Original Article

PATTERNS OF IMPACTED THIRD MOLARS AND CATEGORIZATION OF THEIR ASSOCIATED ORAL PATHOLOGIES: A RADIOGRAPHIC STUDY

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ABSTRACT

Objective: To assess the relationship between radiolucencies associated with the impacted third molars and their patterns of impaction (depth, angle and ramus relationship).

Material and Methods: A cross sectional descriptive study was conducted on 385 Orthopantomograms of patients visiting dental outpatient departments of Sharif Medical and Dental College (SMDC)and Services Institute of Medical Sciences (SIMS) from December 2020 to February 2021. Teeth were analyzed with respect to the angle, depth of impaction and associated radiolucencies in mandibular and maxillary impacted molars. The impacted mandibular molars were also analyzed with respect to ramus relationship. P value ≤ 0.05 was considered significant.

Results: In mandibular molars depth of impaction and presence of caries had significant association (p=0.007). The association between ramus relation and pericoronal radiolucencies (p≤0.001) and external resorption (p=0.040) was significant where pericoronal radiolucencies were greatest in class 2 ramus relationship and external resorption was highest in class 1 ramus relationship. In Maxillary molars the association between depth of impaction and pericoronal radiolucencies (p=0.001) and Periapical radiolucency (p=0.077) was significant where both were seen highest in class C depth of impaction.

Conclusion: In mandibular molars the highest percentage of caries, periapical and pericoronal radiolucencies were seen in class A depth of impaction, Class 2 ramus relationship and mesioangular impactions. External resorption was highest in Class 1 ramus relation. In the Maxilla the highest number of carious teeth, teeth with Periapical and pericoronal radiolucencies were seen in Class C depth of impaction and distoangular angle of impaction.

Key Words: Impacted third molars, Periapical radiolucency, Pericoronal radiolucency, External root resorption, Dental caries, Orthopantomogram (OPG).

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INTRODUCTION

The failure of the tooth to erupt in the dental arch within physiological eruption time frame is referred to as tooth impaction [1,2]. The tooth most commonly impacted is the third molars in both the maxilla and mandible and has a prevalence of up to13.7% to 68.5% followed by maxillary canines [3,4]. The incidence of impacted teeth has increased over the past decade due to poor dietary habits and inadequate growth leading to lack of adequate space for tooth eruption [5]. Etiology of impacted tooth is multi-factorial including both local and systemic factors [5,6]. Local factors include retained deciduous tooth, trauma, supernumerary teeth, dense overlying bone, odontogenic tumors and arch-length deficiency [5,7]. Systemic factors include conditions like Down syndrome, Cleidocranial dysplasia, febrile diseases, and endocrine deficiencies [6].

The treatment of choice for impaction molars is extracting them surgically and for this reason different methods have been proposed to estimate the level of surgical difficulty which classify impacted molars on the basis of their relationship to the anterior border of the ramus, depth and angulation of impaction [8,9]. It has been highly recommended that the operator effectively estimates the surgical difficulty beforehand to avoid any complications at the time of extraction [10].

It is of utmost importance to evaluate the level of difficulty before treating an impacted third molar [11]. Pre-operative radiographs are pre-requisite before removal of impacted third molar. Pre-surgical radiographic examination aids in identification of type of impaction, underlying pathologies, relation with critical structures and other significant finding. An orthopantomogram (OPG) is the radiographic modality of choice to assess the parameters which help in determining the level of surgical difficulty posed by impacted third molars [12].

Our study was a radiographic study which predominantly highlighted a rarely written upon

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aspect of radiographic changes associated with impacted mandibular and maxillary third molars and their patterns of impaction. This study will help understand the effect of the impaction patterns on the development of pathologies in and around the impacted third molars. This information can be applied for prophylactic as well as therapeutic purposes while treating patients with third molar impactions.

MATERIAL AND METHODS

A cross sectional descriptive study was conducted on 385 Orthopantomograms (OPG) of patients visiting Sharif Medical and Dental College (SMDC) and Services Institute of Medical Sciences (SIMS) over a period of three months from December 2020 to February 2021. The sample size was calculated keeping the confidence level 95%, anticipated population proportion 0.462, absolute precision 0.05 [13] and was determined to be 383. The Sampling technique used was non-probability convenience sampling. Ethical approval was obtained from the Sharif Medical Research Centre (SMRC) before the commencement of the study. Patients above the age of 21 years were a part of the study. Grossly carious third molars with inadequate tooth structure to be evaluated and patients with missing maxillary and mandibular third molars were excluded from the study. Orthopantomograms (OPG) were obtained from the radiology department of Sharif Medical and Dental College (SMDC) and Services Institute of Medical Sciences (SIMS). The panoramic machine model used was Asahi AutoIII ECM, input power 1.5 kVA, tube current 10mA Constant, tube voltage 60-90 kV, exposure time 12sec (continuous), total filtration 2.8mmAl (min), Metal flat cassette 8" x 10" (Attached grid: 34lines/cm) (Grid ratio:5/1), 203 x 254 mm Kodak T-Mat G film, Kodak lanex regular (1*) intensifying screen. The OPGs were evaluated for the Mandibular and Maxillary Third molar impactions. The impacted molars were then analyzed with respect to the angle, depth of impaction and associated radiolucencies in case of mandibular molars and maxillary molars. The mandibular molars were also analyzed with respect to ramus relationship. Winter`s classification was used for classifying the angle of impaction [14]. The Pell and Gregory classification was used for depth of third molar impaction and ramus relationship of mandibular third molars [15]. The criteria used for evaluating the associated radiolucencies has been given in Table-I [13].

Table-I: Criteria for analyzing radiolucencies associated with impacted third molars [13].

Radiographic Appearance	Diagnosis
An area of radiolucency in the impacted third molar	Caries
An area of radiolucency surrounding the crown of the impacted molar	Pericoronal radiolucent area
An area of radiolucency around the apical third of the root that can have extension on either side of the root without crossing the cemento-enamel junction.	Periapical radiolucent area
An evident loss of structure of the root in the impacted third molar.	External root resorption

Statistical analysis was done using SPSS 23 and P value ≤ 0.05 was considered significant. Chi square test was used to find the association of arch (mandible and maxilla) with angle of impaction and depth of impaction. Chi square test was used to find the association between ramus relationship (mandible only), angle of impaction and depth of impacted Third molar with associated radiolucencies in the mandible and maxilla.

RESULTS

A total of 385 OPG with 840 impacted third molars were examined. The mean age of the patients was 32.71±9.198 years with 49.9% females and 50.1% males. The number of impacted third molars in the mandible was 605 with 299 in the right mandible and 306 in the left mandible while that in the Maxilla was 235 with 112 in the right maxilla and 123 in the left maxilla. A significant association between the arch type and depth of impaction (p≤0.001) was seen. The angulation of impacted mandibular and maxillary third molars and arch type also had a significant association (p≤0.001). The association of angle and depth of impacted third molars with arch type has been shown in Table-II.

It was seen that there was a significant association between the arch type and the presence of caries (p=0.032), Periapical radiolucencies (p=0.001) and pericoronal radiolucencies (p=0.037) in the impacted third molar as shown by Chi square test but a non-significant association with external root resorption (p=1.000) as demonstrated by Fisher exact test. The radiolucencies associated with the impacted third molars in the mandible and maxilla have been shown in Figure-I.

The association between radiolucencies associated with impacted mandibular third molars and their relationship with angle and depth of impaction and ramus relationship has been given in Table-III.

Table-II: Association of angle and depth of impacted third molars with the arch.

Arch	Depth of Impaction				Angle of Impaction					
	Class A N (%)	Class B N (%)	Class C N (%)	P value [a]	Vertical N (%)	Mesioangular N (%)	Distoangular N (%)	Horizontal N (%)	Buccolingual N (%)	P value [a]
Mandible	271 (32.3%)	227 (27%)	107 (12.7%)	p ≤ 0.001	155 (18.5%)	279 (33.2%)	28 (3.3%)	142 (16.9%)	1 (0.1%)	p ≤ 0.001
Maxilla	0 (0%)	67 (8%)	168 (20%)		52 (6.2%)	54 (6.4%)	122 (14.5%)	1 (0.1%)	6 (0.7%)	

[a]Chi square test

Table-III: Relationship between patterns of impacted mandibular third molar and associated radiolucencies.

	Classification	Caries		Periapical		Pericoronal		External resorption	
		n (%)	P value [a]	n (%)	P value [a]	n (%)	P value [a]	n (%)	P value [b]
Depth of Impaction	**Class A**	14 (2.3%)	0.007	242 (40%)	0.286	257 (42.5%)	0.353	1 (0.2%	1.000
	Class B	2 (0.3%)		197 (32.6%)		221 (36.5%)		1 (0.2%)	
	Class C	1 (0.2%)		99 (16.4%)		102 (16.9%)		0 (0%)	
Ramus relationship	**Class 1**	5 (0.8%)	**P value [b]**	91 (15%)	**P value [a]**	89 (14.7%)	**P value [b]**	2 (0.3%)	**P value [b]**
	Class 2	12 (2%)	0.277	429 (70.9%)	0.833	471 (77.9%)	≤0.001	0 (0%)	0.040
	Class 3	0 (0%)		18 (3%)		20 (3.3%)		0 (0%)	
Angle of impaction	**Vertical**	4 (0.7%)	**P value [b]**	138 (22.8%)	**P value [b]**	149 (24.6%)	**P value [b]**	0 (0%)	**P value [b]**
	Horizontal	1 (0.2%)		129 (21.3%)		137 (22.6%)		0 (0%)	
	Mesioangular	11 (1.8%)	0.239	246 (40.7%)	0.793	267 (44.1%)	0.763	2 (0.3%)	
	Distoangular	1 (0.2%)		24 (4%)		26 (4.3%)		0 (0%)	0.546
	Buccolingual	0 (0%)		1 (0.2%)		1 (0.2%)		0 (0%)	

[a] Chi square test, [b] Fisher Exact test

Table-IV: Association between radiolucencies associated with impacted maxillary molars and depth and angle of impaction.

	Classification	Caries		Periapical		Pericoronal	
		n (%)	P value [b]	n (%)	P value [a]	n (%)	P value [a]
Depth of Impaction	**Class A**	0 (0%)		0 (0%)		0 (0%)	
	Class B	0 (0%)	1.000	50 (21.3%)		56 (23.8%)	
	Class C	1 (0.4%)		105 (44.7%)	0.077	161 (68.5%)	0.001
Angle of impaction	**Vertical**	0 (0%)	**P value [b]**	33 (14%)	**P value [b]**	46 (19.6%)	**P value [b]**
	Mesioangular	0 (0%)		38 (16.2%)		51 (21.7%)	
	Distoangular	1 (0.4%)	1.000	82 (34.9%)	0.102	113 (48.1%)	0.709
	Horizontal	0 (0%)		1 (0.4%)		1 (0.4%)	
	Buccolingual	0 (0%)		1 (0.4%)		6 (2.6%)	

[a] Chi square test, [b] Fisher Exact test

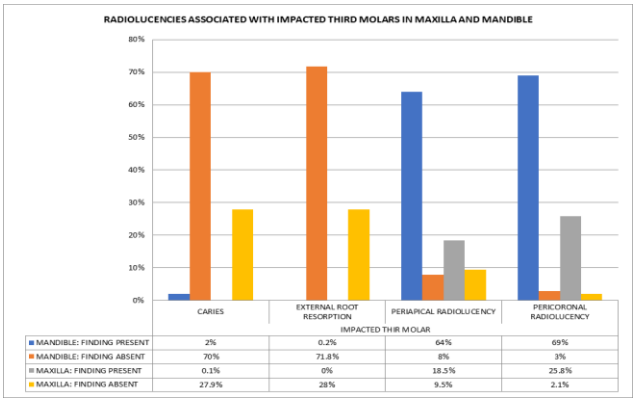

Figure-I: Radiolucencies associated with impacted third molars in maxilla and mandible.

DISCUSSION

The third molar impactions mainly occur due to lack of space in the arch or when the tooth fails to rotate to mesioangular and vertical positions from a horizontal position [1]. Various patterns of third molar impactions have been reported in the past [14,15]. According to our study it was seen that most of the mandibular impacted third molars (32.3%) fell in the category of class A depth of impaction while the least (12.7%) had class C depth of impaction. Another study reported contrary results with 53.9% of the mandibular molars having class C depth of impaction while the least (20.6%) had class A depth of impaction [16]. It was also seen in our study that none of Maxillary impacted teeth had class A depth of impaction while the highest percentage (20%) had class C. The results of another study were comparable to our study where it was seen that only 2% of the Maxillary impacted molars had class A while majority (62.1%) had class C depth of impaction [16]. The difference in the patterns of depth of impaction of molars can be attributed to the fact that it is influenced by various factors which include race and ethnicities [17].

The angulation of impaction has been studied to be influenced by many factors. Our study reported that most of the mandibular impactions (33.2%) were mesioangular followed by vertical (18.5%) while the least were buccolingual (1%). This can be explained by the difference in the growth of the mesial in comparison to the distal root of the third molar. This means that mesioangular impaction can be a result of underdeveloped mesial root [6]. Another study reported the majority of mandibular impactions (53%) to be vertical followed by mesioangular (29%) while the least (13%) had distoangular angulation [17]. Majority of maxillary impactions (14.5%) in our study were distoangular followed by mesioangular (6.4%) while the least were horizontal (0.1%). While according to the study above [17], most of the maxillary impactions (57%) were vertical followed by distoangular (33%) while the least (0.5%) were horizontal. The high percentage of maxillary distoangular impactions in our can be explained in the light of a study conducted previously which reported that the overdevelopment of the mesial root of the impacted third molar can contribute to the distoangular position of the tooth [6].

In our study, it was reported that majority of the mandibular impacted third molars (95.9%) had pericoronal radiolucencies followed by Periapical radiolucencies (88.9%) and then caries (2.8%) associated with the impacted tooth while only 0.3% were associated with external root resorption. Another study reported comparable results where it was seen that the occurrence of pericoronal radiolucencies was the highest (37%) followed by caries (29.5%) and then pericoronal radiolucencies [13].

It has been reported in the past that impacted mandibular molars with class C, vertical and class III patterns of impaction were associated with the development of more pathologies [1]. Our study reported that highest percentage of caries (1.8%) was found in mandibular molars with mesioangular impactions followed by vertical (0.7%) and none in buccolingual. In the past a relationship between the impacted mandibular molars and angulation of impaction have been reported to have an impact on development of radiolucencies around the impacted tooth. One such study reported that the percentage of caries on impacted third molars was the highest (24%) in mesioangular impactions [18] which is very similar to our study followed by horizontal (1.6%) and then vertical (16.3%). One study concluded that bone loss is very prevalent when the impacted third molar is in the vertical or distoangular positions [1].

A radiographic study on impacted maxillary and mandibular third molars reported that a wide pericoronal space was observed in 5 out of 477 maxillaries impacted third molars while the same was observed in 43 out of 734 mandibular impacted third molars [19]. The most common problems associated with the impacted molars radiographically were reported to be dental caries, supernumerary teeth, loss of alveolar bone height and coronal radiolucencies [20]. Periodontal bone loss and widened follicular space have also been reported as radiographic findings associated with impacted molars [21]. One limitation that our study faced was that the radiographic evaluation was not followed by histopathological analysis. Evaluating the lesions histologically is very essential to make a

specific diagnosis as radiographic evaluation alone cannot serve the purpose. The histopathological evaluation can help in identify if these radiolucencies are cysts, tumors or any other pathology.

CONCLUSION

Pericoronal followed by periapical radiolucencies were the predominant radiolucencies in maxilla and mandible. In the mandible the highest percentage of impacted molars had Class A depth of impaction and mesioangular position. In the maxilla impacted teeth mostly has class C depth of impaction and distoangular position. Mandibular molars with class A depth of impaction, Class 2 ramus relationship and mesioangular impactions had the greatest percentage of caries, periapical and pericoronal radiolucencies. External resorption was highest in Class 1 ramus relation. Maxillary molars with class C depth of impaction and distoangular position had highest number of carious teeth, periapical and pericoronal radiolucencies.

LIMITATION

A larger sample size can help unravel more findings on this topic. Additionally, histopathological analysis of the lesions can help reach a definitive diagnosis which cannot be done by radiograph alone.

RECOMMENDATION

There does not exist a vast body of literature that discusses the relationship between the ramus relationship of impacted mandibular third molars and the associated radiographic findings. There is a dire need for more research in this area. More studies should be carried out to assess the impact of patterns of third molar impaction and the development of radiographic changes in these teeth. These studies should involve histopathological evaluation in addition to radiographic analysis.

AUTHOR CONTRIBUTION

Hira Butt: Conception and design, literature review, study design, data collection, result analysis, drafting manuscript, proof reading, critical revision and final approval.

Fizza Tahir: Conception and design, study design, data collection, drafting manuscript and literature review.

Hafiz Aamer Iqbal & Nayab Rauf: Data collection.

Nauman Rauf Khan: Study design and data collection.

Maila Habib Piracha: Literature review

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