Research Article

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# Eruption Status of Mandibular Third Molar and Mandibular Incisor Crowding Using Little's Irregularity Index

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## ABSTRACT

**Introduction**: Crowding is the deviation in the alignment of the teeth within the same arch. The cause of late incisor crowding is controversial, and the debate about the involvement of third molars in the development of late incisor crowding is still a topic of interest.

**Objective**: To evaluate the relation between eruption status of mandibular third molar and mandibular incisor crowding using Little's Irregularity Index on cone beam computed tomography (CBCT) scans.

**Methodology**: A total of 126 CBCT scans were conveniently selected from 2024 February to April after institutional ethical clearance according to the inclusion criteria and were grouped into three groups for this analytical cross-sectional study. The images were observed in the axial view and manually marked to calculate the amount of crowding using Little's irregularity index. Statistical analysis was done using SPSS v.21. Descriptive statistics like mean and standard deviation was calculated. One-way Analysis of Variance (ANOVA) test was done to assess the statistically significant difference. Post-hoc Tukey test was done to assess the difference between each group. Independent t-test was done to compare the gender difference. Statistical level was set at $p \leq 0.05$ for significance.

**Result**: Statistically significant differences were observed among the three groups on applying one-way ANOVA. Lower incisor crowding has no relation with the status of mandibular third molar on applying Post-hoc Tukey test. Statistically significant difference was observed between the genders.

Conclusion: The findings of this study provide substantial evidence to suggest that presence, absence, or partially erupted mandibular third molar has no role in contributing lower incisor crowding.

**Keywords**: Cone beam computed tomography; eruption; impaction; mandibular incisor crowding; third molar.

## INTRODUCTION

Crowding is the phenomenon which occurs when teeth deviate within the same dental arch. Late incisor crowding is a multifactorial phenomenon, but there is a controversial opinion in orthodontics

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that third molars contribute to the development of malocclusion or relapse after orthodontic treatment.[1] The size and form of the arch have substantial implications in orthodontic treatment planning affecting the space available for the dentition and the stability of normally aligned teeth. The relationship between third molars and mandibular incisor crowding is one of the most debated topic in the field of orthodontics. The causes of late crowding in the lower arch alternative to mesially directed forces are reviewed under the headings: late mandibular growth, skeletal structure and complex growth pattern, soft tissue maturation, periodontal forces, tooth structure, occlusal factors, and connective tissue changes.[1] Various studies have been attempted to clarify and evaluate the third molars and incisor crowding interrelationship.[2-6]

Broadbent's introduction of lateral cephalogram in dentistry opened up new horizons for developments in orthodontic diagnosis and treatment planning. Currently, cone beam computed tomography (CBCT) is widely used in the field of orthodontics for diagnosis and treatment planning of complex cases, such as cases involving asymmetries, pathologies, tooth impactions, cleft of lip or palate, etc. The CBCT produces less radiation exposure than the computed tomography (CT) scan technique and is hence ideal as an imaging modality in dentistry. Since impacted teeth can easily be visualised on a CBCT image along with the normal dentition, the records obtained from this imaging modality were selected for this study. This study aimed to evaluate the relation between the presence and absence of mandibular third molars and the mandibular lower incisor crowding using CBCT images.

## METHODOLOGY

This was an analytical, cross-sectional, observational study done in CBCT of patients visiting Kantipur Dental College and Hospital. The inclusion criteria were CBCT of patients of age range 18-30 years with the presence of all the permanent dentition and the exclusion criteria were scans showing presence of supernumerary, missing teeth, impacted teeth other than third molar, retained deciduous teeth, skeletal asymmetries, underlying pathologies, partial or complete absence of teeth (other than third molar), missing teeth, blurred or unclear images. The study period was from 2024 February to April. Ethical clearance was obtained from Institutional Review Committee, Kantipur Dental College (Reference number: 4/024). The sampling technique was non-probability convenient sampling and was calculated in reference to the study done by Singh and Sharma[7] using the following formula:

$$\text{Sample size (n)} = \frac{2\int(\alpha_{\,1}\beta)\ SD^2}{D^2}$$

Where, $\int\alpha_{\,1}\beta$ = 10.5 (at 80% power); standard deviation (SD) = 0.40; D = 0.34; n = 29.4 (30). Thus, the sample was calculated to be 30 for each group. A total of 126 CBCT scans meeting the inclusion criteria were divided into three groups: Group 1 - Both third molars erupted to the line of occlusal plane, Group 2 - Bilaterally impacted third molars, and Group 3 - Bilateral agenesis of mandibular third molar. Forty-two scans in each group were selected from the Department of Oral Medicine and Radiology which were between 16-30 years of age. The CBCT image was taken via CS9300 Care Stream, USA machine using the standard protocol at 85 kV,6.3 mA, 11.30 s, voxel size of 300 µm and 17 X 13 cm field of view. Data collection sheet was developed for data collection. The selected DICOM file was opened in CS imaging suite software and measurements were done. Oblique slicing was selected and image was displayed simultaneously with their coronal, axial, and sagittal slices (Figure 1). Sagittal section was selected for determining different cut level. Axial view was selected, and reference points and lines were determined.

The data were normally distributed. Twenty percent of the total samples were randomly selected and traced after seven days from the initial measurement. Kappa test showed substantial intraobserver agreement for all measurements as kappa value for each measurement was above 0.75. Statistical analysis was done using IBM SPSS Statistics for

Windows, version 23 (IBM Corp., Armonk, N.Y., USA). Descriptive statistic like mean, standard deviation was calculated. One-way analysis of variance (ANOVA) test was done to assess the statistically significant difference the groups. Post-hoc Tukey test was done. Statistical level was set at p ≤0.05 for significance.

After categorisation, the amount of crowding was calculated using Little's irregularity index.[8] The index consisted of the following scores: 0 = Perfect alignment, 1-3 = Minimal irregularity, 4-6: = Moderate irregularity, 7-9 = Severe irregularity and >10 = Very severe irregularity.

The images will be viewed from the axial view to calculate mandibular incisor crowding. The images will be adjusted in the axial view to the point where the incisal edges and the contact points of mandibular incisors were barely visible. The points will be manually plotted from the mesial incisal edge of one tooth to the distal incisal edge of another tooth to make linear measurements. Such points will be plotted from the mesial incisal edge of the left mandibular canine to the mesial incisal edge of the right mandibular canine, as shown in (Figures 1, 2). The linear measurements will be summed up to obtain Little's irregularity index score for that sample. The obtained values will be tabulated and subjected to statistical analysis.

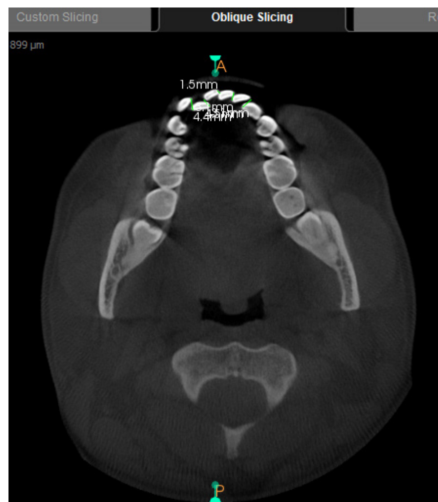


**Figure 1: Measurements of Little's Irregularity Index using cone beam computed tomography axial view.**

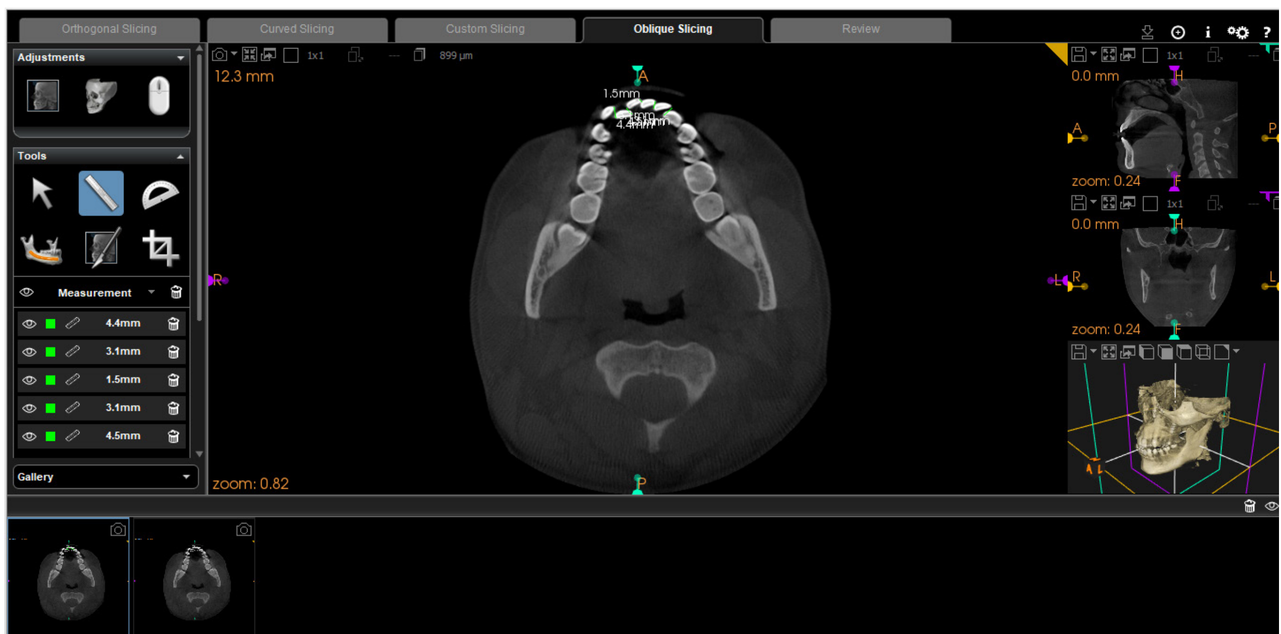


**Figure 2: Measurements of Little's irregularity index using cone beam computed tomography axial view.**

## RESULT

The sample consisted of 126 CBCT scans which was divided into three groups: Group 1- 42 samples, Group 2- 42, Group 3- 42 aged between sixteen to thirty years. Mean values of the various grading of Little's Irregularity Index of Perfect alignment, Minimal irregularity, Moderate irregularity, Severe irregularity and Very severe irregularity were seven (5.7%), 36 (29.3%), 33 (26.8%), 31 (25.2%), and 16 (13%) respectively (Table 1).

Mean values of the lower incisors crowding in Group 1, Group 2 and Group 3 were 8.70±4.14, 6.21±2.99, and 3.34±2.08 respectively (Table 2). The results of comparison of the status of mandibular third molar with lower incisor crowding using ANOVA (Table 2). Statistically significant difference was observed between the status of third molar with lower incisor crowding. The results of comparison of the status of mandibular third molar with lower incisor crowding using Post-hoc Tukey test (Table 3). Statistically significant difference was observed between the status of third molar and lower incisor crowding which signifies that presence, absence or partially erupted third molar has no role in contributing lower incisor crowding. The results of comparison between gender groups using t-test are (Table 4). Statistically significant difference was observed between the lower incisor crowding and the gender.

**Table 1: Descriptive statistics of the Little's irregularity index.**

| Grading | n (%) |
|---|---|
| Perfect alignment | 7 (5.7) |
| Minimal irregularity | 36 (29.3) |
| Moderate irregularity | 33 (26.8) |
| Severe irregularity | 31 (25.2) |
| Very severe irregularity | 16 (13) |

**Table 2: Comparison of the status of mandibular third molar with lower incisor crowding using analysis of variance.**

| Status of mandibular third molar | Mean±SD | p-value |
|---|---|---|
| Group 1 (erupted) | 8.70±4.14 | 0.0001* |
| Group 2 (impacted) | 6.21±2.99 | |
| Group 3 (agenesis) | 3.34±2.08 | |

**Table 3: Comparison of the status of mandibular third molar with lower incisor crowding using Post-hoc Tukey test.**

| Status of third molar (I) | Status of third molar (J) | Mean difference (I-J) | Standard error | p-value |
|---|---|---|---|---|
| 1 | 2 | 2.50244* | 0.70335 | 0.002 |
| | 3 | 5.37073* | 0.70335 | 0.000 |
| 2 | 1 | -2.50244* | 0.70335 | 0.002 |
| | 3 | 2.86829* | 0.70335 | <0.001 |
| 3 | 1 | -5.37073* | 0.70335 | <0.001 |
| | 2 | -2.86829* | 0.70335 | <0.001 |

**Table 4: Comparison between gender groups using t-Test**

| Gender | n (%) | Mean±SD | p-value |
|---|---|---|---|
| Male | 68 (55.3) | 6.76±4.46 | 0.023* |
| Female | 55 (44.7) | 5.25±2.75 | |

*Statistically significant at p-value <0.05

## DISCUSSION

The role of third molar has been the most debated topic in regard to lower anterior crowding. Mandibular lower anterior crowding is a common multifactorial phenomenon. It has been hypothesised that the tooth transmits an anterior component of force down the dental arch concentrating in the areas of canines and incisors, which results in tooth rotation and misplacement during the process of eruption.[5,9] Niedzielska suggested that the tooth assumes a normal position in the dental arch and does not causes displacement of the other teeth when a sufficient space is available for the eruption of the third molars; conversely, when the space is deficient third molars may aggravate dental crowding.[5]

The role of the third molars in late lower incisor crowding is frequently observed concurrently to the eruption of third molar. An increase in mandibular incisor crowding was reported to occur between 13-26 years, in late adolescence and early adulthood.[10,11] The influence of third molar in contributing to lower anterior crowding is been evaluated. This study concluded that the position of the third molar had no significant role in contributing lower anterior crowding which was in accordance with Zawawi and Melis,[12] Sidlauskas and Trakiniene,[13] Harradine et al.,[2] van der Schoot et al.,[14] Kaplan,[15] Ades et al.,[16] Buschang and Shulman.[17]

Research by Bramante concluded that the vast bulk of evidence indicated the insignificant role of third molars in late crowding.[18] These finding has been attributed to extracting unerupted mandibular third molars neither decreases the interdental force measurably nor prevents the mandibular incisor crowding. There are valid reasons for extracting the third molars. But extraction for the exclusive purpose of relieving interdental pressure and thereby preventing incisor crowding is unwarranted.[19]

These findings were not in agreement with the research conducted by Niedzielska I, Abdulla EH et al and Selmani et al. concluding that the third molar can be a contributing factor to mandibular anterior segment crowding.[5,20,21] Abdulla EH et al concluded the crowded group revealed a higher percentage of impacted third molar while lowest percentage of third molar agenesis.[20] These findings highlight the importance of carefully evaluating dental arch dimensions and the presence of third molars when assessing and treating mandibular anterior segment crowding.[21]

Buschang and Shulman stated that not only gender, age and absence/presence of first and second molars, but also race is associated with crowding of lower incisors.[17] It was found that more frequently crowded teeth are identified in black people than white or Asian people.[17] Statistically significant differences were observed in the three groups between male and female which was in accordance with Sinclair and Little.[22]

The study was conducted among the patients visiting Kantipur Dental College Hospital which cannot represent the wider population group. Further studies with larger sample group are required to evaluate the relationship between mandibular third molar and lower anterior crowding.

## CONCLUSION

The eruptive status of bilaterally erupted, impacted and agenesis of mandibular third molar has no role in contributing lower anterior crowding. Thus, the extraction of mandibular third molar for relieving lower anterior crowding is not justified.

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