

Original paper

Assessment of impacted mandibular third molars and inferior alveolar canal contact: correlation with classification systems on cone-beam computed tomography

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Abstract

Purpose: This study analysed the distribution patterns of impacted mandibular third molars (IMTMs) using the Winter classification system and the Pell and Gregory classification system, which guide surgical planning and complication risk assessment. Additionally, the spatial relationship between IMTMs and the inferior alveolar canal (IAC) was evaluated with cone-beam computed tomography (CBCT) to enhance preoperative risk stratification.

Material and methods: A total of 1594 IMTMs were retrospectively reviewed in patients with available panoramic and CBCT imaging. Angulation was classified according to Winter, while depth and ramus relation were categorised using Pell and Gregory. CBCT was used to assess IAC relationships. Associations between classifications and IAC contact were analysed, and logistic regression identified independent risk factors.

Results: Mesioangular impaction was most frequent (37.6%), and class II, level B was the predominant Pell and Gregory type (29.6%). CBCT showed IAC contact in 83.5% of cases, most commonly superior and buccal. Logistic regression showed no statistically significant association between horizontal impaction and IAC contact compared with vertical impaction (OR = 1.41, $p = 0.054$), whereas class III, level C impaction was associated with higher odds of contact compared with class I, level A (OR = 10.22, $p < 0.001$). A “between roots” IAC configuration, undetectable on panoramic radiographs, was noted in 7.5%.

Conclusions: While Winter classification offers moderate predictive value, Pell and Gregory – particularly deeper and more posterior subtypes – correlates strongly with IAC involvement. Findings highlight the value of CBCT in high-risk IMTM cases to improve radiographic assessment of the canal–root relationship and surgical planning.

Key words: mandibular third molar, cone-beam computed tomography, inferior alveolar canal.

Introduction

Impacted mandibular third molars (IMTMs) are frequently encountered in oral and maxillofacial surgery, often associated with complications such as pericoronitis, second molar caries, cyst or tumour formation, and risk of inferior alveolar nerve injury during extraction [1,2]. Owing to their anatomical proximity to the inferior alveolar

canal (IAC), precise preoperative radiographic evaluation is critical to better understand the spatial relationship between the roots and the IAC [3].

Panoramic radiography has traditionally served as the primary imaging modality for assessing impaction angulation and depth through standardised classification

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Authors' contribution:

A Study design · B Data collection · C Statistical analysis · D Data interpretation · E Manuscript preparation · F Literature search · G Funds collection

systems. Classification systems such as the Winter classification (based on angulation) and the Pell and Gregory classification (based on depth and ramus proximity) have been widely used to estimate surgical difficulty and anatomical positioning [4,5]. However, panoramic radiographs provide only two-dimensional information, which may be insufficient for evaluating complex anatomical relationships, particularly in high-risk cases where IAC involvement is suspected [6].

Cone-beam computed tomography (CBCT) has emerged as a superior alternative, offering accurate three-dimensional visualisation of the relationship between impacted molars and adjacent anatomical structures. CBCT enables precise assessment of cortical bone integrity, root morphology, and the spatial positioning of the IAC [3,7]. Several studies have confirmed that CBCT significantly improves diagnostic sensitivity and surgical planning, particularly in high-risk impactions [8,9].

This study aimed to analyse IMTMs by evaluating their classification patterns and spatial relationship with the IAC using CBCT, thereby improving radiographic assessment of canal–root proximity.

Material and methods

Ethical protocol

This retrospective study was conducted in accordance with the ethical standards of the Declaration of Helsinki. Ethical approval was obtained from the Ethics Committee of Istanbul University Faculty of Dentistry (Approval No. 2644624). All radiographic data were fully anonymised.

Study population and selection criteria

This retrospective study was performed on the records of patients evaluated for IMTMs at the Faculty of Dentistry, Istanbul University, between January 2016 and December 2023. All radiographs were retrieved from the institution's digital imaging archive.

Patients were eligible for inclusion if they were 18 years of age or older and had at least one IMTM. This retrospective study included archived cases in which both panoramic radiography and CBCT images were available. The CBCT scans had been obtained previously for various clinical indications rather than according to a standardised indication defined for the purposes of this study. Only radiographs of sufficient diagnostic quality, free of artifacts or image distortions, were included in the study.

Patients were excluded if they had any congenital or acquired syndromes affecting craniofacial development, such as cleft lip/palate or craniofacial dysplasia. Those with a history of mandibular trauma or previous oral surgery in the region of interest were also excluded. Moreover, images with significant radiographic artifacts

or incomplete coverage of the mandibular molar region were not considered. Third molars that had already been extracted or existed only as root fragments were also excluded from analysis.

Pell and Gregory classification

The Pell and Gregory classification system was utilised to assess the anatomical position of each IMTM based on two parameters: relationship to the anterior border of the ramus and vertical depth relative to the adjacent second molar (Figure 1) [10].

Relationship to the ramus:

- class I: Sufficient space exists between the distal surface of the second molar and the anterior border of the mandibular ramus for the eruption of the third molar (Figure 1A);
- class II: The available space is less than the mesiodistal width of the third molar, allowing for partial eruption (Figure 1B);
- class III: The third molar is completely located within the ramus, with no available space for eruption (Figure 1C).

Vertical position:

- level A: The highest point of the impacted tooth is at or above the occlusal plane of the second molar (Figure 1D);
- level B: The highest point lies between the cervical line and the occlusal plane of the second molar (Figure 1E);
- level C: The highest point is below the cervical line of the second molar (Figure 1F).

Winter classification

The angulation of each IMTM was determined using the Winter classification, which categorises the orientation of the third molar's long axis relative to that of the adjacent second molar (Figure 2) [11]. The impactions were classified as follows:

- vertical: The long axis of the third molar is parallel to that of the second molar (Figure 2A);
- horizontal: The long axis of the third molar is perpendicular to the second molar, lying in a horizontal position (Figure 2B);
- mesioangular: The long axis of the third molar is angled mesially, at approximately 45°, toward the second molar (Figure 2C);
- distoangular: The long axis of the third molar is angled distally, at approximately 45°, away from the second molar (Figure 2D).

Classification of the relationship with the IAC

The spatial relationship between the IMTM roots and the IAC was assessed using CBCT images. Based on axial,

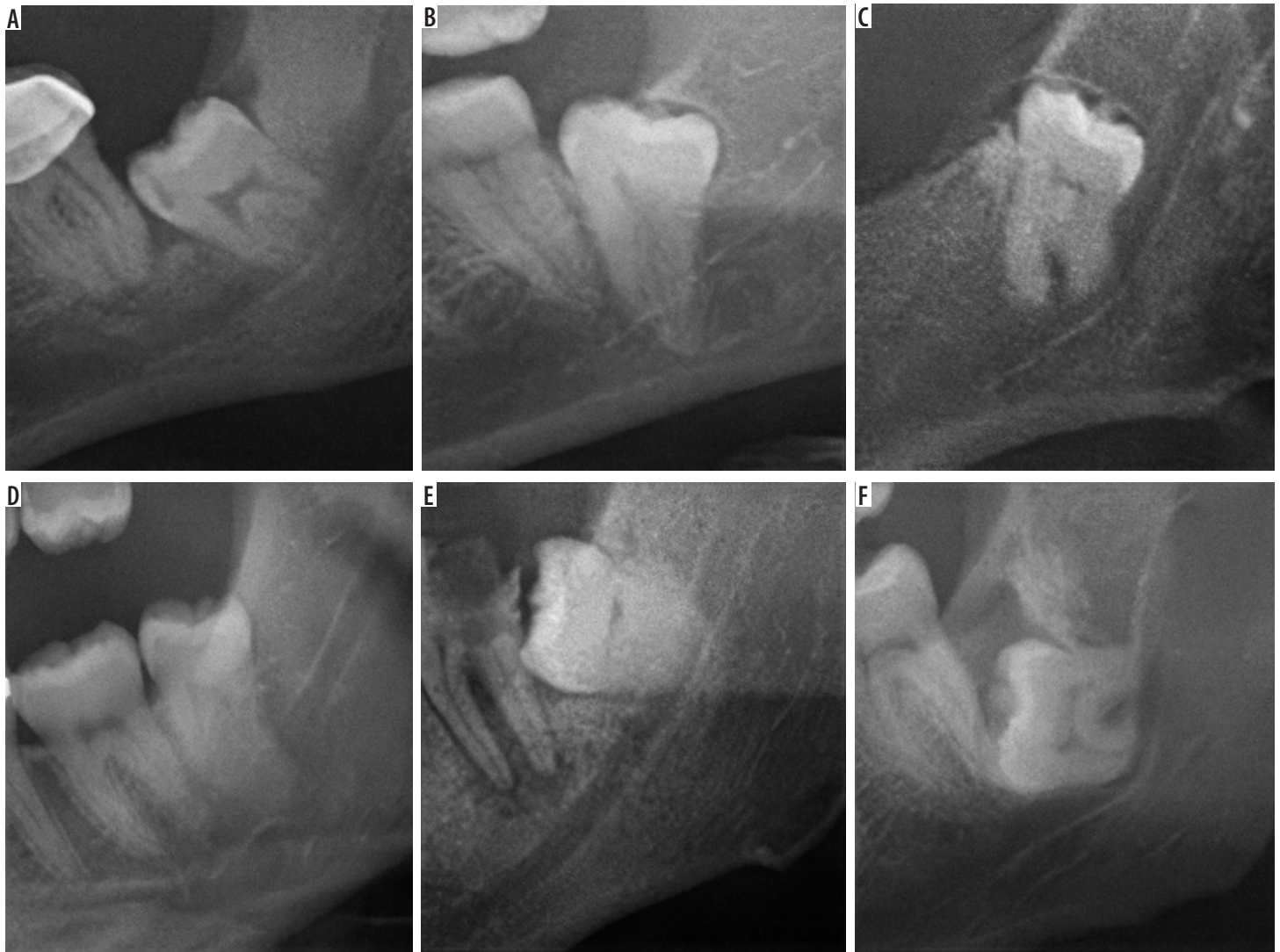


Figure 1. Pell and Gregory classification: (A) class I, (B) class II, (C) class III, (D) level A, (E) level B, (F) level C

sagittal, and coronal reconstructions, the relationships were categorised as follows:

- no contact: no contact between the tooth and the canal (Figure 3A);
- buccal contact: the IAC is located buccal to the root (Figure 3B);
- lingual contact: the IAC is located lingual to the root (Figure 3C);
- superior contact: the root is in contact with the superior aspect of the canal (Figure 3D);
- buccal + superior contact: the canal contacts the root from both buccal and superior aspects (Figure 3E);
- lingual + superior contact: the canal contacts the root from both lingual and superior aspects (Figure 3F);
- between roots: the canal runs between the divergent roots of the tooth (Figure 3G).

These classifications were used to evaluate the potential risk of IAC involvement and to correlate radiographic findings with surgical risk levels.

Radiographic examination

Panoramic radiographs had been obtained using a digital panoramic X-ray unit (Instrumentarium Orthopantomograph OP 300, KaVo Kerr Group, Finland) with standardised exposure settings of 73 kVp and 5 mA, and an exposure time of 13.2 seconds. The study dataset consisted of panoramic and CBCT images retrieved from the institutional Picture Archiving and Communication System of the Faculty of Dentistry, Istanbul University. All images included in the analysis had been acquired for routine diagnostic purposes between January 2016 and December 2023. According to the institution's standard clinical protocol, patients had been positioned with a chin rest and head stabiliser to ensure proper alignment, using the Frankfort horizontal plane as a reference.

All images were evaluated for image quality and positioning accuracy. Only radiographs without motion artifacts or distortions were included in the study. Two



Figure 2. Winter classification: (A) vertical, (B) horizontal, (C) mesioangular, (D) distoangular

experienced oral and maxillofacial surgeons independently evaluated the radiographic images and classified the IMTMs according to the Winter classification and the Pell and Gregory classification.

CBCT scans had been acquired with a Scanora® 3D-X imaging system (Soredex, Tuusula, Finland), which provides a variable field of view (FOV) ranging from 50×50 mm to 240×165 mm. Voxel size varied between 0.1 mm^3 and 0.5 mm^3 depending on the selected FOV. The system operated at 60-90 kVp and 4-10 mA, with a focal spot size of 0.5 mm and an imaging time of 18 to 24 seconds. The effective exposure time ranged from 2.4 to 6 seconds.

Image reconstruction was performed using OnDemand 3D™ software (Cybermed Co., Irvine, CA, USA). CBCT images were assessed on a high-resolution medical-grade LCD monitor (Advantech KT-R240FEE, Kostec, Gangwon, South Korea) by two oral and maxillofacial radiologists. Both observers evaluated the spatial relationship between

the IMTMs and the IAC using predefined classification criteria.

Image evaluation and observer reliability

All panoramic and CBCT images were independently evaluated by two oral and maxillofacial surgeons and two oral and maxillofacial radiologists, respectively. Prior to formal data analysis, a calibration session was conducted using 50 randomly selected cases that were not part of the main study sample. This calibration aimed to standardise the application of the Winter and the Pell and Gregory classification systems on panoramic radiographs, as well as the assessment of IAC relationships on CBCT scans.

Each observer independently classified the impaction type on panoramic images according to the Winter and the Pell and Gregory systems. Separately, the radiologists evaluated the CBCT images to determine the spatial rela-

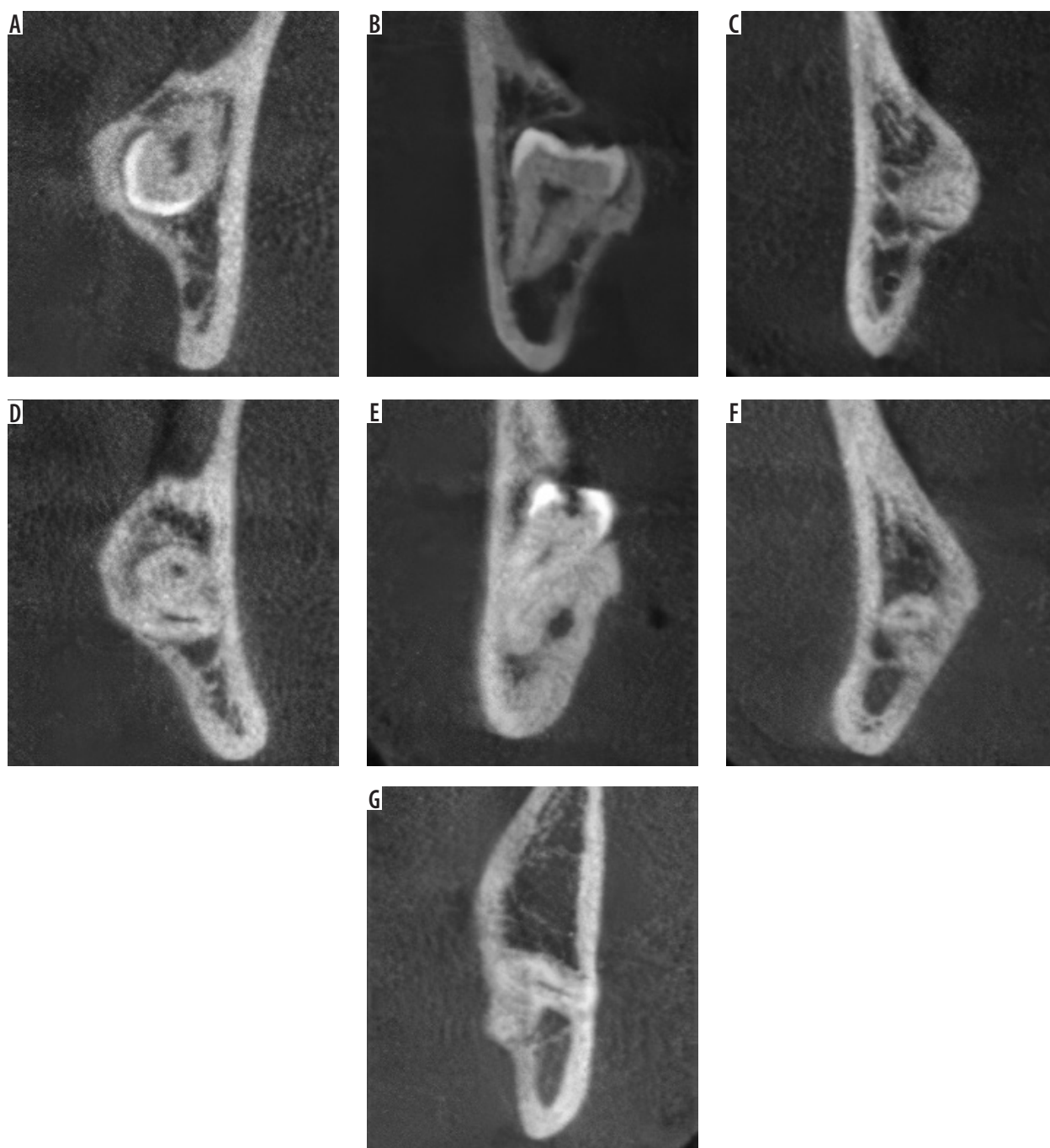


Figure 3. Classification of the relationship with the inferior alveolar canal (IAC): (A) no contact, (B) buccal contact, (C) lingual contact, (D) superior contact, (E) buccal + superior contact, (F) lingual + superior contact, (G) between roots

tionship between the IMTMs and the IAC. Interobserver agreement for the categorical classifications was assessed using the weighted Cohen's kappa (κ) statistic, and 95% confidence intervals (CI) were calculated.

Statistical analysis

All statistical analyses were performed using NCSS 2007 Statistical Software (Number Cruncher Statistical Systems, Kaysville, Utah, USA). Descriptive statistics including frequency, percentage, mean, and standard deviation

were used to summarise the demographic characteristics and distribution of impaction classifications.

The chi-square (χ^2) test was applied to assess associations between impaction classifications and IAC contact, as well as between demographic variables and IAC relationship. A weighted Cohen's kappa (κ) coefficient was calculated to assess interobserver agreement for categorical classifications. Interpretation of κ values followed the guidelines by Landis and Koch [12]: ≤ 0.20 , poor; 0.21-0.40, fair; 0.41-0.60, moderate; 0.61-0.80, good; and 0.81-1.00, very good agreement.

Additionally, binary logistic regression analysis was conducted to determine whether specific Winter classification and Pell and Gregory classification types were independently associated with the presence of IAC contact. Odds ratios (ORs) with 95% CIs were calculated, using vertical angulation and Pell and Gregory class I, level A as reference categories. Statistical significance was considered at $p < 0.05$ for all analyses.

The unit of analysis in this study was the IMTM. When bilateral impacted third molars were present in the same patient, each tooth was included and analysed as a separate observation because the radiographic characteristics and clinical indication for CBCT evaluation may differ between the right and left sides.

Results

Interobserver agreement was excellent for the evaluated classifications ($\kappa = 0.84$; 95% CI: 0.81–0.87 and $\kappa = 0.86$; 95% CI: 0.83–0.89), indicating high reproducibility between observers.

A total of 1594 IMTMs were evaluated in this retrospective study. The patient sample included 1103 females (69.2%) and 491 males (30.8%), with a mean age of 27.6 ± 10.2 years (range: 18–74 years). Detailed demographic information is presented in supplemental Table 1.

Distribution of impaction classifications

According to the Winter classification, the most commonly observed angulation type was mesioangular impaction ($n = 600$, 37.6%), followed by horizontal ($n = 485$, 30.4%), vertical ($n = 406$, 25.5%), and distoangular impactions ($n = 103$, 6.5%). The detailed distribution of impaction types is presented in supplemental Table 2.

In terms of the Pell and Gregory classification, class II, level B was the most frequent impaction type ($n = 472$,

29.6%), followed by class II, level C ($n = 278$, 17.4%), class I, level B ($n = 228$, 14.3%), class I, level A ($n = 197$, 12.4%), class I, level C ($n = 181$, 11.4%), class II, level A ($n = 157$, 9.8%), class III, level C ($n = 70$, 4.4%), and class III, level B ($n = 11$, 0.7%). The full classification distribution is detailed in supplemental Table 3.

IAC contact and spatial relationship

CBCT evaluation revealed that 1331 of the IMTMs (83.5%) demonstrated some form of contact with the IAC, while 263 teeth (16.5%) exhibited no contact. The most frequently observed contact type was superior contact ($n = 549$, 34.4%), followed by buccal contact ($n = 278$, 17.5%) and buccal + superior contact ($n = 216$, 13.6%). Other contact types included lingual contact ($n = 123$, 7.7%), lingual + superior contact ($n = 45$, 2.8%), and between roots ($n = 120$, 7.5%). The complete distribution of IAC relationship types is summarised in supplemental Table 4.

Associations between classification and IAC contact

Statistical analysis revealed a significant association between Winter classification types and the presence of contact with the IAC ($\chi^2 = 28.69$, $p < 0.001$). Among the Winter categories, mesioangular impactions exhibited the highest contact rate with the IAC (88.8%), followed

Table 3. Frequency of impaction based on the Pell and Gregory classification

Pell and Gregory classification	Count (n)	Percentage (%)
Class I, level A	197	12.4
Class I, level B	228	14.3
Class I, level C	181	11.4
Class II, level A	157	9.8
Class II, level B	472	29.6
Class II, level C	278	17.4
Class III, level B	11	0.7
Class III, level C	70	4.4

Table 4. Spatial relationship types between impacted mandibular third molars and the inferior alveolar canal (IAC)

IAC contact type	Count (n)	Percentage (%)
Superior contact	549	34.4
Buccal contact	278	17.5
No contact	263	16.5
Buccal + superior contact	216	13.6
Lingual contact	123	7.7
Between roots	120	7.5
Lingual + superior contact	45	2.8

Table 1. Distribution of patients by gender and age

Gender	Number of patients	Percentage (%)	Age in years (mean $\pm$ SD)
Female	1103	69.2	26.4 ± 8.8
Male	491	30.8	30.3 ± 12.3
Total	1594	100	27.6 ± 10.2

SD – standard deviation

Table 2. Distribution of impacted mandibular third molars according to Winter classification

Winter classification	Count (n)	Percentage (%)
Mesioangular	600	37.6
Horizontal	485	30.4
Vertical	406	25.5
Distoangular	103	6.5

by distoangular (84.5%), horizontal (82.9%), and vertical (76.1%) impactions. These results are summarised in supplemental Table 5 and Figure 4.

Similarly, the Pell and Gregory classification demonstrated a highly significant correlation with IAC contact ($\chi^2 = 209.36$, $p < 0.000001$). The contact frequency was notably high in deeper and more posteriorly located impactions such as class II, level C (97.8%), class III, level C (94.3%), and class III, level B (90.9%). In contrast, class I, level A and class I, level B displayed the lowest IAC contact rates, at 52.3% and 76.3%, respectively. The full distribution is presented in supplemental Table 6 and Figure 5.

Moreover, an evaluation of contact types revealed that superior contact was the most common across all groups. Specifically, mesioangular, horizontal, and vertical impactions tended to contact the superior border of the IAC. In Pell and Gregory categories, the class II, level B, class II, level C, and class III, level C subtypes were predominantly associated with superior, buccal, and combined buccal-superior contact types.

Multivariate logistic regression analysis

Multivariate logistic regression was performed to identify independent predictors of IAC contact based on impaction classifications. Vertical impaction (Winter classification) and Class I Level A (Pell and Gregory classification) were set as the reference categories.

Table 5. Association between Winter classification and inferior alveolar canal (IAC) contact

Winter classification	Total (N)	With IAC contact (n)	Contact rate (%)
Distoangular	103	87	84.5
Horizontal	485	402	82.9
Mesioangular	600	533	88.8
Vertical	406	309	76.1

Table 6. Association between Pell and Gregory classification and inferior alveolar canal (IAC) contact

Pell and Gregory classification	Total (N)	With IAC contact (n)	Contact rate (%)
Class I, level A	197	103	52.3
Class I, level B	228	174	76.3
Class I, level C	181	165	91.2
Class II, level A	157	128	81.5
Class II, level B	472	413	87.5
Class II, level C	278	272	97.8
Class III, level B	11	10	90.9
Class III, level C	70	66	94.3

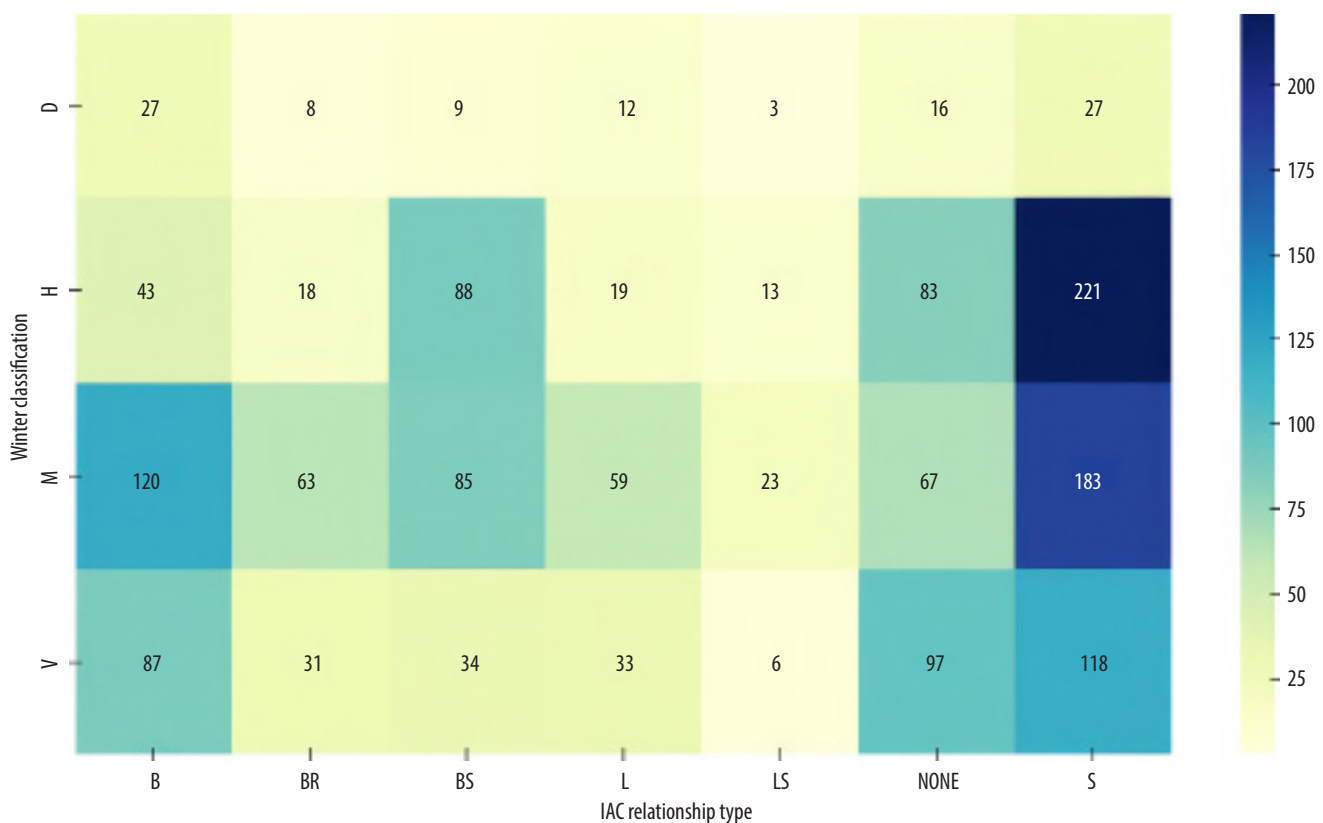


Figure 4. Proportion of the inferior alveolar canal (IAC) contact among Winter classification

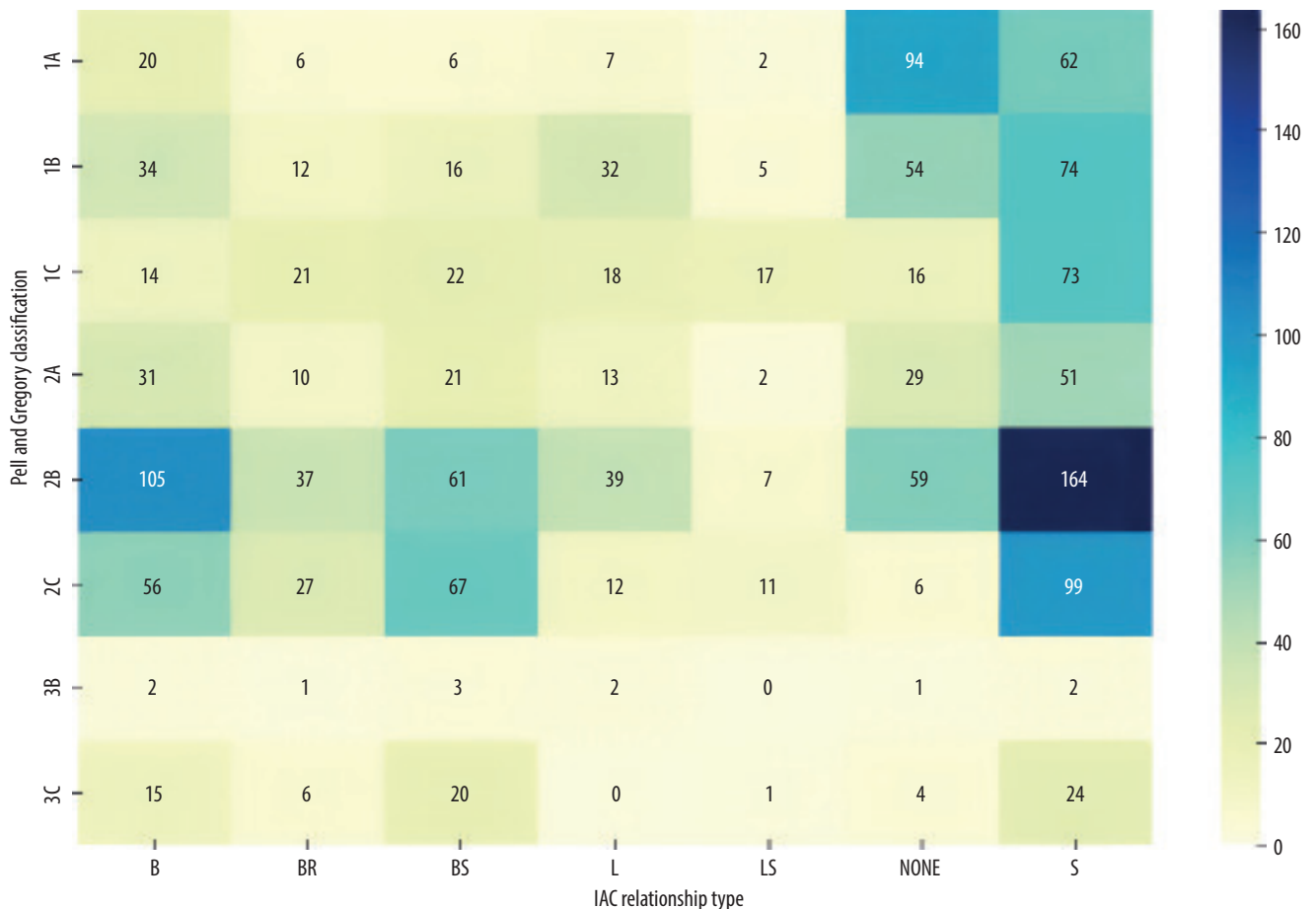


Figure 5. Proportion of the inferior alveolar canal (IAC) contact among Pell and Gregory classification

Among the Winter angulation types, mesioangular impactions were associated with a significantly increased risk of IAC contact (OR = 1.61, 95% CI: 1.14-2.27, $p = 0.0006$), while horizontal impactions showed a borderline association (OR = 1.41, 95% CI: 0.99-2.02, $p = 0.054$). Distoangular impactions did not demonstrate a statistically significant association (OR = 0.87, $p = 0.633$), suggesting a comparable or slightly reduced risk relative to vertical impactions.

In contrast, the Pell and Gregory classification exhibited a much stronger and more consistent predictive value. Impactions categorised as class III, level C showed the highest independent risk of IAC contact (OR = 10.22, $p < 0.001$), followed by class II, level C (OR = 5.26, $p < 0.001$) and class III, level B (OR = 5.09, $p = 0.02$). In addition to the reported ORs, the prevalence of IAC contact increased progressively with increasing impaction depth according to the Pell and Gregory classification.

These findings suggest that impaction depth and posterior ramus proximity, as reflected by the Pell and Gregory classification, are more robust predictors of IAC involvement than root angulation alone. While Winter classification offers some insight-particularly for mesioangular cases, its predictive capacity appears limited when compared to the anatomical depth-based framework of Pell and Gregory. The logistic regression findings are summarised in supplemental Table 7.

Table 7. Multivariate logistic regression analysis of predictors for inferior alveolar canal (IAC) contact

Classification	Odds ratio (OR)	95% CI	p-value
Winter-Mesioangular	1.61	1.14-2.27	0.0006
Winter-Horizontal	1.41	0.99-2.02	0.054
Winter-Distoangular	0.87	0.49-1.54	0.633
P&G – class I, level B	1.78	1.16-2.73	0.008
P&G – class I, level C	2.4	1.53-3.76	<0.001
P&G – class II, level A	2.47	1.54-3.95	<0.001
P&G – class II, level B	3.98	2.61-6.07	<0.001
P&G – class II, level C	5.26	3.30-8.38	<0.001
P&G – class III, level B	5.09	1.28-20.16	0.02
P&G – class III, level C	10.22	6.25-16.72	<0.001

P&G – Pell and Gregory classification

Discussion

This study provides a detailed radiographic analysis of IMTMs, utilising both two-dimensional panoramic imaging and three-dimensional CBCT to classify impaction patterns and evaluate their spatial relationship with

the IAC. The findings aim to enhance radiographic assessment of canal–root proximity and surgical planning.

Consistent with previous studies, mesioangular impaction was found to be the most frequent angulation type according to the Winter classification (37.6%), followed by horizontal (30.4%) and vertical (25.5%) types. These findings align with the results reported by Yıldırım *et al.* [1], who observed a similar mesioangular predominance in a Turkish population. Celikoglu *et al.* [2] also noted high rates of mesioangular impaction among orthodontic patients. However, in different geographic and ethnic cohorts, such as those studied by Shaari *et al.* [13] in Malaysia and Al-Dajani *et al.* [14] in Saudi Arabia, vertical impactions were more common. This discrepancy may reflect inter-population differences in craniofacial morphology, including ethnic anatomical variations, dietary habits, and other population-specific factors.

Regarding the Pell and Gregory classification, class II, level B emerged as the most prevalent type (29.6%), followed by class II, level C and class I, level B. Consistent with our findings, the CBCT-based analysis by Vasegh *et al.* [15], along with panoramic studies by Khouri *et al.* [16] and Santos *et al.* [5], reported a higher prevalence of class II, level B and level C impactions, both of which were more frequently associated with IAC contact. However, other studies have demonstrated a predominance of class I, level A impactions in certain populations, highlighting the influence of population-based anatomical variation [17,18].

In contrast to prior studies using diverse imaging methods, the concurrent use of panoramic radiography and CBCT in our study, along with a notably large sample size, enhances its diagnostic value and strengthens its contribution to the literature.

CBCT imaging revealed that 83.5% of impacted molars had some form of contact with the IAC, most commonly of the superior (34.4%) or buccal (17.5%) type. These contact types were similarly reported as dominant in studies by Pogorzelska *et al.* [8] and Yang *et al.* [7], reinforcing the importance of three-dimensional imaging for evaluating root proximity and canal orientation. Compared to panoramic radiographs, CBCT offers enhanced accuracy in detecting cortical thinning, root compression, and root canal overlap, as emphasised in the comparative analysis by Soman *et al.* [6].

Additionally, the “between roots” contact type was identified in 7.5% of the cases, representing a clinically relevant subgroup. Although less frequently emphasised in the literature, this configuration poses unique challenges in terms of radiographic interpretation and surgical access. Root divergence with interradicular canal passage may represent a challenging anatomical configuration during surgical procedures. This finding is also supported by the CBCT-based analysis of Urechescu *et al.* [19], who reported that the mandibular canal ran between the roots in 8.2% of cases and emphasised that such configurations

may be overlooked on panoramic radiographs, reinforcing the need for CBCT in preoperative assessment.

A key contribution of this study lies in its statistical assessment of impaction classification systems for predicting IAC contact. Although a significant overall association was observed for the Winter classification ($p < 0.001$), only the mesioangular group demonstrated a significantly increased risk of IAC contact ($OR = 1.61$; $p = 0.0006$). Horizontal impactions showed a borderline association ($OR = 1.41$; $p = 0.054$), while distoangular impactions did not exhibit a statistically significant relationship ($OR = 0.87$; $p = 0.633$). These findings suggest that mesioangular impactions may carry a higher likelihood of radiographic proximity to the mandibular canal, whereas horizontal and distoangular types are not strongly predictive. Previous studies, such as those by Yang *et al.* [7], have considered spatial factors in root positioning to be crucial in assessing nerve proximity. Likewise, Neves *et al.* [20] demonstrated that CBCT imaging provides a more accurate evaluation of root–canal relationships, revealing that some impactions may appear closer to the mandibular canal on panoramic radiographs than they actually are.

In contrast, the Pell and Gregory classification exhibited a more robust and consistent predictive capacity for IAC contact. Deeply positioned impactions, particularly class III, level C ($OR = 10.22$; $p < 0.001$) and class II, level C ($OR = 5.26$; $p < 0.001$), showed the highest independent risk levels. These findings align with CBCT-based studies by Vasegh *et al.* [15] and Khojastepour *et al.* [9], who emphasised the significance of ramus proximity and vertical depth in predicting neurovascular risk. Additionally, Prados-Frutos *et al.* [21] highlighted the clinical importance of detailed assessment of mandibular neurovascular anatomy in surgical planning.

Another significant finding was the slight but statistically significant difference in IAC contact between sexes, with females showing higher contact rates. While the reasons for this disparity remain unclear, similar observations were made by Yilmaz *et al.* [22], who hypothesised that differences in mandibular bone morphology might contribute. This finding is also supported by the work of de Oliveira Gamba *et al.* [23], who demonstrated that female patients tend to have thinner mandibular cortices and reduced bone volume in the molar region, potentially increasing the likelihood of root proximity to the IAC.

Limitations

This study has several limitations. First, although the sample size was large, the data were derived from a single institution, which may limit the generalisability of the findings to other populations. Second, the retrospective design limited control over imaging protocols and CBCT acquisition parameters. In addition, the variability in CBCT voxel sizes may have influenced the detection of subtle canal–root relationships.

Furthermore, the classification of impaction types and IAC contact was based on radiographic evaluation rather than intraoperative verification, which may introduce a degree of subjectivity. Because the analysis was performed at the tooth level, bilateral third molars from the same patient may have been included in the dataset, which could introduce potential clustering effects and partially violate the independence assumption of logistic regression analyses. The study sample was derived from archived cases with available CBCT imaging obtained for various clinical indications; therefore, the possibility of selection or spectrum bias cannot be completely excluded, and the reported prevalence of IAC contact should not be interpreted as representative of the general population of IMTMs. In addition, intraobserver reliability was not evaluated in this study, which should be considered a methodological limitation.

Conclusions

This study highlights the combined utility of panoramic classification systems and CBCT imaging in the

preoperative evaluation of IMTMs. While the Winter classification offers insights into surgical difficulty, the Pell and Gregory system – particularly class III, level C and class II, level C types – demonstrated stronger predictive value for IAC contact. Given the increased likelihood of close radiographic canal–root relationships in deep and posterior impactions, CBCT imaging may be particularly useful for detailed preoperative evaluation in selected cases. Future prospective and multicentre studies are warranted to refine risk models and guide evidence-based surgical decision-making.

Disclosures

1. Institutional review board statement: Ethical approval was obtained from the Ethics Committee of Istanbul University Faculty of Dentistry (Approval No. 2644624).
2. Assistance with the article: None.
3. Financial support and sponsorship: None.
4. Conflicts of interest: None.

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