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# Assessment of Third Molar Impaction Pattern in the Mandible and in the Maxilla

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**Abstract**

**Aim:** The aim of this study was to compare characteristics of erupted and impacted third molars in the mandible and the maxilla using quantitative measurements and determine any relationship between the eruption/impaction pattern of third molars in both jaws with available eruption space and tooth inclination.

**Material and Methods:** Patients who visited to the Department of Oral and Maxillofacial Surgery at tertiary care institute of India were screened for eligibility to join our study. The eruption status of the third molars in both jaws were examined on orthopantomographs by measuring the distance from the line tangent to the highest points of occlusal cusps of the third molar to that of the adjacent second molar. The presence of available space for the eruption was determined by the ratio of the mesiodistal length of the third molar crown to the length of the alveolar arch distal to second molars.

**Results:** There was sufficient space for the eruption of third molars in 17.6% of the cases in the mandible as opposed to 61.7% of the cases in the maxilla. In the mandible, 37.7% of third molars were in vertical position, 37.1% were in mesioangular position, and 19.9% were in distoangular position. In the maxilla, 62.5% of third molars were in vertical position and 33.12% were in distal inclination. The presence of favorable parameters does not warrant full eruption of third molars in both jaws.

**Conclusion:** Removal of impacted third molars is the most commonly employed procedure in oral surgery practice. Pain and pericoronitis were the most common symptoms usually associated with level A impaction and vertical position.

**Keywords:** impacted third molars, Mandible, Maxilla, Pericoronitis

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## Introduction

Tooth impaction is a pathological situation in which a tooth cannot or will not erupt into its normal functioning position.[1] In human dentition, the third molars have the highest impaction rate of all teeth. The major factors related to tooth impaction are lack of space, limited skeletal growth, increased crown size and late maturation of the third molars.[2] Although impacted third molars may remain symptom free indefinitely, they could give cause for various symptoms and pathologies, such as pericoronitis, pain, swelling, distal caries, bone loss, root resorption of adjacent teeth, odontogenic cysts and tumors.[3] It is considered that the occurrence of pathology resulting from impaction has a multifactorial origin.[4] Eruption status, position and angulation have an impact on these symptoms.[5]

Third molar impactions are rarely observed after second molar extraction, suggesting an increase in eruption space.[6]Recent studies have also demonstrated that premolar extraction therapy as part of orthodontic treatment leads to a reduced frequency of third molar impaction in both the maxilla and mandible.[7]

There have been a number of reports on the association of third molar impaction with the available space for an eruption in the alveolar arch and with the inclination of the teeth.[8-11]A deficiency of space in the alveolar arch and/or unfavorable inclination of third molar have been the chief factors implied in the failure of third molars to erupt. However, studies on these two factors have been mainly on the mandible with scarce reports comparing both of the jaws.[9,10] Moreover, most of the studies used the Pell and Gregory classification system for the vertical and horizontal impaction level and Winter classification system for the angulation. These traditional classification systems utilize the anatomical landmarks as a reference point and are subjective. Although a high level of intra and interexaminer agreement was achieved for classification of inclination of third molars by the Winter criteria, the classification of third molars following the Pell and Gregory criteria were shown to lack both intra and interexaminer reproducibility.[12]

The aim of this study was to compare characteristics of erupted and impacted third molars in the mandible and the maxilla using quantitative measurements and determine any relationship between the eruption/impaction pattern of third molars in both jaws with available eruption space and tooth inclination.

## Material and Methods

Patients who visited to the Department of Oral and Maxillofacial Surgery at tertiary care institute of India were screened for eligibility to join our study. Those over 20 years of age and those who had orthopantomographs for radiographic examination were selected by retrospectively. The exclusion criteria of the study were tooth agenesis other than third molars; previous extraction of any permanent teeth (including third molars); previous orthodontic treatment, dentoalveolar surgery or maxillofacial trauma; developmental anomalies such as ectodermal dysplasia, cleft lip or plate; asymmetric deformity on the face; and radiographs of poor quality.

A total of 500 individuals, who met the inclusion/exclusion criteria and agreed to join the study, were included. Ethical approval was taken from the institutional ethical committee and written informed consent was taken from all the participants.

Orthopantomographs were examined to determine the presence of third molars. Where present, measurements were performed for spatial positioning of third molars.

Retromolar space width was calculated as the distance from distal contact point of the lower second molar to the junction of the anterior border of the ramus with the body of the mandible, landmarked as intersection of the mandibular occlusal plane with the anterior border of ramus. Tuber space width was calculated as the distance from the distal contact point of the upper second molar to the line tangent to the posterior wall of the maxilla. Crown width of the third molars was determined by measuring the greatest distance between the mesial and distal surface of the crown. The presence of sufficient space for the eruption was calculated by the ratio of eruption space width in the maxillary and the mandibular alveolar arch to the third molar crown width. A classification was made accordingly: a ratio of at least 1 indicating available space; a ratio of 1–0.67 indicating a mild lack of space; a ratio of 0.66–0.33 indicating a moderate lack of space; and a ratio of 0.32–0 indicating a severe lack of space.

The inclination of the third molars was determined by their sagittal relationship to the adjacent second molar. Lines tangential to the highest points of occlusal cusps of the third molar and the second molar were drawn. The angle formed between the intersected lines gave the degree of third molar

inclination relative to the second molar. Accordingly, third molars positioned 170°–190° to the second molar were classified as vertical. An angle above 190° was regarded as distoangular(191°–225°, partially distoangular and 226°–260°, fully distoangular) while an angle below 170° was regarded as mesioangular (135°–169°, partially mesioangular and 100°–134°, fully mesioangular). Those positioned in an angle between 80° and 99° were regarded as horizontal. The other was classified as ectopic.

Eruption level of third molars was recorded measuring the distance from the occlusal table of the third molar to that of the adjacent second molar. Eruption level of mandibular third molars was classified as: (−1)0 mm fully erupted; 0.1–4.9 mm, infraocclusion; 5–9.9 mm, intermediate impaction; 10 mm and above, deep impaction. Eruption level of maxillary third molars was classified as 0–1 mm, fully erupted; 1.1–6 mm, infraocclusion; 6.1–10.9 mm, intermediate impaction; 11 mm and above, deep impaction.

## Statistical analysis

The recorded data was compiled and entered in a spreadsheet computer program (Microsoft Excel 2007) and then exported to data editor page of SPSS version 15 (SPSS Inc., Chicago, Illinois, USA). For all tests, confidence level and level of significance were set at 95% and 5% respectively.

## Results

Among 500 individuals, 240 (48%) were female and 260 (52%) were male. The mean age was 24.9 with the minimum being 20 and maximum being 51 years of age. While 50 (10%) mandibular third molars on the right and 43 (8.6%) on the left were missing, 98 (19.6%) maxillary third molars on the right and 117 (23.4%) on the left were missing. Therefore, 907 mandibular third molars and 785 maxillary third molars were evaluated.

Table 1 shows the means ± standard deviations of parameters related to all third molars examined in this study. Mandibular third molars had a wider mesiodistal crown length compared to their maxillary counterparts. The space available for the eruption of third molars on the alveolar arch was shorter in the mandible than that in the maxilla.

Table 2 shows the frequency and percentage of parameters related to third molars. There was sufficient space for the eruption of third molars in 17.6% of the cases in the mandible as opposed to 61.7% of the cases in the maxilla. In the mandible, 37.7% of third molars were in vertical position, 37.1% were in mesioangular position, and 19.9% were in distoangular position. In the maxilla, 62.5% of third molars were in vertical position and 33.12% were in distal inclination. The eruption/impaction level of third molars in both jaws was correlated with the inclination of teeth and with the crown/available space ratio. In addition, the inclination of the third molars correlated with available eruption space.

The predominant impaction type was vertical in both jaws, which was followed by partial mesial inclination in the mandible (22.7%) and partial distal inclination in the maxilla (39.6%). When there is sufficient space for eruption, 12.5% of third molars in the mandible as opposed to 63.7% third molars in the maxilla got impacted. In the mandible, the deepest impaction was observed in teeth with horizontal orientation, followed by fully mesioangular and partially mesioangular position. In the maxilla, partial mesioangular teeth had the deepest impaction.

As a whole, 75.5% of maxillary and 56.2% of mandibular fully erupted third molars were vertically oriented. The second most common inclination for full eruption for both jaws was partial distal angulation. More than half of the third molars (65.3%) in the mandible as opposed to 15.5% in the maxilla were fully erupted even when there was inadequate space on the alveolar arch to accommodate the full mesiodistal length of the crown. However of these teeth with favorable parameters, 26.4% of mandibular and 59.4% of maxillary third molars had a chance to fully erupt.

**Table 1: Mean values of parameters related to the third molars in the mandible and maxilla**

| Variable | Mandible | Maxilla |
|---|---|---|
| **Crown width (mm)** | 10.6±1.2 | 9.3±1.0 |
| **Available eruption space (mm)** | 7.5±2.6 | 10.3±2.6 |
| **Ratio of eruption space/crown** | 0.6±0.2 | 1.3±0.4 |
| **Inclination (°)** | 166.1±30.4 | 185.4±14.2 |
| **Level of impaction (mm)** | 2.4±2.1 | 3.1±3.2 |

**Table 2: Spatial orientation of third molars**

| Variable | Mandible (907) (%) | | Maxilla (785) (%) | |
|---|---|---|---|---|
| **Presence of space for third molars** | | | | |
| **Sufficient space** | 160 | 17.6 | 485 | 61.7 |
| **Mild lack of space** | 332 | 36.6 | 175 | 22.2 |
| **Moderate lack of space** | 338 | 37.3 | 77 | 15.8 |
| **Severe lack of space** | 77 | 8.5 | 48 | 6.11 |
| **Inclination of third molars** | | | | |
| **Horizontal** | 48 | 5.3 | - | |
| **Fully mesioangular** | 150 | 16.5 | 10 | 1.27 |
| **Partially mesioangular** | 187 | 20.6 | 56 | 7.13 |
| **Vertical** | 342 | 37.7 | 491 | 62.5 |
| **Partially distoangular** | 140 | 15.4 | 220 | 32.11 |
| **Fully distoangular** | 38 | 4.19 | 8 | 1.01 |
| **Level of third molar eruption/impaction** | | | | |
| **Fully erupted** | 150 | 16.5 | 300 | 38.21 |
| **Infraocclusion** | 500 | 55.2 | 320 | 40.76 |
| **Intermediate impaction** | 170 | 18.7 | 150 | 19.1 |
| **Deep impaction** | 85 | 9.39 | 15 | 1.91 |

## Discussion

Failure of Mandibular third molars to erupt is most affected by a lack of space in the alveolar arch between the distal of the second molar and the ascending ramus. Bjork et al.[13] noted that in cases of mandibular third molar impaction, the alveolar arch space behind the second molar was reduced in 90 per cent of cases. The growth was in a predominantly vertical component in those with impacted mandibular third molars.[14-16]

When we exclude the teeth in infraocclusion in the analysis of data, the most commonly impacted third molars in the mandible were partially mesioangular or mesioangular inclination and in the maxilla in vertical or partially distoangular position. Such findings conform to the previous reports[17,18,19,20].

In the mandible, the most apparent reason for the highest frequency of third molar impaction was reported to be the lack of space in the alveolar arch distal to the second molar.[21] Mandibular first molar extraction was shown to increase the space for mandibular thirdmolar eruption and decrease their impaction.[22] Kim et al.[23] reported that premolar extraction and concomitant mesial movement of the molars during space closure as part of orthodontic treatment led to increased eruption space for third molars and reduced the frequency of third molar impaction in both the maxilla and mandible. Furthermore, most mandibular and maxillary third molars erupted into a good or acceptable position to replace the second molars after their extraction for orthodontic purposes.[24,25], [26]

In the mandible, 26.7% of such teeth erupted to fully functional level while the rest were in infraocclusion. Interestingly in the maxilla, 59.6% of teeth having favorable parameters fully erupted but 11.4% of these had >6 mm of impaction.

We considered the age of 20 as the stable time point for the eruption and angulation movements of the third molars and therefore included subjects older than 20 years of age in the present study. Nevertheless, longitudinal observational studies have shown that some changes in eruption status and the sagittal inclination of third molars may occur even after the age of 20.[27,28] One of the most common third molar extraction indications includes pericoronitis which is associated with partially (but not full impacted) impacted third molars. , Bataineh et al[29]reported that pericoronitis cases were much more frequently seen in female patients than male patients. Likewise Yamalık

and Bozkaya[30] found a predominance of females for pericoronitis.

## Conclusion

Removal of impacted third molars is the most commonly employed procedure in oral surgery practice. Pain and pericoronitis were the most common symptoms usually associated with level A impaction and vertical position. Characteristics of erupted and impacted third molars in the mandible and the maxilla are the important point of the surgical procedures.

**Ethical approval was taken from the institutional ethical committee and written**

**Informed consent was taken from all the participants.**

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