

Panoramic Radiograph as a Diagnostic Tool for the Prediction of Mandibular Third Molar Eruption

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Abstract

Purpose: Third molar impaction is the most important clinical issue because it is involved in number of pathologies such as pericoronitis, caries, periodontitis, pathological resorption of mandibular second molar, cyst formation, benign and malignant odontogenic tumours and incisor crowding. The study based on impaction status of third molars and prediction of eruption is highly needful because early extraction of this teeth might help to avoid further complication or avoid extraction of the teeth that may possibly erupt normally.

Materials & Methods: 90 cases were selected according to the inclusion & exclusion criteria and panoramic radiograph was taken in Planmeca Promax panoramic x-ray machine. Two variables A (angle b/w long axis of second and third molar) & B (angle b/w long axis of third molar and tangent to the lower border of mandible) were measured from the panoramic radiograph for each case and the study was followed-up for 3 years. Mann-Whitney u test was carried out for statistical analysis.

Results: All the cases in the completely erupted group were in the angulation range of 20-30° for the variable A & 66.67% cases were in the angulation range of 60-70° for the variable B.

Conclusion: Mesially inclined third molars with an angulation range of 20-30° for the variable A & an angulation range of 60-70° for the variable B will be having more probability for complete eruption.

Key words: Angulation of the third molar, Panoramic radiograph, PMM3, Mandibular third molar.

Introduction

A tooth is considered as impacted if it fails to erupt into a normal functional position within normal time because of unfavourable angulations, aberrant path of eruption and inadequate space in the dental arch.^[1] Eruption of third molars generally occurs between the ages of 17-21 yrs.^[2,3] Because of its abortive eruption path, third molars accounts for 98% of all impacted teeth. Mandibular third molars are the most commonly impacted tooth with an incidence rate of 9.5 to 68% in different populations.^[4,5,6,7] The most commonly seen mandibular third molar impactions are mesioangular type and it accounts for more than 90%.^[8] Impaction of mandibular third molars is a serious problem in dentistry as it is involved in a series of pathologies such as pericoronitis, caries, periodontitis and cyst formation.^[4]

Prediction of mandibular third molar impaction or eruption would prove highly useful in clinical dentistry because the number of people reaching adult life with impacted third molars seems to be increasing to an epidemic extent. A study for assessing the impaction status of third molars and prediction of its eruption is highly useful because early extraction of this teeth might help to prevent further complication or avoid extraction of the teeth that may possibly erupt normally. The benefit of using panoramic radiographs

for predicting lower third molar eruptions is that it is very simple to use and studies have shown that it has a reliability of 97%.^[9]

Aims and Objectives

The aim of this present study was to investigate the variables associated with the prediction of eruption of permanent mandibular third molar and to measure the angulation most favorable for its eruption.

The objectives of this study was to investigate whether the variables associated with the eruption of permanent mandibular third molar could be co-related and significantly differentiated between a fully erupted and impacted permanent mandibular third molar. This study assessed the incidence rate of mandibular third molar impaction. Also, we assessed the frequency of mesioangular and distoangular impaction of mandibular third molars.

Materials and Methods

We selected 90 patients in the age group of 17-18 years who visited the out patient department of Oral Medicine and Radiology, Yenepoya Dental College, Yenepoya University, Mangalore after obtaining ethical clearance from the ethical committee of this institution. Patients undergoing orthodontic treatment, having missing tooth from mandibular arch and

having horizontally impacted mandibular molars, any history of trauma, developmental disorders were excluded from the study. Informed consent was obtained from all the patients included in the study. A standardized panoramic radiograph of each subject was taken following a standardized technique by means of Planmeca promax panoramic X-ray Machine.

According to the inclination of mandibular third molar, the subjects were divided into 2 groups:

1. Mesially inclined permanent mandibular third molar.
2. Distally inclined permanent mandibular third molar.

Measurements

The radiographs of all the subjects were traced and analyzed by a single observer and the following measurements were taken:[Fig. 1]

1. **Inclination of third molar (A):-** Angle between the long axis of permanent mandibular third molar and the long axis of adjacent permanent mandibular second molar.
2. **Angle made by PMM3 with the base of the mandible (B):-** Measured as the angle formed between the long axis of PMM3 and the tangent drawn to the inferior border of the mandible.

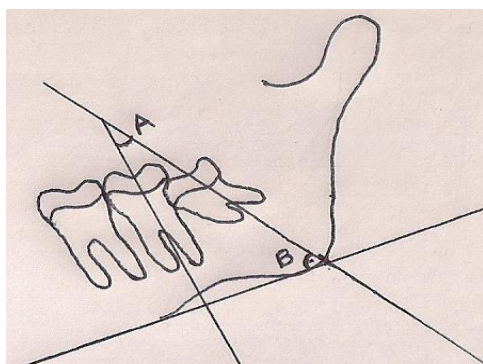


Fig. 1: Shows the tracing done on the panoramic radiograph for the measurement of angle A and angle B

Followed over a period of 3 years, the tests were repeated. By comparing position of permanent mandibular third molar with earlier taken radiograph, the angulation most favourable for the eruption of permanent mandibular third molar was evaluated. After obtaining the measurements, the values were analyzed statistically.

Statistical analysis: A statistical analysis of the measurements were carried out. The results were expressed as means and standard deviation of means. Mann- Whitney U test was carried out to find the significance of the test.

Results and Observations

Of the total 82 cases in the mesially inclined group, 9 cases were partially erupted, 3 were completely erupted & 70 were unerupted when the follow-up radiograph was taken. Of the total 8 cases in the distally inclined group, 2 cases were partially erupted, 6 were unerupted when the follow-up radiograph was taken. According to the definition of impaction, we considered the partially erupted third molars as impacted teeth.

1. Out of the 82 cases in the mesially inclined group, 3 cases showed completely erupted third molars after 3 years of study. All the 8 cases in the distally inclined group failed to erupt or were impacted. So out of the total 90 cases, 87 cases were impacted. Hence, according to our study, the incidence rate of mandibular third molar impaction is found to be 97%.
2. In this study, we observed that, out of the total 87 impacted cases, 79 cases were mesioangular type. Thus the frequency of mesioangular impaction in our study is found to be 91%.
3. The frequency distribution of angle A in the mesially inclined partially erupted, unerupted & completely erupted group ranged from minimum of 11 to maximum of 46 degrees for mesially inclined partially erupted group, minimum of 9 to maximum of 67 degrees for mesially inclined unerupted group & minimum of 23 to maximum of 26 degrees for mesially inclined completely erupted group.[Table 1]
4. The frequency distribution of angle B in the mesially inclined partially erupted, unerupted & completely erupted group ranged from minimum of 56 to maximum of 96 degrees for mesially inclined partially erupted group, minimum of 52 to maximum of 86 degrees for mesially inclined unerupted group & minimum of 62 to maximum of 77 degrees for mesially inclined completely erupted group.[Table 2]
5. The frequency distribution of angle A in the distally inclined partially erupted & unerupted group ranged from minimum of 14 to maximum of 16 degrees for mesially inclined partially erupted group & minimum of 9 to maximum of 22 degrees for mesially inclined unerupted group.[Table 3]
6. The frequency distribution of angle B in the distally inclined partially erupted & unerupted group which ranged from minimum of 81 to maximum of 92 degrees for mesially inclined partially erupted group & minimum of 69 to maximum of 97 degrees for mesially inclined unerupted group.[Table 4]
7. Comparison of angle A of mesially inclined group with that of distally inclined group which showed a *p* value <0.001 which was very highly significant.[Table 5]

8. Comparison of angle B of mesially inclined group with that of distally inclined group which showed a **p** value **0.01** which was significant.[Table 6]
 9. It was observed that all the teeth in the completely erupted group were in an angulations range of 20-30° for angle. A suggesting that this angulation of third molar is highly predictive of eruption of tooth.
 10. It was also observed that 66.67% of completely erupted cases of the present study were in an angulation range of 60-70° with the lower border of mandible. Thus, if angle B is in a range of 60-70°, it is highly predictive of third molar eruption.
- As seen in the table a significant difference in angle A & angle B is observed between the two groups & Mann-Whitney t test revealed that the variables A & B were highly significant as **P** value was less than 0.05.

Table 1: Frequency distribution of angle A in mesially inclined partially erupted, unerupted & completely erupted group

Degrees	Frequencies in partially erupted group	%	Frequencies in unerupted group	%	Frequencies in completely erupted group	%
0-10	0	0	1	1.42	0	0
10-20	4	44.44	13	18.57	0	0
20-30	2	22.22	24	34.29	3	100
30-40	2	22.22	25	35.71	0	0
40-50	1	11.11	4	5.71	0	0
50-60	0	0	1	1.42	0	0
60-70	0	0	2	2.86	0	0
Total	9	100	70	100	3	100

Table 2: Frequency distribution of angle B in mesially inclined partially erupted, unerupted & completely erupted group

Degrees	Frequencies in partially erupted group	%	Frequencies in unerupted group	%	Frequencies in completely erupted group	%
50-60	1	11.11	7	10	0	0
60-70	1	11.11	17	24.29	2	66.67
70-80	5	55.56	33	47.14	1	33.33
80-90	0	0.00	13	18.57	0	0
90-100	2	22.22	0	0	0	0
Total	9	100	70	100	3	100

Table 2: Table 3: Frequency distribution of angle A in distally inclined partially erupted & unerupted group

Degrees	Frequencies in partially erupted group	%	Frequencies in unerupted group	%
0-10	0	0	2	33.33
10-20	2	100	3	50
20-30	0	0	1	16.67
Total	2	100	6	100

Table 4: Frequency distribution of angle B in distally inclined partially erupted & unerupted group

Degrees	Frequencies in partially erupted group	%	Frequencies in unerupted group	%
60-70	0	0	1	16.67
70-80	0	0	3	50
80-90	1	50	0	0
90-100	1	50	2	33.33
Total	2	100	6	100

Table 5: Comparison of angle A of mesially inclined group with that of distally inclined group

	Group	N	Mean	Std. Deviation	Z
A	Mesially inclined group	82	28.5000	11.0345	3.945
	Distally inclined group	8	13.6250	4.2741	P<0.001 Significant at 0.001 levels

Table 6: Comparison of angle B of mesially inclined group with that of distally inclined group

	Group	N	Mean	Std. Deviation	Z
B	Mesially inclined group	82	71.9024	8.9313	2.583
	Distally inclined group	8	82.3750	9.8116	P=0.010 Significant at 0.01 levels

Discussion

The development of third molars, the age at which they develop, time, position and direction of its eruption are highly relevant to every branch of dentistry. The main reason for the clinical significance of third molars are because third molars most often follow an abortive eruption path and become impacted as a result of inadequate space between the second molar and ramus. Impacted or partially erupted third molars may be associated with numerous complications such as infection, pain, dental caries, root resorption and crowding. This necessitates the extraction of third molars in most of the patients. Therefore the assessment of germ position and prognosis of third molar eruption is of great interest for patient management.^[4]

In this study, an attempt was made to predict the eruption of mandibular third molar based on correlation of variables measured from panoramic radiograph. This would prove highly useful in clinical dentistry. There are numerous studies based on lateral cephalographic measures for the prediction of lower third molar eruption. In our study, panoramic tomograms were used as a predictor for the possibility of third molar eruption. Since panoramic tomograms were more and more widely available to most practicing dentists, it would be highly beneficial if such projections could be used as a predictor of future development of the third molars.^[4,10]

In the present study, patients selected were mostly in the age group of 17-18 years. Longitudinal studies on the positional changes and eruption of third molars demonstrate that many unerupted, partially erupted third molars are likely to shift their position and may erupt after the age of 20 years and that their final state remains highly unpredictable.^[11,12] In the present study we found significantly fewer completely erupted lower third molars compared to partially erupted molars during the 3 years of observation period which was similar to those observed in the earlier studies.^[13,14] Reasons for this may be either delayed eruption of third molars or due to an increased tendency for impaction. In the present study, final examination showed that approximately 84% of total

cases remained as unerupted during the 3 years observation period which was much higher compared to earlier studies & 12% cases were partially erupted which conforms well with the previous studies.^[11]

In the mesially inclined partially erupted group, 44% of cases were in the angulation range of 10-20 degrees in relation to second molar whereas 36% of cases in unerupted group were in the angulation range of 30-40 degrees. It was observed that all the teeth in the completely erupted group were in an angulations range of 20-30° with that of second molar which conforms well with the studies carried out by Richardson who reported that third molar with a small degree of angulation erupted earlier.^[13]

In the present study, 56% of mesially inclined partially erupted cases & 47% of unerupted cases were in an angulation of 70-80° to the lower border of mandible. 66.67% of completely erupted cases of the present study were in an angulation range of 60-70° with the lower border of mandible which conforms well with earlier studies.^[4] From the results of the present study, it can be concluded that third molars with a mesial angulation of 20-30° in relation to second molar & 60-70° in relation to lower border of mandible will have a greater probability for complete eruption.

There was no completely erupted teeth in the distally inclined group of the present study. In this group, 25% cases were partially erupted and 75% cases remained unerupted during the observation period of 3 years. Both the partially erupted and unerupted cases of this group were in an angulation of 10-20° in relation to second molar. All the partially erupted cases were in an angulation range of 80-100° & 50% of unerupted cases were in an angulation of 70-80° to the lower border of mandible.

In conclusion, by comparing with the results observed in the mesially inclined group, it can be interpreted that, irrespective of inclination, third molars with an angulation range of 10-20° with that of second molar and 70-80° to the lower border of mandible will not have the possibility of eruption. Based on the inclination of third molar in relation to second molar & lower border of mandible, in our

study it is possible to carry out a long-term study so as to predict the ultimate position of lower third molar in the arch.

Conflict of Interest: None

Source of Support: Nil

References

1. Khawaja NA. Third molar impaction: a review. *J Pak Dent Assoc* 2006;15(2):97-101.
2. Juodzbaly G, Daugela P. Mandibular Third Molar Impaction: Review of Literature and a Proposal of a Classification. *Journal of Oral and Maxillofacial Research* 2013;4(2):e1-12.
3. Fuiler JL, Denehy GE. Concise dental anatomy and morphology. 3rd ed. Chicago: Year Book Medical Publishers, Inc;1981.p.225.
4. Amin K, Vasavi K, Vahanwala S, Nayak CD, Pagare SS, Ramdev SS. Co- relation of variables as determined from panoramic radiograph and evaluating their significance in eruption of permanent mandibular third molar. *JIAOMR* 2008;20(1):14-7.
5. Secic S, Prohic S, Komsic S, Vucovic A. Incidence of impacted mandibular third molars in population of Bosnia and Herzegovina: a retrospective radiographic study. *Journal of Health Sciences* 2013;3(2):151-158.
6. Richardson M. Late third molar genesis: its significance in orthodontic treatment. *The Angle orthodontist* 1980;50(2):121-8.
7. Richardson M. Changes in lower third molar position in the young adult. *Am J Orthod Dentofac Orthop* 1992;102(4):320-7.
8. Breik O, Grubor D. The incidence of mandibular third molar impactions in different skeletal face types. *Australian Dental Journal* 2008;53(4):320-324.
9. Venta I, Murtomaa H, Ylipaavalniemi P. A device to predict lower third molar eruption. *Oral Surg Oral Med Oral Pathol* 1997;84(6):598-603.
10. Hattab FN, Elham SJ, Alhaija A. Radiographic evaluation of mandibular third molar eruption space. *Oral Surg Oral Med Oral Pathol* 1999;88(3):285-91.
11. Hattab FN. Positional changes and eruption of impacted mandibular third molars in young adults-a radiographic 4-year follow-up study. *Oral Surg Oral Med Oral Pathol* 1997;84(6):604-8.
12. Hattab FN, Rawashdeh MA, Fahmy MS. Impaction status of third molars in Jordanian students. *Oral Surg Oral Med Oral Pathol* 1995;79(1):24-9.
13. Richardson ME. The etiology and prediction of mandibular third molar impaction. *The Angle Orthodontist* 1977;47(3):165-72.
14. Rajasuo A, Murtomaa H, Meurman JH. Comparison of the clinical status of third molars in young men in 1949 and in 1990. *Oral Surg Oral Med Oral Pathol* 1993;76(6):694-8.