

## Differences in various measurements on panoramic radiograph among erupted and impacted lower third molar groups

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### Abstract

**Objective:** To determine the differences in various linear and angular measurements between erupted and impacted lower third molar group on conventional panoramic radiographs.

**Methods:** The quasi-experimental study based on non-probability convenience sampling and done at the National Institute of Oral Diseases, Karachi, comprised 140 patients having full dentition with bilaterally present mandibular third molars varying between ages of 18-30 years. After clinical examination, 280 lower third molars were divided into two groups; Group A had erupted, while Group B comprised impacted mandibular third molars. All radiographs were traced and measured for five variables to compare the two groups. For statistical purpose, SPSS version 10, and t test were used.

**Results:** Retromolar space measured from Xi (centre of ramus) was  $31.60 \pm 3.33$  mm in Group A and  $27.02 \pm 4.17$  mm in Group B. Retromolar space measured from anterior edge of ramus (AER) was  $16.30 \pm 2.51$  mm in Group A and  $11.21 \pm 3.69$  in Group B. Mesiodistal width was  $13.39 \pm 1.44$  mm in Group A and  $13.80 \pm 1.58$  in Group B. Retromolar space/width ratio was  $1.22 \pm 0.20$  for Group A and  $0.82 \pm 0.34$  for Group B. Mean angulations in Group A was  $5.98 \pm 5.9^\circ$  whereas  $34.56 \pm 27.89^\circ$  in Group B.

**Conclusion:** The probability of eruption of the lower third molar increases if retromolar space measured from anterior edge of ramus (AER-7) and centre of ramus point (Xi-7) is 13mm and 25mm respectively, provided the space/width ratio is greater than 1 and angulation is also vertical. Mesiodistal width of the tooth has no significant role in impactions.

**Keywords:** Third molar group, Anterior edge of ramus, Centre of ramus. (JPMA 62: 883; 2012)

### Introduction

Impaction may be defined as the failure of complete eruption into a normal functional position of one tooth within normal time due to lack of space in the dental arch, caused by obstruction by another tooth or development in an abnormal position.<sup>1</sup>

The most often congenitally missing as well as impacted teeth are the third molars, which are present in 90% of the population with 33% having at least one impacted third molar.<sup>2</sup> They account for 98% of all the impacted teeth.<sup>3</sup>

The mandibular third molar is the most frequently impacted tooth.<sup>4</sup> The incidence varies from 9.5% to 25% in different populations.<sup>5</sup> Several factors have been reported to be responsible for the high rate of impaction of mandibular third molars. These include deficient space in the dental arch,<sup>6</sup> unfavourable angulations and aberrant path of eruption, density of overlying soft and hard tissues, and the late eruption sequence.<sup>4</sup> Mesiodistal width of the

third molar may also play a role in the tendency for impactions.<sup>7</sup>

The ability to predict the eruption or impaction of third molars is of considerable value in clinical dentistry. If they erupt, they may be beneficial for orthodontic anchorage, prosthetic abutments, or transplantation.<sup>8</sup> If they get impacted, they can cause adjacent root resorption, inflammatory process (pericoronitis), temporomandibular joint dysfunction and late incisor crowding;<sup>9</sup> thus prophylactic removal greatly reduces risk to a patient as opposed to extraction later in life.<sup>10</sup> Early germectomy can also reduce the risk of intra-operative and post-operative complications associated with surgery on a fully developed third molar such as nerve damage with resultant paresthesia, dry socket, inflammation, bleeding, and pain.<sup>11</sup> Therefore, assessment of germ position and progress of mandibular third molar eruption is necessary for better patient management.

Many studies have been done to predict the

probability of third molar eruption. Henry and Morant<sup>12</sup> suggested third molar space index, while Schulhof<sup>13</sup> used centre of ramus (Xi) point to measure the available space for eruption of the mandibular third molar. Most of the authors have used lateral cephalometric radiograph, but because of least amount of superimposition, orthopantomogram (OPG) is considered a more accurate radiograph to evaluate the position of the third molar.<sup>9,14-17</sup>

Although accurate prediction of third molar eruption or impaction is not possible before 20 years of age, but the differences in various angular and linear measurements performed on radiographs of impacted and erupted lower third molars can be used as a reference for early prediction of lower third molar eruption or impaction. Therefore, the purpose of this study was to determine the differences in various measurements among the erupted and impacted lower third molars on conventional panoramic radiograph. It was hypothesised that retromolar space, mesiodistal width and initial angulations of the lower third molar have a significant role of their own in the impaction and eruption of the tooth.

### Patients and Methods

The study was conducted at the National Institute of Oral Diseases, Karachi. The study design was quasi-experimental whereas the study population was based on non-probability convenience sampling. A sample size of about 142 third molars in each group was calculated to detect a two-sided difference of 1mm in Xi -7 assuming a standard deviation (SD) of 3 mm at 5% level of significance and 80% power. The final sample has 140 patients having full dentition with bilaterally present mandibular third molars varying between ages of 18 and 30 years. Of them, 74 were females and 66 were males. Patients with worn-out dentition, previous orthodontic treatment or dentofacial anomalies were excluded. Two groups of mandibular third molars were formed on the basis of dental examination of the patients. Group A had those mandibular third molars which were fully erupted into functional position whereas Group B comprised those mandibular third molars which were below the occlusal plane/erupted up to the occlusal plane but not fully functional because of their aberrant angulations. Conventional panoramic radiographs of all the patients were taken by means of an orthopantomograph machine (Rotograph plus, model MR05, CEI Bologna Italy with the magnification of  $\times 1.2$ ). The radiographs were traced on overlying acetate paper and analysed by means of various measurements (Figure-1).

Retromolar space was measured by drawing a line from Ricketts Xi point i.e. centre of ramus to distal surface of the lower second molar.

Retromolar space from anterior edge of ramus AER-7

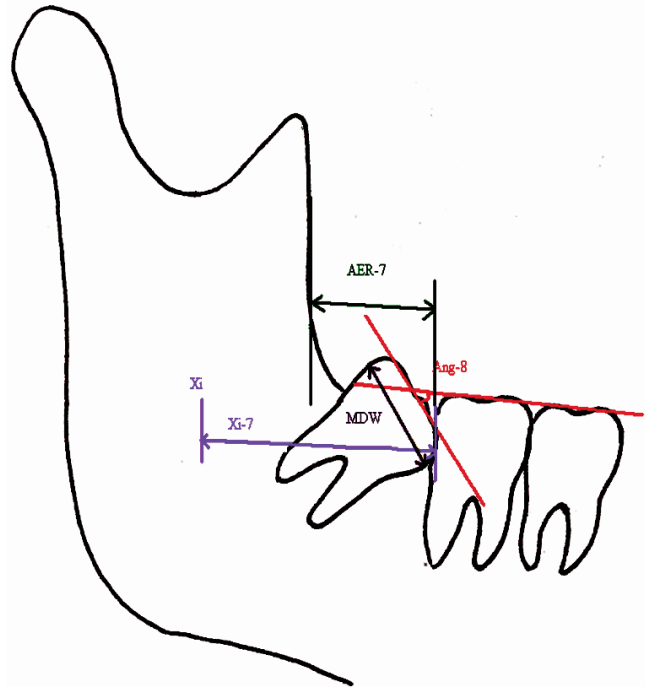


Figure-1: Measurement of Retromolar space.

was measured up to the distal surface of the lower second molar along the occlusal plane.

Mesiodistal width of the lower third molar (MDW) was calculated, while the space/width ratio (SWR) was obtained through  $AER-7/MDW$ . The angulations of the lower third molar (Ang-8) were measured using the method of Ventä.<sup>18</sup> The angle between the occlusal line of the lower third molar and the occlusal plane was measured. The angulations were classified as: Vertical ( $\pm 10$  degrees); Mesioangular ( $11 \pm 70$  degrees); Distoangular ( $11 \pm 70$  degrees); and Horizontal (greater than  $\pm 71$  degrees).

All the measurements were recorded by one author and then reconfirmed by the other authors for reliability of data, which was then analysed with independent t test using SPSS version 10 for detecting the difference between the two group means.

### Results

Of the 140 subjects with a total of 280 mandibular third molars, 168 teeth were impacted, while 112 molars were erupted (Table-1). In Group A, the mean distance between Xi-7 was  $31.60 \pm 3.33$  mm, whereas in Group B it was  $27.02 \pm 4.17$  mm. There was significant difference ( $p=0.00$ ) between the groups (Table-2).

In terms of AER-7, the difference was again

**Table-1: Descriptive statistics of Group A and B.**

	Minimum	Maximum	Mean±SD
<b>Group A (erupted mandibular third molars)</b>			
Xi-7 (mm)	25	39	31.60±3.33
AER-7 (mm)	13	22	16.30±2.51
MDW (mm)	9	17	13.39±1.44
SWR	0.93	2	1.22±0.20
Ang-8 (°)	-8	22	5.98±5.90
<b>Group B (impacted mandibular third molar)</b>			
Xi-7 (mm)	18	37	27.02±4.17
AER-7 (mm)	1	22	11.21±3.69
MDW (mm)	5	16	13.80±1.58
SWR	0.07	3	0.82±0.34
Ang-8 (°)	-20	90	34.56±27.89

Xi-7: Centre of ramus. AER-7: Anterior edge of ramus. MDW: Mesiodistal width. SWR: Space width ratio. Ang-8: Angulation.

**Table 2: Comparison and differences in measured variables for Group A and B.**

	Group A (mean)	Group B (mean)	difference in means	p value
Xi-7 (mm)	31.60	27.02	-4.58	≤0.001
AER-7 (mm)	16.30	11.21	-5.08	≤0.001
MDW (mm)	13.39	13.80	0.416	0.117
SWR	1.22	0.82	-0.399	≤0.001
Ang-8 (°)	5.98	34.56	27.17	≤0.001

\*Statistically significant at p < 0.05.

Xi-7: Centre of ramus. AER-7: Anterior edge of ramus. MDW: Mesiodistal width. SWR: Space width ratio. Ang-8: Angulation.

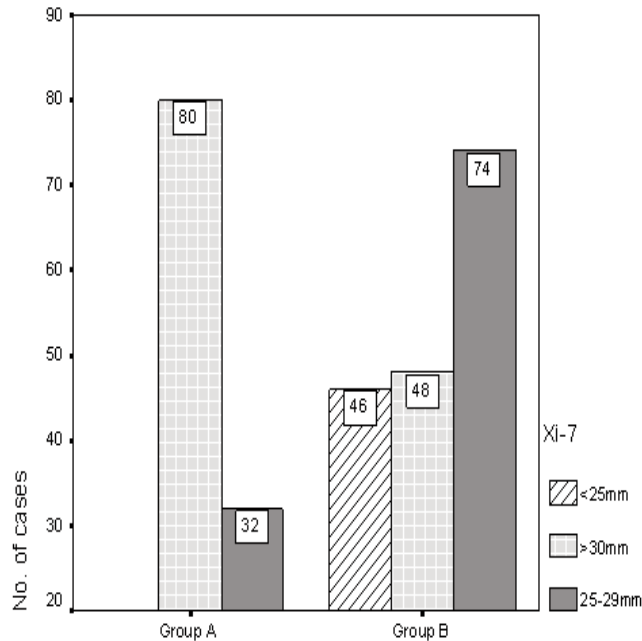


Figure-2: distribution of mandibular third molars in groups according to retromolar space available (Xi-7).

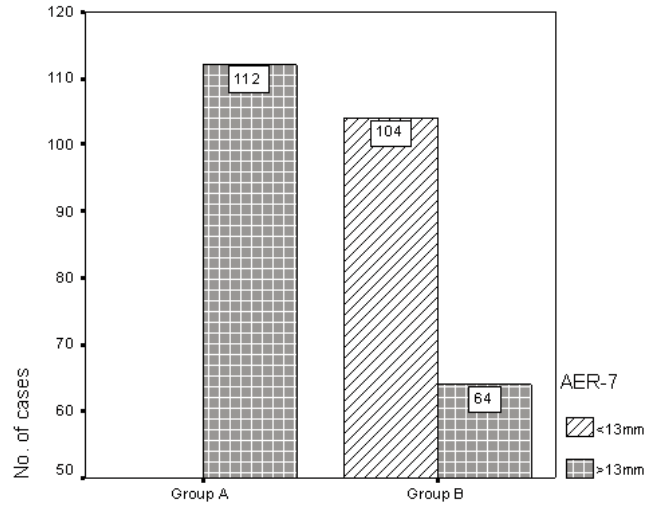


Figure-3: distribution of mandibular third molars in groups according to retromolar space available (AER-7).

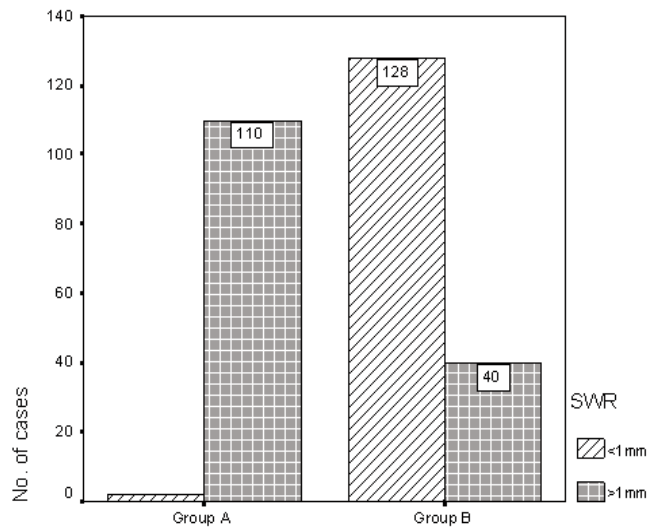


Figure-4: distribution of lower third molars in Groups according to Space width ratio (SWR).

significant (p=0.00). It was insignificant (p=0.117) for MDW, while the difference was significant for SWR (p=0.00) and ANG-8 (p=0.00).

## Discussion

Mandibular third molars exhibit the highest rate of impaction as well as the highest rate of agenesis.<sup>19</sup> Hellman<sup>20</sup> found the rate of mandibular third molar impaction up to 9.5% while Björk<sup>5</sup> found 17% to 22% in the two groups of patients in his research.

Although third molar impaction has multifactorial elements, but inadequate retromolar space for eruption is

considered to be the major factor.<sup>11,16</sup> The distance from Xi to the distal surface of the lower second molar is the most useful measurement for the evaluation of lower third molar space.<sup>21</sup> In the current study, the mean value for Xi-7 was 31.60 mm for Group A and 27.02 mm for the Group B which was close to findings by others.<sup>13</sup> In Group A, 100 (71.4%) of mandibular third molars had Xi-7 value >30mm while 40 (28.57%) had Xi-7 value between 25-29mm which shows that the minimum required value for successful eruption of the lower third molar is 25mm if the angulation is favourable (Figure-2). In Group B, 28.5% had Xi-7 value >30mm while 62 (44%) mandibular third molars had Xi-7 value between 25-29mm, and 38 (27.38%) had Xi-7 value <25mm which shows that retromolar space is not the only factor responsible for the lower third molar impaction. Quiros<sup>22</sup> used panoramic radiograph and found the range of 35-39mm for the successful eruption of the lower third molar. In another study conducted on Iraqi population using digital panoramic radiographs, the mean value for Xi-7 was 29.2mm for marginal eruption group and 35.2mm in males and 34.4mm in females with full eruption.<sup>18</sup>

In our study, the mean distance from AER to the distal surface of second molar was 16.30mm for the Group A and 11.21mm for Group B. Significant difference was observed between the two groups. Ventä<sup>10</sup> also reported that the probability of eruption is 100% if the retromolar space is at least 16.5mm. Quiros<sup>22</sup> also found the range between 14-17mm in the erupted group. Minimum retromolar space required for the eruption of lower third molar measured from AER-7 observed in our study was 13mm (Figure-3) which was almost similar to the findings of Hattab at el<sup>8</sup> who reported 13.9mm for females and 14.3mm for males.

Mesiodistal crown widths of lower third molars were more or less similar in both the groups, i.e. 13.39mm for Group A and 13.80mm for Group B; with average difference of 0.41mm. Other studies,<sup>8,10</sup> also confirmed that third molars were larger in the impacted group, but the difference was insignificant.

The SWR was greater in the erupted group with the mean value of 1.22 whereas in the impacted group, it was 0.82 (Figure-4). This is in accordance with previous research<sup>23</sup> which found this ratio to be 0.85 in the marginal eruption group and 1.94 in the full eruption group. In this study, 76.2% of the impacted cases had ratio of less than 1, while 23.8% cases had SWR of more than 1. However, in the erupted group, 98.21% of the lower third molars had SWR >1. Dierkes<sup>24</sup> stated that some third molars get impacted even in the presence of sufficient space.

It has been demonstrated that the greater the inclination, the greater the probability of impaction.<sup>25</sup> Mean angulations of the lower third molars among the impacted

group was found to be 34.56°, while in erupted group, it was 5.98°. Significant difference of 27.17° between the two groups was observed. It has been suggested in another study that if a third molar has a low initial inclination and adequate space, then eruption is possible.<sup>26</sup> Among Group A, 100 (71.42%) of lower third molars were vertical, while 40 (28.57%) were mesioangular. A maximum angulation of lower third molar in the erupted group was found to be 22°. Among Group B, 80 (57.14%) of lower third molars were mesioangular; 39 (27.85%) were vertical; 18 (13.09%) showed horizontal angulation; and 3 (2.38%) were distoangular. Queck<sup>27</sup> in his study also reported the highest frequency of mesioangular impactions as well as Uthman<sup>23</sup> made the same conclusion in his study.

## Conclusion

Early removal of those mandibular third molars which are unlikely to erupt in a normal position can prevent the associated pathology and surgical complications. Results from the study can be useful in assessing the prognostic value of mandibular third molars on conventional orthopantomogram.

## References

1. Khawaja NA. Third molar impaction: a review. *J Pak Dent Assoc* 2006; 15: 97-101.
2. Haq Z. A Survey of reasons for Surgical Removal of Impacted Mandibular third Molar in Armed Forces Personnel at AFID Rawalpindi. *Pak Oral Dent J* 2002; 22:137-9.
3. Saderni Fayad J, Levy JC, Yazbeck C, Cavezian R, Cabanis EA. Eruption of third molars: relationship to inclination of adjacent molars. *Am J Orthod Dentofacial Orthop* 2004; 125: 200-2.
4. Peterson LJ. Principles of management of impacted teeth. In: Peterson LJ, Eills E, Huup JR, Tucker MR, editors. *Contemporary oral and maxillofacial surgery*. 4th ed. New York: Mosby, 2003; 184-213.
5. Björk A, Jensen E, Palling M. Mandibular growth and third molar impaction. *Acta Odont Scandinav* 1956; 14: 231-72.
6. Bishara SE, Andreasen G. Third molars: a review. *Am J Orthod* 1983; 83: 131-7.
7. Henry CB. Excision of the developing mandibular third molar by lateral trepanation. A new approach with a reappraisal of the enucleation of the unmineralised germ. *Br Dent J* 1969; 127: 111-8.
8. Hattab FN, Alhaija ES. Radiographic evaluation of mandibular third molar eruption space. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 1999; 88: 285-91.
9. Daley T.D. Third molar prophylactic extraction, a review and analysis of the literature. *Gen Dent* 1996; 44: 310-2.
10. Ventä I, Murtomaa H, Ylipaavalniemi P. A device to predict lower third molar eruption. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 1997; 84: 598-603.
11. Niedzielska IA, Drugacz J, Kus N, Kreska J. Panoramic radiographic predictors of mandibular third molar eruption. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2006; 102: 154-8.
12. Henry BC, Morant GM. A preliminary study of the eruption of the mandibular third molar tooth in man based on measurements obtained from radiographs, with special reference to the problem of predicting cases of ultimate impaction of the tooth. *Biometrika* 1936; 28; 378-427.
13. Schulhof RJ. Third molars and orthodontic diagnosis. *J Clin Orthod* 1976; 10: 272-81.
14. Larheim TA, Svanaes DB. Reproducibility of rotational panoramic radiography: mandibular linear dimensions and angles. *Am J Orthod*

- Dentofacial Orthop 1986; 90: 45-51.
15. Mattila K, Altonen M, Haavikko K. Determination of the gonial angle from the Orthopantomogram. *Angle Orthod* 1977; 47: 107-10.
  16. Olive R, Basford K. Reliability and validity of lower third molar space assessment techniques. *Am J Orthod* 1981; 79: 45-53.
  17. Wenzel A, Aagaard E, Sindet-Pedersen S. Evaluation of a new radiographic technique: diagnostic accuracy for mandibular third molars. *Dentomaxillofac Radiol* 1998; 27: 255-63.
  18. Ventä I, Murtomaa H, Turtola L, Meurman J, Ylipaavalniemi P. Assessing the eruption of lower third molars on the basis of radiographic features. *Br J Oral Maxillofac Surg* 1991; 29: 259-62.
  19. Lucchese A, Manuelli M. Prognosis of third molar eruption: a comparison of three predictive methods. *Prog Orthod* 2003; 4: 4-19.
  20. Hellman M. Some aspects of wisdom teeth and their impactions. *Arch Clin Oral Path* 1938; 2: 125-41.
  21. Ricketts RM, Turley P, Chaconas S, Schulhof RJ. Third molar enucleation: diagnosis and technique. *J Calif Dent Assoc* 1976; 4:52-7.
  22. Quiros OJ, Palma A. The mandibular third molar. A method of predicting its eruption. *The Orthodontic Cyber Journal*. (Online) (Cited 1999 July 20). Available from URL: <http://www.oc-j.com/3rdmolar/3rdmlr.html>.
  23. Uthman AT. Retromolar space analysis in relation to selected linear and angular measurements for an Iraqi sample. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2007; 104: e76-82.
  24. Dierkes DD. An investigation of the mandibular third molars in orthodontic cases. *Angle Orthod* 1975; 45: 207-12.
  25. Shiller WR. Positional changes in mesio-angular impacted mandibular third molars during a year. *J Am Dent Assoc* 1979; 99: 460-4.
  26. 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 Oral Radiol Endod* 1997; 84: 604-8.
  27. Queck SL, Tay CK, Tay KH, Toh SL, Lim KC. Pattern of third molar impaction in a Singapore Chinese population: a retrospective radiographic survey. *Int J Oral Maxillofac Surg* 2003; 32: 548-52.
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