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A cross-sectional study to evaluate impacted third molars using Orthopantamograph

Laliytha K.B[1], Sivaraman GS[2], Nelson A[3], Azhal Vel P[4], John Hearty Deepak R[5], Kathiravan S[6]
Saveetha Dental College, Vivekananda dental college for women, Ragas dental college, Ragas dental college, Sri Vekateshwara Dental College, Saveetha Dental College
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Abstract: Aim: The aim of the present study is to evaluate impacted mandibular third molars for pattern of impaction and relationship with mandibular canal using panaromic radiography. Methods and Material: The present study was conducted from March 2015 to August 2015. Panoramic radiographs were collected retrospectively from radiology clinics. A total of 145 samples were included in the study. Then from the samples, the following data was analyzed regarding the pattern of impaction, level of impaction, angulation and relationship of third molar to the inferior alveolar Canal with their roots and also assessment of any effect on the adjacent tooth structure such as an external root resorption. Results: Mandibular third molar impaction is more common between 18-27 years of age and is statistically significant. There is a statistically significant difference in the available space for eruption and side of impaction (P-value: <0.001). There is a statistically significant difference in the type of angulation and level of impaction (P-value: <0.001). Data was analyzed using the Statistical Package for the Social Sciences (version 15.0; SPSS, Inc, Chicago, IL). Conclusions: More precise studies with large randomized samples will be necessary to evaluate the prevalence of impaction. Further research is recommended with a larger sample size to find the difference gender wise

Keywords: Impaction, mandibular third molar, orthopantamograph, angulation, level of impaction, inferior alveolar canal, external root resorption, surgical removal.

1. Introduction

Tooth impaction is a pathological condition in which a tooth may not or will not erupt into its normal functioning position. Garn stated that the mandibular third molar is an unusual tooth characterized by variability in tooth formation, timing, variation in crown and root morphology and not infrequently, by agenesis (Garn SM). Impacted teeth are often associated with pericoronitis, cystic lesions, and adjacent root resorption sometimes completely asymptomatic also. The frequency of inferior alveolar nerve injury associated with mandibular third molar removal ranges from 0.6% to 5.3%. However the risk of permanent inferior alveolar nerve injury is less than 1% (Sandhu S). Panoramic radiography is a preferred radiographic technique to evaluate impacted third molars prior to surgical removal. The null hypothesis tested was that there were no differences between the right and left side impactions based on pattern of third molar impactions and its factors such as age, gender, the angulation type, available space and depth of impaction.

2. Materials and Methods

The present study was a retrospective, cross sectional prevalence study. The radiographs were collected

*Corresponding author (e-mail: lalithadentist@gmail.com)

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which was taken from a digital panaromic machine with 76 KvP, 5 mA and 9.3 seconds setting. A total of one hundred and seventy one OPG's were collected. The criteria for selection of radiographs of patient's with an age range between 18 to 40 years that has either unilateral or bilateral mandibular third molar impaction. Third molar was considered impacted if the roots were in complete formation and has not reached a functional occlusion. The exclusion criteria were OPGs with findings of orthodontic treatment, having underdeveloped roots, major pathologies such as cyst or tumour were excluded. One hundred and forty five OPGs were selected and the remaining was excluded from the study due to lack of fulfilling the inclusion criteria.

The radiographs were viewed digitally and measurements were made using digital software called DICOM viewer and analyzer. The available third molar space was determined using the Ganss method as the distance between the intersections of the vertical line with the occlusal plane, also the mesio-distal width of the third molar crown was recorded (Figure 1). The available space was determined and the impactions are classified as Class I, Class II, Class III (Ganss C).

1. Class I - The available space is more or equal to the mesio-distal diameter of third molar.
2. Class II - The available space is less than the mesio-distal diameter of the third molar.
3. Class III -The tooth was located completely within the mandibular ramus

Based on Radiographic analysis, the levels of eruption were categorized as Level A, B, C (Hazza'a M).

1. Level A: When there is crown to crown position between impacted third molar and second molar.
2. Level B: When there is crown to cervical position between the impacted third molar and second molar.
3. Level C: When there is crown to root position between the impacted third molar and second molar.

Angulation of impacted molars was also noted. Outline of the inferior alveolar canal was traced to record its relation to the third molar root apices as follows Adjacent, Superimposed, notching, Grooving, Perforation, None (Hazza'a M). Any effect on adjacent tooth structure such as caries or External root resorption was assessed

1. Adjacent: When the superior border of the canal was touching the root apices or within 2mm below them.
2. Super imposed: When the canal was superimposed over part of the roots which appeared less radio opaque than the remaining radiological image.
3. Notching: When there was a radiolucent band at the apex of the roots, a break in the continuity. When radiolucent band across the root above apex was present with interruption of both superior and inferior border of the canal, and narrowing of the canal space.
4. Perforation: With radiolucent band crossing the root above the apex and loss of both superior and inferior border of the canal at the area where they cross the root, with constriction of the canal maximal in the middle of the root was present.
5. None: When there was no relation between the canal and the root apices, condition was recorded.

The inclination of third molars was determined based on Winter's classification by measuring the angle formed between the line intersecting the long axis of the second and third molars, drawn through the midpoint of the occlusal surface and midpoint of the bifurcation. (Brann CR) Inclination of third molars was considered vertical if angle was +/-10◦, +11◦ to 70◦ was considered mesioangular, –11◦ to –70◦ was

considered distoangular and horizontal if more than 70◦. The sign (+) denotes that intersection of line is above the molars and sign (-) denotes that intersection of line is below the molars.In addition any effect on the adjacent tooth structure like dental caries or external root resorption was also evaluated.

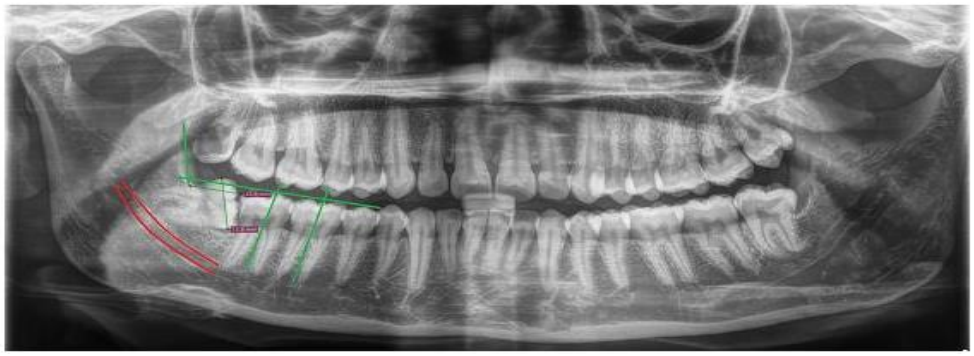


Figure 1: Tracing of OPG for evaluation of impacted mandibular third molar

3. Statistical analysis

The present study data was analyzed using the Statistical Package for the Social Sciences (version 15.0; SPSS, Inc, Chicago, IL). This study included a total of 145 samples of which 75(51.7%) were males and 70 were females (Table 1). A total of 86 (59.3%) samples were between 18-27 years, 43(29.7%) samples were between 28 to 37 years and 16(11%) samples were more than 37 years. Among the 145 samples 76 (52.4 %) samples had impacted mandibular third molar right side and 69 (47.6%) samples has impaction on left side (Table 2). The available space for eruption was maximum in class II relation of 85 samples (58.6%) followed by class I in 57 samples (39.3%), class II and class III in 3 samples (2.1%) (Table 3). According to the level of eruption, 60 (41.4%) samples had level B followed by 45 (31.0 %) samples had Level C and 40 (27.6 %) samples had level A (Table 4). Based on the relation of mandibular third molar with inferior alveolar nerve, 64 (44.1 %) samples were adjacent, 39 (26.9%) samples were superimposition, 19 (13.1 %) samples were notching, 5 (3.4 %) samples were grooving, 7 (4.8%) samples were perforation and 11 (7.6%) samples had no relation (Table 5). The most common type of impaction was mesioangular(41.4 %) followed by horizontal (29%), Vertical (25.5%), and distoangular (4.1%). Only 55 (37.9%) samples had external root resorption of the adjacent tooth and 90 samples had no effect on adjacent tooth (Table 6).

3.1 Simulation result analysis

Table 1: Chi-Square test to compare proportions between genders and age group

Age group	Gender					
	Male		Female		Total	
	N	%	N	%	N	%
18 - 27 yrs	46	61.3	40	57.1	86	59.3
28 - 37 yrs	17	22.7	26	37.1	43	29.7
> 37 yrs	12	16.0	4	5.7	16	11.0
Total	75	100.0	70	100.0	145	100.0
Pearson Chi-Square: 6.137					P-Value: 0.046	

Inference: Mandibular third molar impaction is more common between 18-27 years of age and is statistically significant

Table 2: Chi-Square test to compare proportions between sides of impaction.

Age group	Side of impaction					
	Left		Right		Total	
	N	%	N	%	N	%
18 - 27 yrs	40	58.0	46	60.5	86	59.3
28 - 37 yrs	22	31.9	21	27.6	43	29.7
> 37 yrs	7	10.1	9	11.8	16	11.0
Total	69	100.0	76	100.0	145	100.0
Pearson Chi-Square: Value: 0.355						P-value:0.837

Inference: There is no difference between the age group and side of impaction statistically

Table 3: Available space on right and left side of impaction

Available space	Side of impaction					
	Left		Right		Total	
	N	%	N	%	N	%
Class I	39	56.5	18	23.7	57	39.3
Class II	30	43.5	55	72.4	85	58.6
Class III	0	.0	3	3.9	3	2.1
Total	69	100.0	76	100.0	145	100.0
Fisher's Exact Test: Value: 17.440						P - Value: <0.001

Inference: There is a statistically significant difference in the available space for eruption and side of impaction.

Table 4: Level of eruption on right and left side

Level of eruption	Side of impaction					
	Left		Right		Total	
	N	%	N	%	N	%
Level A	20	29.0	20	26.3	40	27.6
Level B	28	40.6	32	42.1	60	41.4
Level C	21	30.4	24	31.6	45	31.0
Total	69	100.0	76	100.0	145	100.0
Pearson Chi-Square: Value: 0.129						P-value: 0.938

Inference: There is no statistical difference in the level of eruption and side of impaction

Table 5: Chi-Square test to compare proportions between side of impaction

Relation to Inferior alveolar nerve	Side of impaction					
	Left		Right		Total	
	N	%	N	%	N	%
Adjacent	34	49.3	30	39.5	64	44.1
Superimposition	17	24.6	22	28.9	39	26.9
Notching	10	14.5	9	11.8	19	13.1
Grooving	1	1.4	4	5.3	5	3.4
Perforation	3	4.3	4	5.3	7	4.8

No relation	4	5.8	7	9.2	11	7.6
Total	69	100.0	76	100.0	145	100.0
Fisher's Exact Test: Value: 3.291					P-Value: 0.670	

Inference: There is no statistical difference in the relation of impacted mandibular third molar and side of impaction.

Table 6: Type of angulation on right and left side

Angulation	Side of impaction					
	Left		Right		Total	
	N	%	N	%	N	%
Distoangular	4	5.8	2	2.6	6	4.1
Horizontal	16	23.2	26	34.2	42	29.0
Mesioangular	32	46.4	28	36.8	60	41.4
Vertical	17	24.6	20	26.3	37	25.5
Total	69	100.0	76	100.0	145	100.0
Fisher's Exact Test: Value: 3.206					P-Value: 0.363	

Inference: There is no statistical difference in the type of angulation and side of impaction

Table 7: Type of angulation and level of eruption

Angulation	Level of eruption							
	Level A		Level B		Level C		Total	
	N	%	N	%	N	%	N	%
Distoangular	5	12.5	1	1.7	0	0	6	4.1
Horizontal	2	5.0	13	21.7	27	60.0	42	29.0
Mesioangular	12	30.0	33	55.0	15	33.3	60	41.4
Vertical	21	52.5	13	21.7	3	6.7	37	25.5
Total	40	100.0	60	100.0	45	100.0	145	100.0
Fisher's Exact Test: Value:52.292							P-Value: <0.001	

Inference: There is a statistically significant difference in the type of angulation and level of impaction

4. Discussion

The prevalence of third molar impaction ranges between 16.7% and 68.6%. Our present study revealed a slight male predilection of mandibular third molar impaction than that of females. Most studies have reported no sexual predilection in third molar impaction (Kaya GS). However, some have also reported a higher frequency in females than males (Quek SL, Sandhu SS). There is a lack of definitive gender predominance in the third molar impaction. This has raised a question against Hellmen's statement that the jaws of the females cease to grow when third molar just begin to erupt. However, in males the growth of the jaws continues even beyond the eruption of third molar (F. N. Hattab).

Our present study had a Class II relation of available space to erupt followed by class I and class III. According to a study by Jerjes et al., they found maximum number of mandibular third molars in class I relation followed by class II and class III (Jerjes W). Lack of mesiodistal space seems to be major cause of

an obstacle to eruption. However eruption cannot be guaranteed even if there is an adequate space available in the jaw. Hattab and Abu Alhaija reported that the space distal to the second molar was decreased in 90% of cases with mandibular third molar impaction. The average space or the crown width ratio was 1:1 for erupted group and 0.8 for the impacted group (Hattab FN). According to studies by Ventä et al., it may be inaccurate to predict the eruption of third molars before the age of 20 years owing to the continuous positional changes of the third molar during development (Ventä I).

In our present study, the most common type of impaction was mesioangular(41.4 %) followed by horizontal (29%), Vertical (25.5%), and distoangular (4.1%). According to study conducted by Maryam A on mandibular third molar impaction was that the most common type of inclination was mesioangular (48.3%) followed by horizontal (29.3%). It appears that mesioangular impactions may be the commonest type and this may be owing to numerous factors such as delayed development, delay in maturation, an altered path of eruption and lack of available space in the mandible distal to second molar (Maryam A).

5. Conclusions

Thus to conclude, OPG serves as a valuable predictor of outcome of the impacted mandibular third molars position, as they are cost effective and gives maximum information. The right and left side impactions appear to be independent to the pattern of third molar impactions and its factors. In addition, the buccolingual orientation of tooth can pose a serious nerve injury during the surgical procedure. Thus, a three dimensional imaging technique such as a Cone Beam Computed Tomography can be considered.

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