of maxillary tuberosity

Thickness and density of surrounding bone					**Total**	**p Value**
Fracture of maxillary tuberosity		Thin	normal	thick and dense		
	Yes	1	3	6	10	0.029*
	No	21	125	44	190	
Total		**22**	**128**	**50**	**200**	

*Significant, chi-square test

Table 6: Effect of age on the fracture of maxillary tuberosity during upper third molar extraction

		Age Groups				**Total**	**p-value**
		21-30	31-40	41-50	51-60		
Fracture of maxillary tuberosity	Yes	2	0	5	3	10	0.00
	No	142	20	25	3	190	
Total		144	20	30	6	200	

*Chi-Square vaue=39.181, df=3, p-value=0.000

Table 7: Effect of occupation on the fracture of maxillary tuberosity during upper third molar extraction

		Occupation					**Total**
		House wife	shop keeper	student	Businessman	teacher	
Fracture of maxillary tuberosity	Yes	3	1	3	2	1	10
	No	43	21	63	42	21	190
Total		46	22	66	44	22	200

*Chi-Square vaue=0.291, df=34 p-value=0.991

concern, which can result in torrential hemorrhage due to close proximity of significant vessels (greater palatine neurovascular system). Maxillary tuberosity is especially important for the stability of upper denture and may cause oroantral communication if fractured[11].

In the present study the frequency of third molar extraction was 5% during upper third molar extraction. The incidence of tuberosity fracture during upper molar extraction in previous studies is relatively low. In a study conducted to investigate and compare the prevalence of complications of simple exodontia(n=8455), 0.15% prevalence tuberosity fractures was found[4]. In a retrospective study conducted to analyze pre- and postoperative complications associated with third molar extraction, the tuberosity fracture was 0.08%[5]. This difference may be due to the fact that in the current study, most of the extraction of upper third molar was carried out by house surgeons and undergraduate students. Due to less experience the frequency of maxillary tuberosity fracture was higher.

In this study the most common reason for extraction of upper third molar was caries followed by impaction. Malpositioned and Orthodontic was the least reason for extraction. Third molar is last tooth in the dentition and commonly bucally placed , inaccessible to oral hygiene measures and easily affected by caries[12]. Impaction can lead to pericoronitis and pain and may require extraction. Other reason to remove impacted third molar is prophylactic. Now a days in the discipline of Orthodontics the emphasis on non-extraction treatment has increased. In non extraction treatment the molars need to be distalized for which space is created by upper third molars removal[13]. Research have shown maxillary tuberosity utilization for implant placement when sufficient bone is not available in the other region of maxilla with a success rate of 94.1%[18].

Because of the frequency and importance of third molar surgery, the literature has focused mainly on extraction criteria and extraction complications when they are impacted, retained or partially erupted, adjunct therapies for the postoperative course, and postoperative complications. Additionally, a number of studies have examined risk factors for complicated 3rd molar extraction, using measurable outcomes such as extraction time and surgeon assessment of difficulty[15,16].

In the current study the responsible factors for maxillary tuberosity fracture were the old age, root morphology (divergent and multiple), and thickness of surrounding bone. In old age the bone become hyper-dense and brittle so lead to more fracture. According to Hupp[17], in cases of extreme age, surgical removal of the third molars is contraindicated because as the patient ages, the bone becomes increasingly more calcified and thus less flexible. As a result, more bone should be removed during the procedure. When roots of upper third molar are multiple and divergent, the chances of maxillary tuberosity fracture increases[6]. The thick and dense bone is more brittle and is not liable to expand during tooth removal so can fracture easily.

CONCLUSION

Overall frequency of maxillary tuberosity fracture is higher 5% than reported (0.1% to 0.2% in earlier studies. The responsible factors for maxillary tuberosity fracture were the old age, root morphology, and thickness and increased density of the surrounding bone. Use of broader elevator and especially when to use it as a lever has more chance of tuberosity fracture. Experience and cautions are required during upper third molar extraction to avoid the fracture of maxillary tuberosity and associated short term and long term complications. A correct preoperative radiographic interpretation, coupled with the anatomical knowledge of the structures involved, is essential to prevent such complications

REFERENCES

1. McKernon S, Reid S, Taylor K, Balmer M. A fractured tuberosity following attempted extraction. Br Med J case Report 2015;2015:1-2.
2. Chrcanovic BR, Freire-Maia B. Considerations of maxillary tuberosity fractures during extraction of upper molars: a literature review. Dent Traumatol 2011;27(5):393-98.
3. Pierse JE, Dym H, Clarkson E. Diagnosis and management of common postextraction complications. Dent Clinic North Am 2012;56(1):75-93.
4. Baniwal S, Paudel K, Pyakurel U, Bajracharya M, Niraula S. Prevalence of complications of simple tooth extractions and its comparison between a tertiary center and peripheral centers: a study conducted over 8,455 tooth extractions. J Nepal Med Assoc 2007;46(165):20-24.
5. Christiaens I, Reychler H. Complications après extraction de dents de sagesse. Rev Stomatol Chir Maxillofac 2002;103(5):26974-78.
6. Polat HB, Ay S, Kara MI. Maxillary tuberosity fracture

associated with first molar extraction: a case report. Eur J Dent 2007;1(4):256-62.

7. Lapointe H. How to manage tuberosity fracture during extraction. J Canad Dent Assoc 2013;80:e62-e62.
8. Salim S, Newman A, Closmann J, Borris T. Management of uncommon complications in seemingly routine oral surgeries. Gen Dent 2015;63(3):4-10.
9. Shah N, Bridgman J. An extraction complicated by lateral and medial pterygoid tethering of a fractured maxillary tuberosity. Br Dent J 2005;198(9):43-8.
10. Thirumurugan K, Munzanoor RRB, Prasad GA, Sankar K. Maxillary tuberosity fracture and subconjunctival hemorrhage following extraction of maxillary third molar. J Natl Sci Biol Med 2013;4(1):242.
11. Bell G. Oro-antral fistulae and fractured tuberosities. Br Dent J 2011;211(3):119-23.
12. Haseeb M, Ali K, Munir MF. Causes of tooth extraction at a tertiary care centre in Pakistan. J Pak Med Assoc 2012;62(8):812-15.
13. Shashidhar NR, Reddy SRK, Rachala MR. Comparison of K-loop Molar Distalization with that of Pendulum Appliance-A Prospective Comparative Study. J Clin Diagnostic Research 2016;10(6):20-25.
14. Lopes L.F.dT.P. Placement of dental implants in the maxillary tuberosity: a systematic review DOI: http://dx.doi.org/10.1016/j.ijom.2014.08.005.
15. Morales-Trejo B, Rocha-Navarro ML, Acosta-Veloz AL, Juárez-Hernández A. Class, type and position of 9148 surgically removed third molars in 3206 patients: A retrospective study. Med Oral Patol Oral Cir Bucal 2012;17(3):447.
16. Susarla SM, Dodson TB. Predicting third molar surgery operative time: a validated model. J Oral Maxillofac Surg 2013;71(1):5-13.
17. Hupp JR, Ellis E, Tucker MR. Oral maxillofacial surgery and contemporary. 5. ed. Rio de Janeiro: Elsevier; 2009.