

Original Research Article

Radiographic Assessment of Type of Angulation and Bone Resorption in Relation to Mandibular Third Molar

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ABSTRACT

Introduction: The most common type of impaction is observed in the mandibular third molars. Numerous symptoms and pathologies such as bone loss, pericoronitis can cause due to impacted third molar. So, the aim of the study was to assess the bone resorption adjacent to third molar and distal to second molar and also to evaluate age estimation by periodontal ligament visibility of third molar.

Methods and material: 200 OPG's were included in study. Bone resorption is measured on the OPG with respect to third molar and second molar. We also evaluated age estimation by periodontal ligament visibility by Olse's method.

Results: Vertical type of impaction was seen more followed by mesioangular, horizontal and distoangular. Bone loss with respect to third molar was found to be slightly more with respect to third molar as compared with second molar, but the results were statistically insignificant. Most of the males and female presented with stage 2 were more than 21 years of the age.

Conclusion: The most common type of impaction seen in the adults was vertical type followed by mesio-angular type of impaction. Bone resorption was seen with respect to second and third molars. Periodontal ligament visibility of lower third molar may become an important method in forensic age estimation.

Key words: third molar impaction, bone resorption, periodontal ligament

INTRODUCTION

The only tooth to erupt in adolescents or even in adults is third molar, which is also known as "Wisdom tooth". Impaction is defined as completely or partially unerupted and positioned against another tooth, bone or soft tissue, such that its further eruption would be unlikely. Impactions may be unilateral or bilateral. Patterns of impacted third molar are classified on the basis of Winter's

classification. The classification is determined by the angle formed between the intersected longitudinal axis of the second and third molars Vertical impaction (10° to -10°), mesioangular impaction (11° to 79°), horizontal impaction (80° to 100°), distoangular impaction (-11° to -79°).^[1]

Third molars account for 98% of all impacted teeth. The frequency of impaction of permanent teeth is observed in the following descending order: Mandibular

third molars, maxillary third molars, maxillary canines, maxillary and mandibular premolars, maxillary incisors, mandibular canines, mandibular incisors, maxillary and mandibular first molars, and maxillary and mandibular second molars. [2]

Numerous pathologies such as bone loss, root resorption of adjacent teeth, cystic lesions and tumours, pericoronitis, and systemic infections are associated with impacted and partially erupted third molars. [3,4]

Acute pericoronitis is commonly seen in patients with partially impacted third molars which results in marked increase in bone resorption. [5] The extent and type of bone loss is influenced by a variety of factors such as inclination of the impacted tooth. Nevertheless considerable radiographic changes may occur without significant clinical symptoms. [6]

There are very few studies to determine whether the level of bone resorption is associated with the type of impaction. The objective of the study was to find the relationship between the type of impaction with the third molar and bone resorption with respect to second and third molar.

MATERIALS AND METHODS

After institutional ethics clearance 200 patients visiting Department of Periodontology and Implantology of our institute were included in study. Patients aged 18 to 35yrs with third molar impaction were included.

Cariou tooth, fractured tooth, tooth with any pathology other than bone resorption were excluded from the study. Mandibular impacted third molars (n = 200) were seen on orthopantomogram (OPG). The bone loss on the adjacent second molar was investigated, and the position of the third molar was determined using Winter's classification (vertical, horizontal, mesioangular, distoangular, and transverse).

The radiographs will be measured by the linear distance from the cemento-enamel junction to the alveolar crest (A) and the

cemento-enamel junction to the apex of root (B), and evaluated for the ratio (A/B) of bone crest resorption against the root length from the cemento-enamel junction to the apex in the proximal aspects of the third molar and the distal aspect of the second molar (Figure 1).

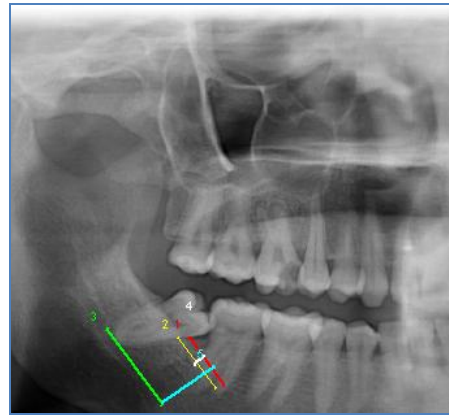


Figure 1: Measurements on OPG.

While taking measurements we also evaluated visibility of periodontal ligament. By evaluating the visibility of periodontal ligament, we co-related with it with age estimation using Olse's method (Figure 2).

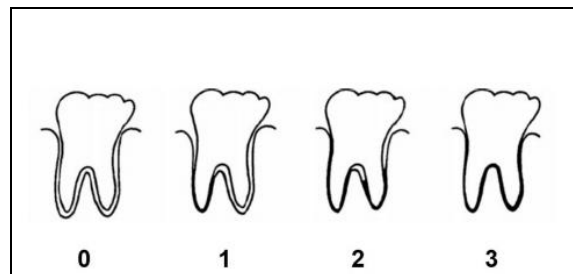


Figure 2: Stages of periodontal ligament visibility given by Olse.

Stage zero: The periodontal ligament visible along the full length of all roots;

Stage 1: The periodontal ligament is invisible in one root from apex to more than half root;

Stage 2: Is the invisible along almost the full length of one root or along part of the root in two roots or both;

Stage 3: The periodontal ligament is invisible along almost the full length of two roots.

Statistical analysis: All the data regarding the age, gender, type of impaction and A/B ratio was presented as mean ± SD. Categorical variables (age, gender) were expressed as actual numbers and percentage. Pearson's Chi-square test was applied for distribution of sites as per position of 3rd molar and gender. Comparison of distances for 2nd and 3rd molar, comparison of mean A/B ratio for 3rd and 2nd molar and comparison of mean A/B ratio for 3rd and 2nd molar between male and female patients according to position was done using t-test.

RESULTS

A total of 200 patients, age ranged from 18 to 40 years with completely and partially impacted mandibular third molar were included in the study. Table 1 shows the distribution of patients according to age. Prevalence of third molar impaction was more in 21-25 years of age followed by 26-30 years of age and least in patients less 20 years of age. Third molar impaction was seen more in females (53%) as compared males (47%).

Table 1: Distribution of patients according to age

Age in years	No. (%)
≤20	31 (15.5)
21-25	94 (47)
26-30	41 (20.5)
> 30	34 (17)
Mean ± SD	25.53 ± 4.83
Median	25

Table 2 shows distribution of sites as per position of 3rd molar and gender. Vertical type of impaction was seen more followed by mesioangular, horizontal and distoangular. Vertical type of impaction was seen in 92 females 70 males, whereas 12

females and 6 males were having distoangular type of impaction. The A/B ratio gives the amount of bone resorption with respect to third molar and second molar.

Table 2: Distribution of sites as per position of 3rd molar and gender

Position_3rd molar	Total	Male	Female	P-value*
Horizontal	32	15	17	0.2135 (NS)
Mesio-angular	115	62	53	
Vertical	162	70	92	
Distoangular	18	6	12	
Total	327	153	174	

*Using Pearson's Chi-square test; NS: Not significant

Table 3 shows the A/B ratio with respect to third molar was found to be more as compared second molar in male as well as in females. These results were not statistically significant.

Table 3: Comparison of distances for 2nd and 3rd molar between male and female patients

Point	Gender	Mean	SD	P-value*
A- 3rd molar	Female	3.68	1.49	0.4109 (NS)
	Male	3.82	1.48	
B- 3rd molar	Female	14.91	1.95	0.0188 (S)
	Male	15.41	1.87	
A- 2nd molar	Female	3.54	1.09	0.4653 (NS)
	Male	3.64	1.43	
B- 2nd molar	Female	15.51	1.70	0.2577 (NS)
	Male	15.72	1.99	

*Using t-test for independent samples; S: Significant; NS: Not significant

Table 4 shows the comparison of mean A/B ratio for 3rd and 2nd molar between male and female patients according to position. A/B ratio with respect to third molar was found to be more in patients with vertical type of impaction followed by mesioangular, horizontal and distoangular. Similar results as found with respect to second molar. But these results were not statistically significant.

Table 4: Comparison of mean A/B ratio for 3rd and 2nd molar between male and female patients according to position

Position	Gender	No.	3rd molar ratio		2nd molar ratio	
			Mean ± SD	P-value	Mean ± SD	P-value
Distoangular	Female	12	0.211 ± 0.053	0.9735 (NS)	0.210 ± 0.093	0.7676 (NS)
	Male	6	0.212 ± 0.037		0.201 ± 0.034	
Horizontal	Female	17	0.241 ± 0.114	0.6983 (NS)	0.261 ± 0.097	0.8286 (NS)
	Male	15	0.227 ± 0.092		0.253 ± 0.085	
Mesioangular	Female	53	0.222 ± 0.103	0.7425 (NS)	0.224 ± 0.063	0.9998 (NS)
	Male	62	0.228 ± 0.090		0.224 ± 0.067	
Vertical	Female	92	0.271 ± 0.115	0.9354 (NS)	0.231 ± 0.073	0.3962 (NS)
	Male	70	0.269 ± 0.097		0.277 ± 0.444	

*Obtained using t-test for independent samples; NS: Not significant

Results on the cross tabulation of age thresholds between 18-21 years of age and more than 21 years of age by periodontal ligament visibility are shown in Table 5. Stage 0 was seen in 6 males and 2 females in age range of 18-21 years. Only 1 male in stage 3 was between 18-21 years of age and 2 males was more than 21 years of age. No females older than 21 years presented with right side in stage 3 but this differed to the left side where 2 was aged more than 21 years. More number of patients was with stage 1 as compared to other stages. Most of the males and females were presented with stage 2 were older than 21 years of life.

Table 5: Distribution of patients in two age categories as per gender, position and stage.

Gender	Position	Stage	Age (in years)	
			18-21	> 21
Male	Left	1	4	26
		2	10	17
		3	1	2
	Right	1	7	30
		2	7	15
		3	2	2
Female	Left	1	7	18
		2	14	25
		3	3	1
	Right	1	7	30
		2	15	27
		3	2	0

Table 7: Distribution of patients in two age categories as per gender, position and stage.

Gender	Position	Stage	Age (in years)	
			18-21	> 21
Male	Left	1	4	26
		2	10	17
		3	1	2
	Right	1	7	30
		2	7	15
		3	2	2
Female	Left	1	7	18
		2	14	25
		3	3	1
	Right	1	7	30
		2	15	27
		3	2	0

DISCUSSION

According to our results bone resorption was found to be slightly more in patients with vertical type of impaction with respect to third molar and second molar, but the results were statistically insignificant when compared with other type of impactions i.e. mesioangular, horizontal and disto angular. Our results are in accordance

with Yilmaz S et al. in 2016 where the authors observed high occurrence rate of level C impaction with vertical position pattern of third molar impaction in a Central Anatolian Turkish population. The most common symptoms usually associated with level A impaction and vertical position were pain and pericoronitis.^[7]

The alveolar bone loss on the distal side of the second molar is seen mainly in impacted adjacent third molar regardless of the presence of acute pericoronitis. A correlation between the inflammatory infiltrate and histological alveolar bone loss has been observed. Endothelial-derived cytokines, T cells, mast cells, and interleukin-1 (IL-1) may be involved in bone resorption.^[8] Hazza A et al. in 2009 found that the soft tissues adjacent to vertically inclined, partially erupted mandibular third molars were more frequently affected by pericoronitis than teeth that are soft tissue impacted or erupted. The tissue adjacent to vertically inclined, partially erupted mandibular third molars that were positioned at or above the level of the occlusal plane were more frequently affected by pericoronitis than teeth that are soft tissue impacted or erupted. Bone loss between the mandibular second and third molars is the only radiographic change associated with pericoronitis and strongly related to the angulation of mandibular third molars.^[9]

Braimah RO et al in 2018 investigated pathologies associated with impacted mandibular third molars in Sub-Saharan Africans and found that caries and pathological pockets were the most common associated pathology with impacted third molar and adjacent second molar teeth.^[4]

According to Mukherji A et al in 2017, noted in their study that pericoronitis was most commonly associated with impacted mandibular third molars and had the highest chances of occurrence in partially erupted, distoangular, and IA position.^[10] Nagaraj T et al in 2016, stated that panoramic radiographs can be used as

valuable predictor of the outcome of the impacted mandibular third molars position as they appear to have quite good cost-information ratio. They also observed that, bilateral impactions are more common than unilateral, mesioangular is the most common pattern of impaction in both unilateral and bilateral impactions, and common pattern of impaction was mesioangular, in both the sexes, followed by horizontal pattern in males and vertical pattern in females. [1] Least type of impaction found in our study was distoangular type of impaction.

Age estimation from developing teeth is frequently required in forensic cases of skeletal remains, mass disasters, children with no identification papers and asylum seekers as well as in the fields of archaeology and anthropology. [11] Age estimations from teeth are frequently used, because teeth may be preserved long after all other tissues, even bone, have disintegrated, but unlike bone they can also be inspected directly in living individuals. [12] Tooth mineralization is seen as the most robust measure in assessing chronological age. The use of the mineralization of third molars to determine whether a subject is over 18 years was first described by the American Board of Forensic Odontology (ABFO). Olse et al first described the radiographic visibility of the periodontal ligament in third molars as a potential age estimation criterion after completed formation of the root. In this study, we analysed the radiographic visibility of the periodontal ligament in lower third molars. [13]

Sequeira CD et al in 2014 stated that periodontal ligament visualization of lower third molars is an important methodology in forensic age estimation. They carried out study on Portuguese population and observed that stage 3 can be used to state that a male person is over 21 years-old. [14] Yu-cheng Guo et al did the study to find whether the radiographic visibility of the periodontal ligament in third molars from a northern Chinese population can be used to

determine the 18-year threshold. Lucas et al found that the presence of periodontal ligament visibility-3 or periodontal ligament visibility -4 indicates that subject is over 18years with a very high level of probability. [13] Most of the males and female presented with stage 2 were more than 21 years of the age. These results of our study are in accordance with M Timme et al. who found that males and females were presented with stage 2 were older than 21years of life. [15] A significant result in our study was the lack of resemblance between the left and right side third molar periodontal ligament visibility stages and how these effects on estimated age. A large percentage of individuals differed in periodontal ligament visibility stage where both sides were included and this can result in a considerable difference in the estimated age. Our study has certain limitations like OPG provides 2 dimensional images as well as percentage distortion of image is there.

CONCLUSION

Radiographic diagnosis of the presence and position of third molar as well as the presence or absence of any pathology is crucial part of treatment planning. Our study concluded that the most common type of impaction seen in the adults was vertical type followed by mesioangular impaction. Bone resorption was seen with respect to third molar than second molar. The present study reveals the important insights regarding various patterns of impacted molars and bone resorption. Assessment of bone resorption is crucial aspect for determination of prognosis. Percentage distortion of the OPG radiographs and two-dimensional image were the limitations of the study. To overcome these limitations further studies should be carried out to prove this significance. Periodontal ligament visibility of lower third molar may become an important method in forensic age estimation. The effect of ethnicity on this method should further studied.

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How to cite this article: Rathod S, Ghoderao D, Kolte A et.al. Radiographic assessment of type of angulation and bone resorption in relation to mandibular third molar. *International Journal of Research and Review*. 2019; 6(12):549-554.
