

4-27-2020

## Evaluation of the Relation Between Impacted Mandibular Third Molar Classification and Inferior Alveolar Canal

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### Recommended Citation

Ertem, S. Y., & Anlar, H. Evaluation of the Relation Between Impacted Mandibular Third Molar Classification and Inferior Alveolar Canal. *J Dent Indones.* 2020;27(1): 17-22

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## **ORIGINAL ARTICLE**

# **Evaluation of the Relation Between Impacted Mandibular Third Molar Classification and Inferior Alveolar Canal**

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## **ABSTRACT**

**Objective:** The development, eruption, and proximity of mandibular third molars with the inferior alveolar canal are highly variable. The classification of mandibular third molars and their relationship with the inferior alveolar canal were discussed. **Methods:** A total of 1,024 orthopantomograms (OPGs) from 422 male patients and 602 female patients were examined. The position of the mandibular third molars and their proximity to the inferior alveolar canal were evaluated. **Results:** Mandibular third molars were observed in 652 (63.67%) of the 1,024 OPGs. According to the Winter's classification, the most common position of third molars was the vertical position (72.38%). Under the Pell and Gregory classification, the most common relationship with ramus was Class I (74.40%), and the most common impaction depth was Level A (73.94%). As for the relationship between the mandibular third molars and the inferior alveolar canal, the most common positions were horizontal (35.44%), Class II (35.20%), and Level C (43.31%). Among the mandibular third molars adjacent to the inferior alveolar canal, the most common positions were horizontal (39.24%), Class III (57.83%), and Level C (35.43%). **Conclusion:** The most common classifications for the mandibular third molars were vertical, Class I, and Level A. Exactly 33.67% of the mandibular third molars were related or adjacent to the inferior alveolar canal, and their most common positions were horizontal, Class III, and Level C.

**Key words:** mandibular third molar, inferior alveolar canal, orthopantomogram

How to cite this article: Ertem SY, Anlar H. Evaluation of the relation between impacted mandibular third molar classification and inferior alveolar canal. *J Dent Indones.* 2020;27(1):17-22.

## **INTRODUCTION**

Third molars are usually characterized by a variable crown root morphology and eruption to normal occlusion. They may also fail to erupt and thus stay impacted. Mandibular third molars (MTMs) commonly stay impacted as they are the last ones to erupt.<sup>1</sup>

MTMs may be positioned in the mouth asymptotically, or complications such as pain, infection, cyst, tumor, jaw fractures, or malposition of the mandibular anterior teeth may arise. Moreover, MTMs may be excessively close to the lingual, inferior alveolar, mylohyoid, and buccal nerves. One of the most serious complications following the extraction of third molars is inferior alveolar nerve injury.

With a sample of Turkish individuals aged 16 years and over, the current study evaluated the prevalence, positions, impaction levels, and agenesis of third molar

teeth and their relationship with the inferior alveolar canal (IAC). The position of MTMs and its relationship with the IAC are important as these factors can lead to nerve injury following an extraction depending on the localization of the third molar teeth on the jaw. The objective of this retrospective radiographic study is to determine the impaction incidence of MTMs and to evaluate the relationship of impaction classification with the IAC.

## **METHODS**

Orthopantomograms (OPGs) of 1,024 patients, including 422 males and 602 females, were randomly selected and retrospectively analyzed. These patients visited the oral and maxillofacial surgery clinic between January and December 2017 due to various complaints. All the panoramic radiographs were taken with a Planmeca Promax Digital Panoramic X-ray



**Figure 1.** Orthopantomogram showing a mandibular third molar in the Class III, Level C, and horizontal positions related to the inferior alveolar canal.

unit (Planmeca Inc., Helsinki, Finland) and evaluated with Planmeca Romexis® 3.0 software (Planmeca Oy, Helsinki, Finland). All the evaluations were made by one physician. The existence of MTMs, their positions according to the Pell and Gregory classification and the Winter's classification, and their relationship with the IAC in the radiographic examination were studied. The relationship between the roots of the MTMs and the IAC was concluded as "unrelated to the canal" if a distance was noted between the dental root and the superior border of the canal. If the dental root was adjacent to the superior border of the canal, the relationship was concluded as "adjacent to the canal." If the dental root passed the superior border of the canal and disrupted it radiographically, the relationship was concluded as "related to the canal" (Figure. 1). The dental history of the patients was examined to learn whether any procedure was applied to their MTMs previously. Patients younger than 16 years of age, those with artifacts in their radiographic images, and those with insufficient information were excluded from this study.

For statistical analysis, a Chi-square test was used to compare the rates according to gender. Cross tables for appropriate variables were constructed. IBM SPSS Statistics Version 22.0 software was used for the statistical analysis. The level of significance was set to  $p < 0.05$ .

## RESULTS

Of the 1,024 randomly selected patients (422 males, 602 females) whose radiographs were examined, 652 (270 males, 382 females) patients were found to have MTMs. The total number of MTMs detected was 1,090,

and this number included 458 teeth in 270 males and 632 teeth in 382 females.

According to the Winter's classification of the 1,090 MTM teeth, 789 (72.38%) were observed to be in the vertical position, 151 (13.85%) in the mesioangular position, 79 (7.24%) in the horizontal position, 64 (5.87%) in the distoangular position, and 7 (0.66%) in the buccoangular position. Of the 458 teeth of the male patients, 340 (74.23%) were in the vertical position, 60 (13.10%) were in the mesioangular position, 41 (8.95%) were in the horizontal position, 15 (3.27%) were in the distoangular position, and 2 (0.45%) were in the buccoangular position. Of the 632 teeth of the female patients, 449 (71.04%) were in the vertical position, 91 were in the mesioangular position, 38 (6.01%) were in the horizontal position, 49 (7.75%) were in the distoangular position, and 5 (0.71%) were in the buccoangular position (Table 1).

According to the Pell and Gregory classification of the relationship between the 1,090 MTM teeth and the ramus, 811 (74.40%) were observed to be in the Class I position, 196 (17.98%) were in the Class II position, and 83 (7.62%) were in the Class III position. Of the MTM teeth of the male patients, 353 (77.07%) were in the Class I position, 66 (14.41%) were in the Class II position, and 39 (8.52%) were in the Class III position. Of the MTM teeth of the female patients, 458 (72.46%) were in the Class I position, 130 (20.56%) were in the Class II position, and 44 (6.98%) were in the Class III position (Table 2).

According to the Pell and Gregory classification of MTM impaction depth, 806 (73.94%) were in the Level A position, 127 (11.65%) were in the Level B position, and 157 (14.41%) were in the Level C position. Of the MTM teeth of the male patients, 354 (77.29%) were in the Level A position, 41 (8.95%) were in the Level B position, and 63 (13.76%) were in the Level C position. Of the MTM teeth of the female patients, 452 (71.51%) were in the Level A position, 86 (13.60%) were in the Level B position, and 94 (14.89%) were in the Level C position (Table 3).

As for the classification of the roots of the 1,090 MTM teeth according to their relationship with the IAC, 723 (66.33%) were concluded as unrelated to the canal, 218 (20%) were adjacent to the canal, and 149 (13.67%) were related to the canal. Of the MTMs of the male patients, 322 (70.30%) were concluded as unrelated to the canal, 91 (19.86%) were adjacent to the canal, and 45 (9.84%) were related to the canal. Of the MTMs of the female patients, 401 (63.44%) were concluded as unrelated to the canal, 127 (20.09%) were adjacent to the canal, and 104 (16.47%) were related to the canal (Table 4).

**Table 1.** Gender distribution of mandibular third molar teeth according to their Winter's classification-based positions

Third Molar Positions	Male	Female	Total
Vertical	340 74.23%	449 71.04%	789 72.38%
Mesioangular	60 13.10%	91 14.39%	151 13.85%
Horizontal	41 8.95%	38 6.01%	79 7.24%
Distoangular	15 3.27%	49 7.75%	64 5.87%
Buccolingual	2 0.45%	5 0.71%	7 0.66%

**Table 2.** Gender distribution of mandibular third molar teeth according to the relationship between their Pell–Gregory classification-based positions and ramus

Third Molar Positions	Male	Female	Total
Class I	353 77.07%	458 72.46%	811 74.40%
Class II	66 14.41%	130 20.56%	196 17.98%
Class III	39 8.52%	44 6.98%	83 7.62%

**Table 3.** Gender distribution of mandibular third molar teeth according to the relationship between their Pell–Gregory classification-based positions and impaction depth

Third Molar Positions	Male	Female	Total
Level A	354 77.29%	452 71.51%	806 73.94%
Level B	41 8.95%	86 13.60%	127 11.65%
Level C	63 13.76%	94 14.89%	157 14.41%

**Table 4.** Gender distribution of root locations of mandibular third molar teeth according to their relationship with the inferior alveolar canal

Third Molar Positions	Male	Female	Total
Unrelated with the canal	322 70.30%	401 63.44%	723 66.33%
Adjacent to the canal	91 19.86%	127 20.09%	218 20%
Related with the canal	45 9.84%	104 16.47%	149 13.67%

Agensis was observed in 65 patients (6.34%), which included 44 females and 21 males. Decay distal to the adjacent second molar was observed in 135 (12.38%) of the 1,090 MTMs. The adjacent MTMs were in the mesioangular position in 72 (53.33%) of the 113 inferior second molars. Decay was detected on the distal surface of these inferior second molars. According to these results, 151 MTMs were in a mesioangular position, and decay was observed in 72 (47.68%) adjacent second molars.

When the MTMs related to the IAC were examined according to the Winter's classification, the highest rate was the horizontal position with 35.44%, followed by distoangular position with 26.56%, mesioangular position with 26.08%, and vertical position with 7.85%.

**Table 5.** Distribution of Winter's classification-based third molar positions according to their relationship with the inferior alveolar canal

Third Molar Positions	Vertical	Mesioangular	Horizontal	Distoangular	Buccoangular
Unrelated with the canal	612	60	20	26	5
Adjacent to the canal	115	49	31	21	2
Related with the canal	62	42	28	17	0

**Table 6.** Distribution of third molar teeth according to the relationship between their Winter's classification-based positions and Pell–Gregory classification-based impaction depth

Third Molar Positions	Level A	Level B	Level C
Unrelated with the canal	658	38	34
Adjacent to the canal	118	45	55
Related with the canal	30	51	68

**Table 7.** Distribution of third molar teeth according to the relationship between the Pell–Gregory classification-based positions and the inferior alveolar canal

Third Molar Positions	Class I	Class II	Class III
Unrelated with the canal	672	38	13
Adjacent to the canal	81	89	48
Related with the canal	58	69	22

When the MTMs adjacent to the canal were examined according to the Winter's classification, the highest rate was the horizontal position with 39.24%, followed by distoangular position with 32.81%, mesioangular position with 30.43%, buccoangular position with 28.57, and vertical position with 14.57% (Table 5).

When the impaction depths of the MTMs related to the IAC were evaluated according to the Pell and Gregory classification, the highest rate was in the Level C position with 43.31%, followed by that in Level B with 40.15% and Level A with 3.72%. When the impaction depths of the MTMs adjacent to the canal were examined according to the Pell and Gregory classification, the highest rate was in the Level B position with 35.43%, followed by that in Level C with 35.03% and Level A with 14.64% (Table 6).

When the relationships between the ramus and the MTMs related to the IAC were evaluated according to the Pell and Gregory classification, the highest rate was in the Class II position with 35.20%, followed by that in Class III with 26.50% and Class I with 7.15%. When

the relationships between the ramus and the MTMs adjacent to the canal were examined according to the Pell and Gregory classification, the highest rate was in Class III with 57.83%, followed by that in Class II with 45.40% and Class I with 9.98% (Table 7).

Statistically, the MTM position according to the Winter's classification differs with sex ( $\chi^2 = 13,451$ ;  $p = 0.009$ ), and the numbers of male and female patients showed a significant difference. The distoangular rate of incidence was higher in females than in males ( $\chi^2 = 9.635$ ;  $p = 0.002$ ). No significant difference was noted between the MTM positions of the male and female patients according to the ramus position based on the Pell and Gregory classification ( $\chi^2 = 7.493192$ ;  $p = 0.001$ ). Similarly, Pell and Gregory's impaction depth classification did not show a significant difference between genders ( $\chi^2 = 7.417391$ ;  $p = 0.001$ ). The relationship of the MTMs with IAC varied with sex ( $\chi^2 = 10.429$ ;  $p = 0.005$ ). The analysis of the difference revealed that the rate of MTMs related to the IAC was higher in females than in males ( $\chi^2 = 9.893$ ;  $p = 0.002$ ). No significant difference was found in the other results.

## DISCUSSION

The impaction of MTMs is of great importance due to their closeness to anatomic tissues and high risk of pathological development. This study was conducted to examine the impaction pattern of MTMs in the Turkish population. Patients older than 16 years of age were examined in this study as the normal eruption time of MTMs generally begins at this age.<sup>2</sup>

The clinical and radiological evaluations of Polat et al. on MTMs revealed a high risk of decay and periodontal defects in teeth adjacent to MTMs, particularly in the horizontal and mesioangular positions.<sup>3</sup>

In the present study, the prevalence of MTMs in the vertical (72.38%), mesioangular (13.85%), and horizontal (7.24%) positions was found to be similar to the literature results; however, several studies reported the mesioangular position as the most prevalent MTM position.<sup>2,4,5</sup> In the current study, the prevalence of MTMs in the vertical, Class I, and Level A positions was higher than that in the literature due to the inclusion of erupted MTMs. According to the literature, the formation of decay in adjacent teeth was reported for half of the teeth in the presence of mesioangular impacted or semi-impacted third molars.<sup>6</sup> Decay in the adjacent second molars was observed in approximately half (47.68%) of the MTMs in the mesioangular position and in 12.38% of all MTMs in the current study. The evaluation of all third molar teeth indicated that the prevalence rates of fully impacted teeth and semi-impacted teeth were 25% and 19%, respectively.

The classification of the impacted teeth showed a similar prevalence between the male and female patients; however, the rates of impacted MTMs in the distoangular (male: 3.27% vs. female: 7.75%), Level B (male: 8.95% vs. female: 13.60%), and Class II (male: 14.41% vs. female: 20.56%) positions were found to be significantly higher in the female patients than in the male patients. According to the study of Quek et al., third molar teeth are more prevalent in female patients than in male patients; this finding is consistent with previous reports related to the sex-based distribution of third molar teeth.<sup>7-10</sup> The relatively high prevalence of third molar teeth reported in female patients is due to the difference between the growth processes of males and females. Females usually stop growing when their third molar teeth start to erupt, whereas males continue to undergo jaw growth even after the eruption of their third molar teeth; the latter condition creates more space for third molar teeth to erupt.<sup>8</sup> Postoperative complication rates and permanent sequel risks increase with age. Hence, MTM extraction is recommended to be performed immediately and especially before the age of 24 for females.<sup>9</sup>

One of the complications that may arise after extraction of MTMs is inferior alveolar nerve injury.<sup>11</sup> OPGs may be the most common radiography used to evaluate impacted MTMs.<sup>12</sup> In the present study, the evaluation of panoramic films revealed that 66.30% of the MTMs were unrelated to the IAC, 20% were adjacent to the IAC, and 13.67% were related to the IAC.

Among the MTMs in the horizontal position, 35% were related to the IAC. By contrast, this rate was low for the MTMs in the mesioangular and distoangular positions, and it even dropped to 7.85% for the MTMs in the vertical position. The rate of the MTMs being related to the canal in the Level C position was found to be 12 times higher than that in the Level A position. When the relationships between the ramus and the MTM positions according to the Pell and Gregory classification were evaluated in terms of the MTMs' adjacency to the IAC, the highest rate was found, as expected, for Class III with 57.83%. This high rate was followed by that for the Class II position at 45.40% and that for the Class I position at 9.98%, which was six times lower than that of the Class III position. However, the rate of relatedness of the MTMs in the Class II position to the canal (35.20%) was unexpectedly higher than that of the MTMs in the Class III position (26.50%). For the MTMs in the Class I position, the rate of relatedness to the canal was 7.15%.

In the study of Miloro, 86.7% of the patients who had nerve damage following MTM extraction were female, and these results are similar to the reports indicating that nerve damage is more prevalent in women than in

men.<sup>13-15</sup> In the current work, the rate of relatedness of the female patients' MTMs to the IAC was almost two times that of the male patients (males, 9.84%; females, 16.47%).

Sisman et al. reported that the rate of third molar agenesis in the Turkish population is 16.8%.<sup>16</sup> Kilinc et al. found that the rate of agenesis of third molars is 23.3%.<sup>17</sup> In the current study, only the MTMs were evaluated, and their agenesis was found to be 6.34%. Celikoglu et al. did not find a significant difference in third molar agenesis between sexes.<sup>1</sup> Conversely, the agenesis of the MTMs in the current study was found to be twice higher in females than in males. However, these rates may change as the number of patients increases.

Evaluating the incidence of MTMs, their positions, and the relationships of their positions with anatomic structures within a population facilitates the comparison of such population with those in other regions of the world. The most prevalent angulation was vertical (72.38%), and the most prevalent impaction was observed in the Class I and Level A positions (Class I: 74.40%; Level A: 73.94%). Of the MTMs observed, 13.67% of them were related to the IAC and frequently in the horizontal, Level C, and Class II positions. As for the relatedness of the MTMs in the distoangular, Class II, and Level B positions to the IAC and agenesis rate, it was markedly higher in females than in males. A comparison of the results of this study with other regional studies supports the conclusion of a nonexistent universal impaction incidence and pattern. Broad comprehensive studies should be carried out to evaluate MTM patterns in populations of different regions.

## CONCLUSION

Inferior alveolar nerve injury is the most important complication encountered in the extraction of lower impacted teeth. According to the OPG evaluations in this work, 33.67% of all MTMs showed neural relations and adjacency; of these MTMs, 75% were in the horizontal position, 79% in the Level C position, and 85% were in the Class III position. MTM teeth under all classifications had similar incidences in men and women. Although all MTM teeth were related to adjoining mandibular canals, the rate of relatedness was significantly higher in females ( $\chi^2 = 9.893$ ;  $p = 0.002$ ) than in males. Physicians should be aware of teeth in the horizontal, Class III, and Level C positions during operation and proactively inform patients, especially females, about the potential of nerve damage before the intervention.

## CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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(Received January 3, 2020; Accepted April 5, 2020)