

Prevalence and Pattern of Mandibular Third Molar Impaction in a Sample of the Albanian Population: A Retrospective Cross-Sectional Study on Digital Panoramic Radiographs

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Abstract

Background: Mandibular third molars (M3M) are the teeth with the highest prevalence of impaction.

Aims: The aim of this retrospective cross-sectional study was to evaluate the prevalence and impaction patterns of M3M in a selected Albanian population using digital panoramic radiographs (DPR).

Study design: Retrospective.

Methods: DPRs of adult patients seeking various dental treatments taken between January 2023 and March 2025 were evaluated, and a total of 650 DPR with at least one impacted M3M (M3MI) were included in the study and evaluated with Winter's and Pell & Gregory classifications.

Results: The prevalence of M3MI was 33.2%. Of

the affected individuals, 119 presented with bilateral impaction, while 97 exhibited unilateral impaction. Impaction depth according to Pell & Gregory revealed that most prevalent were position B (49.2%) followed from position A (26.5%) and position C (21.1%). The distance from ramus shows that Class II is the most prevalent with 43.2%, and class III 38.5%. According to Winter's classification the vertical impaction (VI) type was more prevalent (41.8%), followed from mesio angular MA (36.1%).

Conclusion: This study identified a notable prevalence of M3MI. The most frequently observed impaction type was Class II, Level B according to the Pell&Gregory classification and the VI type. Moreover, the prevalence of caries

on adjacent mandibular second molar (M2M) was high.

Keywords: mandibular third molar, impaction, digital panoramic radiograph

INTRODUCTION

Tooth eruption is defined as a complex biological process involving the movement of a tooth through the bone toward its functional position in the occlusal plane (1). When a tooth fails to erupt due to various factors and remains embedded within the jawbone, covered partially or completely by gingival tissue and/or bone—it is considered impacted (2). The multifactorial etiology of impaction includes both local and systemic factors. Lack of available space in the dental arch and abnormal positioning of the tooth bud are the most common local causes (3,4). Due to the complexity of etiological factors involved in tooth impaction, any tooth can potentially be affected. However, third molars, followed by canines and mandibular premolars, are the most commonly impacted teeth. Specifically, the absence of sufficient arch space distal to the second molars is regarded as the primary contributor to M3MI (5).

M3MI may remain asymptomatic; however, they are also associated with various complications, including distal cervical caries on adjacent M2M, external root resorption (ERR), periodontal disease, and pericoronitis (6). As a result, prophylactic extraction of M3MI is often recommended to prevent such complications (7,8). Nevertheless, the necessity for routine prophylactic extraction remains a subject of ongoing debate (9,10). In the absence of strong scientific evidence supporting routine removal, a conservative management strategy, particularly for asymptomatic third molars—is generally

advocated. This approach emphasizes regular clinical and radiographic monitoring over immediate surgical intervention (11).

Due to the complexity and potential risks associated with third molar surgery, particularly in older patients, a preventive or minimally invasive approach is often the preferred strategy in managing asymptomatic cases (8). The well-established association between anatomical factors and the risk of intraoperative nerve injury in cases of M3MI further emphasizes the necessity of thorough preoperative assessment to support optimal surgical planning and risk mitigation (12). When M3MI is suspected during clinical examination, radiographic imaging is essential for confirming the diagnosis and evaluating the tooth's position. DPR remains the most widely utilized imaging modality for this purpose, despite the inherent limitations of its two-dimensional representation (13). In recent years, Cone-Beam Computed Tomography (CBCT) has gained increasing use, owing to its ability to produce high-resolution, three-dimensional images that significantly enhance diagnostic accuracy. Nonetheless, CBCT should not be employed as a routine diagnostic tool due to considerations of radiation exposure and cost-effectiveness (14).

Given the lack of data on the prevalence and characteristics of M3MI in the Albanian population, the aim of this retrospective cross-sectional study was to evaluate the prevalence and impaction patterns of M3MI in a selected Albanian population using DPRs.

MATERIAL AND METHODS

This cross-sectional study was conducted between March and August 2025. Data were retrospectively collected from the archives of a dental X-ray center (Grafi Dentare Ladi) located in Tirana, Albania. DPRs of adult patients seeking various dental treatments taken between January 2023 and March 2025 were evaluated, and a total of 650 DPRs were included in the study. Inclusion criteria were: individuals aged 18 years or older, good-quality DPR, presence of at least one M3MI, presence of adjacent M2M. Exclusion criteria were: individuals younger than 18 years, absence of adjacent M2M.

All DPR were performed with the same machine Axeos (Sirona Dental Systems GmbH, Charlotte, North Carolina, US) 63 kV power exposure time 14.1 sec.

The decision to use Winter's and Pell & Gregory classifications was based on an extensive literature review (5,7,8,9).

According to the Winter's classification M3MI are divided according to the angle formed intersecting the longitudinal axes of M3MI and adjacent M2M as follows: VI (0° – 10°), MA (11° – 79°), horizontal (H) (80° – 100°) and distoangular (DA) (11° – 79°).

The Pell&Gregory classification evaluates impaction depth using the occlusal plane of M2M.

Position A; the occlusal surface of M3 on the same level or above the occlusal plane; Position B: the occlusal surface of M3 between the occlusal plane and the cervical portion of M2M;

Position C: occlusal surface of the M3 below the cervical portion of M2M.

In addition M3MI classifies based on the amount of the tooth covered by the mandibular ramus bone: Class I—mesio-distal diameter of the M3MI was shorter than the distance from the anterior border of the mandibular ramus to the distal aspect of M2M; Class II: mesio-distal diameter of M3MI was longer than the distance from the anterior border of the mandibular ramus to the distal surface of the M2M;—Class III: there was no space between the distal aspect of M2M and the mandibular ramus.

The statistical analysis was performed using the IBM SPSS Statistics 26.0 package program (IBM Corp., Armonk, New York, USA). The descriptive statistics of categorical data was summarized as number and percentage, mean and standard deviation. The relationship between categorical variables was evaluated with chi-square analysis. The level of significance was set at an alpha value of 5%.

RESULTS

Table 1 shows the descriptive statistics results. The prevalence found in this study was 33.2% as from 650 OPT included in this study 217 had at least one M3MI. Of the total, 119 individuals had bilateral impaction. Unilateral impaction was observed in 97 individuals. Among these, impaction on the right mandibular side was more common ($n = 54$) compared with the left side ($n = 43$). The number of impacted teeth evaluated was 335. There were more participants from the

age group 30-40 years (38.2%) but the change was no significant ($p=0.069$). 68.6% of the sample was composed from females.

According to Winter's classification VI was more prevalent (41.8%), followed from MA (36.1%). Impaction depth according to Pell & Gregory reveals that most prevalent were position B (49.2%) followed from position A (26.5%) and position C (21.1%). The distance from ramus shows that Class II is the most prevalent with 43.2%, and class III 38.5%.

Table 1. Descriptive statistics of the sample

Parameter	Frequency		%
	Age		
18-29 years	69		31.7%
30-40 years	83		38.2%
>40 years	65		30%
Unilateral			
38	43		44%
48	54		56%
Bilateral	119		55%
Total		217	
	Gender		
Male	97		29.9%
Female	120		68.6%
	Winter's		
Vertical	140		41.8%
Mesioangular	121		36.1%
Distoangular	33		9.8%
Horizontal	41		12.2%
Total		335	
	Pell & Gregory		
	Depth		
A	96		26.5%

B	120		49.2%
C	119		21.1%
	Ramus		
I	41		12.2%
II	145		43.2%
III	149		38.5%
Resorption	81		24.1%
Caries	145		43.2%

In table 2 are evidenced the results obtained after the comparison between the presence of resorption and caries and the position of M3MI. A significant change was observed for those cases with resorption with the position according to Pell & Gregory.

Regarding caries, the change was significant for either classifications Pell & Gregory and Winter's. However, caries was more prevalent in Class I (18.1%) and Position B (18.4%).

ERR prevalence was 24.1% and was associated with Position A. Although there were more cases with ERR in VI did not rich statistical significance.

Table 2. Association between resorption and caries with impaction type

Parameter	Resorption		<i>p value</i>	Caries		<i>p value</i>
	Present	Absent		Present	Absent	
Pell&Gregory						
A	15(15.6%)	81(84.3%)	0.0013	19(15.8%)	101(84.1%)	0.0319
B	7(5.8%)	113(94.1%)		22(18.4%)	97(81.5%)	
C	6(5%)	113(95%)		8(8.3%)	88(91.6%)	
Ramus						
I	1(2.4%)	40(97.5%)	0.0630	27(18.1%)	122(67%)	0.0309
II	10(6.8%)	135(93.1%)		20(13.7%)	125(85%)	
III	16(10.7%)	133(89.2%)		2(4.8%)	39(95.2%)	
Winter						
Vertikal	13(9.2%)	127(90.7%)	0.168	6(4.2%)	134(95.7%)	0.000
Mesioangular	7(5.7%)	114(94.2%)		26(21.4%)	94(77.6%)	
Distoangular	4(12.1%)	29(87.8%)		3(9%)	30(91%)	
Horizontal	2(4.8%)	39(95.1%)		13(31.7%)	28(68.2%)	

DISCUSSION

This study’s aim was to evaluate the prevalence and impaction patterns of M3MI in a selected Albanian population. The importance of studies assessing the prevalence and anatomical factors of impaction lies not only in its high occurrence but also in the potential complications and complexity of the numerous surgical interventions required for extraction (3,15). In this study DPR was used to evaluate impaction pattern of M3MI. DPR allows initial overall diagnosis of the patient’s oral health and a more

in-depth examination of third molar teeth, as well as linear and angular measurements of the mandible (16). Furthermore, DPR performs similar to CBCT in estimation of occlusal impaction. Hence, it may also be used to differentiate those cases where a more accurate diagnosis is needed such as suspicion of close proximity to vital anatomic structures (14). According to a recent systematic review, the worldwide prevalence of M3I was 36.9%, underscoring that geographic—and possibly environmental or genetic—factors may influence

the likelihood of impaction (17). Regionally, Europe demonstrated the lowest prevalence (24.5%) compared with other populations. In this context, the prevalence observed in the present study (31.2%) aligns with the findings of that systematic review. However, comparison with a study involving a Kosovar population reveals a notable discrepancy, as that study reported a substantially higher prevalence of M3MI (62.1%) (18). Several factors may account for such inconsistencies, including differences in mineralization rates of the mandibular third molars (MTM), variations in tooth-to-jaw size ratios, and differing levels of physical maturity among study samples (19,20). Age distribution of the participants is another important contributor to variation in prevalence. Research indicates that the prevalence of M3MI decreases with age (21), potentially due to early tooth loss, which may create space and facilitate the eruption of previously impacted teeth. Additionally, the lower prevalence observed in older individuals may also reflect prior extraction of third molars. There is a huge body of literature showing that the prevalence of M3MI is higher among females. This change may be attributed to differences in the methodology, sample size and ethnic groups (3,5,8). Moreover, the growth pattern of the mandible in males persists till 20 years while in females ceases at 18 years of age before the eruption time of M3M (22, 23). A similar tendency was observed in our sample. Both the angulation and depth of impaction influence the likelihood of complications

associated with M3MI, underscoring the importance of early identification and timely surgical extraction to prevent severe complications related to delayed intervention (9). In this study, the pattern of M3MI was assessed using Winter's classification for angulation and the Pell & Gregory classification for both the depth of impaction relative to the occlusal plane and its horizontal relationship to the ramus. As these classification systems are widely recognized and frequently used in similar research, their application ensures methodological consistency (7). According to the results of the present study, the most prevalent impaction type was vertical (41.8%). This is in line with a previous study (2, 24) but contradicts other studies (8,20)

Despite extensive investigation, the etiology of M3MI remains only partially understood. Nonetheless, there is broad agreement in the literature that insufficient space in the mandibular arch is the primary etiological factor (25). Specifically, recent findings suggest that the dimensions of the retromolar space play a critical role, with reduced space significantly increasing the likelihood of impaction (16). The Pell & Gregory classification system, which evaluates impaction based on the depth of the third molar relative to the occlusal plane and its horizontal position in relation to the mandibular ramus, is widely used in clinical and research settings. However, reported prevalence rates based on this system vary considerably across studies, likely

due to differences in population characteristics and diagnostic criteria.

Regarding the position of M3MI according to the Pell & Gregory classification, the present study found that Class II (43.2%) and Level B (49.2%) were the most prevalent impaction types. These findings are consistent with previous studies that also identified Class II, Level B as the most commonly observed pattern (7,22, 26). However, other studies have reported differing results, with Class I, Level A cited as the most frequent configuration (23,25). This variability in findings may be attributed to the age-dependent nature of the Pell and Gregory system. As individuals age, third molars may continue to erupt in an attempt to achieve occlusal contact, potentially leading to changes in their classification over time (8).

Despite these discrepancies, precise assessment of impaction patterns remains essential, particularly because certain impaction types, although less prevalent, are more likely to be in close proximity to or in direct contact with the mandibular canal. This anatomical relationship significantly increases the risk of surgical complications, including nerve injury (9).

The frequent occurrence of caries and ERR as consequences of M3MI has contributed to increased clinical awareness and the need for comprehensive assessment of these teeth. In the present study, the prevalence of caries in the adjacent M2M due to M3MI was found to be 42.9%. This finding is in line with previous reports showing similar caries prevalence (5,24). However, other studies have documented

significantly lower rates, including 16.9% (26), 12.12% (7), and 18.36% (20). Although there is a lack of published data on caries prevalence among the adult Albanian population, the high rate observed in this study is consistent with the authors' clinical experience and expectations.

Consistent with earlier research (5,7,24), MA impactions demonstrated the highest association with caries development. Furthermore, caries was more frequently observed in Level A and B, as well as in Class I and II positions. This distribution likely reflects the formation of stagnation zones that promote plaque accumulation and food impaction (21). In addition to caries, MA impactions have been associated with periodontal bone loss distal to the second molar, underscoring the importance of thorough evaluation during surgical planning (28).

Although DPRs are widely employed as a primary diagnostic tool for M3MI, their diagnostic accuracy is limited for detecting associated pathologies such as ERR (26). A recent systematic review reported ERR prevalence ranging from 20.2% to 54.9%, with higher rates linked to increasing age and MA impaction patterns (29). Accordingly, the prevalence found in the current study aligns with these findings, potentially due to the inclusion of older participants in the sample.

This study has several limitations that should be acknowledged. First, as a single-center investigation, the findings may not be fully generalizable to the entire Albanian population.

Second, the data were obtained solely through DPR, without integration of clinical evaluations or assessment of associated symptoms. As a result, the radiographic findings cannot be directly correlated with clinical situations. To address these limitations, future research should include multicenter studies with combined radiographic and clinical data for a more comprehensive understanding.

CONCLUSION

In conclusion, this study identified a notable prevalence of M3MI. The most frequently observed impaction type was Class II, Level B according to the Pell&Gregory classification and the vertical impaction type. Moreover, the prevalence of caries on adjacent M2M was high. While additional research with larger and more diverse samples is necessary to refine the estimation of M3MI prevalence and its patterns among Albanian adults, the findings of this study offer important baseline data that can inform both clinical decision-making and future epidemiological investigations.

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Conflict of Interest Statement: The authors declare that they have no conflict of interest.

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