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Research / Araştırma Makalesi

The Classification of Impacted Third Molar and Their Relationship with Distal Caries on the Second Molar

Gömülü Üçüncü Azı Dişlerinin Sınıflandırılması ve İkinci Azı Dişindeki Distal Çürüklerle İlişkisi

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ABSTRACT

Background: Teeth are referred to as impacted/mucosa retention impacted when they cannot reach the expected coronal level in occlusion within the expected eruption period due to adjacent teeth on the eruption path, surrounding bone or soft tissue, or different anomalies. They are directly or indirectly linked to various disorders in the dentomaxillofacial region, including caries. The aims of this study are to assess the frequency of impacted third molars and to examine their association with caries formation on the distal surface of adjacent second molars.

Methods: Panoramic radiographs of 705 patients meeting inclusion criteria were analyzed to assess the prevalence and positioning of impacted third molars. The study employed Pell & Gregory (for classify depth of impacted third molar and retromandibular space to anterior border of mandibular ramus) and Winter (impacted third molar relative to second molar) classification systems to classify impacted teeth. Chi square and Z tests were used to evaluate the obtained data.

Results: While vertical angulation has highest rate among angulation types, position C and class 2 were most prevalent types according to Pell & Gregory classification. Statistical analysis revealed a significant association between horizontal angulation and position A with caries occurrence on the distal surface of second molars.

Conclusion: In terms of preventive dentistry, it may be recommended to extract horizontally or mesioangularly positioned third molars, and also those in A position, to prevent the formation of caries in the second molars.

Keywords: Dental caries, Impacted teeth, Panoramic radiography, Third molar

ÖZ

Amaç: Sürme yolundaki komşu dişler, çevredeki kemik veya yumuşak doku veya farklı anomaliler nedeniyle beklenen sürme süresi içerisinde oklüzyonda beklenen koronal seviyeye ulaşamayan dişler, gömülü/mukoza retansiyonlu gömülü diş olarak anılır. Gömülü dişler, diş çürükleri de dahil olmak üzere dentomaksillofasiyal bölgedeki çeşitli bozukluklarla doğrudan veya dolaylı olarak bağlantılıdırlar. Bu çalışmanın amacı, gömülü üçüncü azı dişlerinin sıklığını değerlendirmek ve bunların komşu ikinci azı dişlerinin distal yüzeyindeki çürük oluşumu ile ilişkisini incelemektir.

Gereç ve Yöntemler: Dahil etme kriterlerini karşılayan 705 hastanın panoramik radyografileri, gömülü üçüncü azı dişlerinin prevalansını ve konumunu değerlendirmek için analiz edildi. Bu çalışmada gömülü dişleri sınıflandırmak için, Pell & Gregory (gömülü üçüncü molar gömülülük derinliğini ve mandibular ramusun ön sınırına kadar olan retromandibular boşluğu sınıflandırmak için) ve Winter (gömülü üçüncü moların ikinci molara göre açılanması) sınıflandırma sistemleri kullanılmıştır. Bu çalışmada ki kare ve Z testleri kullanılmıştır.

Bulgular: Açılanma türleri arasında vertikal açılanma en yüksek orana sahipken, Pell & Gregory sınıflamasına göre pozisyon C ve sınıf 2 en sık görülen türlerdir. İstatistiksel analiz, yatay açılanma ve A konumu ile ikinci azı dişlerinin distal yüzeyinde çürük oluşumu arasında anlamlı bir ilişki olduğunu ortaya çıkarmıştır.

Sonuç: Koruyucu diş hekimliği açısından, ikinci büyük azı dişlerinde çürük oluşumunu önlemek amacıyla, pozisyon sınıflaması içinde, özellikle A pozisyonundakiler olmak üzere horizontal ve mezioangular gömülü üçüncü azı dişlerinin çekimi önerilebilir.

Anahtar Kelimeler: Diş çürükleri, Gömülü diş, Panoramik radyografi, Üçüncü azı dişi

1. Introduction

In healthy individuals, while primary dentition is expected to be completed between the 30th and 36th months age; permanent dentition, including the eruption of the wisdom teeth, generally completes between the ages of 17 to 20.[1] Teeth are referred to as impacted/mucosa retention impacted when they cannot reach the expected coronal level in occlusion within the expected eruption period due to adjacent teeth on the eruption path, surrounding bone or soft tissue, or different anomalies.[2-4] The third molars, also can be named as wisdom teeth, showed the highest incidence of impaction. The world-wide incidence of third molar impaction has reported rates ranging from 30.3% to 68.6%. The reason for this wide variable range can be considered as differences in race and ethnicity that affect the epidemiological characteristics of third molar impaction.[4-7] Impacted third molars (ITM) are caused by obstructions in the eruption path due to insufficient space, abnormal positioning, or obstruction caused by adjacent anatomical structures.[8] They can be directly or indirectly linked to various disorders in the dentomaxillofacial region such as pain, infection, cyst, tumor, jaw fractures, misalignment of mandibular anterior teeth, caries, pericoronitis, periodontitis, or root resorption. Furthermore, some impacted teeth may not exhibit symptoms. [9-13]

Pericoronitis is related with mucosa retention impacted teeth, associated with the presence of operculum, inadequate oral hygiene and limited self-cleaning capacity, and caries may occur as a result of the accumulation of food particles and cumulative microorganisms and plaque that resist removal by regular brushing and flossing.[6] Several classification systems have been introduced in dental literature to categorize ITMs. These classification systems consider factors such as the angle of impacted teeth, depth of impaction within the bone, and proximity to the anterior border of the mandibular ramus. Winter and Pell&Gregory classifications are the most common classification methods used to classify ITMs in the literature.[9, 14, 15]

Radiographic imaging examinations play a crucial role in dentistry, serving as fundamental tools for diagnosis, treatment planning, and patient follow-up.[16] The primary radiographs utilized in dentistry are periapical and panoramic radiographs.[15, 17] One of the advantages periapical radiography over panoramic radiography is higher image resolution.[18] Periapical X-rays, due to their limited size, frequently pose a challenge for practitioners when imaging deeply positioned third molars in the jaws. This can result in discomfort for the patient or limiting the visualization of dental anatomy. In contrast, panoramic radiography offers a quicker, and more comfortable method for visualizing third molars, benefiting both the patient and the practitioner.[15] Furthermore, panoramic radiography enables the evaluate of the relationship between maxillary wisdom teeth and the

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maxillary sinus, as well as the proximity of mandibular wisdom teeth to the inferior alveolar canal, although this is limited to a two-dimensional imaging.[17, 18] Panoramic radiographs are widely accepted as the preferred method for evaluating the maxillo-mandibular complex, the entire dento-alveolar area and adjacent anatomical structures, as well as assisting in the analysis and classification of wisdom teeth. [16, 19] Panoramic radiography is often used as the primary method for wisdom teeth detection; however, when there is limited space between mandibular ITMs and the mandibular canal, cone beam computed tomography (CBCT) is recommended for a higher level of detail. Nonetheless, it's important to bear in mind that CBCT exposes patients to a higher radiation dose compared to panoramic radiography.[17, 20]

This study aims to evaluate the frequency of ITM positions and assess the connection between the types of ITMs and the prevalence of caries on the distal aspect of second molars (SM) by using panoramic radiography.

2. Material and Method

Approval for this study was received from the Kütahya University Non-Interventional Clinical Research Ethics Committee, dated February 13, 2024, with protocol number 2024/02-27. Panoramic radiographs of 3320 patients who applied to the Oral and Maxillofacial Radiology department of Kütahya University Faculty of Dentistry between April 2022 and December 2022 were evaluated and 705 panoramic radiographs were included in the study. All digital panoramic radiographs were taken with the Carestream Dental CS 8100 (Carestream Health, Canada) device operating at 65-90 kVp and 6-10 mA. The images obtained were examined on the Acer Veriton VZ4880G (23.8-inch, 1920 X 1080 resolution) model screen.

2.1. Inclusion and Exclusion Criteria

Panoramic radiographs with excessive superposition preventing caries detection or poor image quality, panoramic radiographs of patients with systemic or craniofacial syndromic diseases, under 20 years of age and over 44 years of age, partially ITMs with mucosal retention and those missing SM adjacent to the ITMs were excluded from the study. All panoramic radiographs that could not be excluded with these criteria were included in the study.

The sample size was estimated assuming an alpha error of 5%, effect-size of 0.18 and study power of 95% by means of relation between distal caries presence and third tooth impaction from the previous study.[21] Based on these results, the minimum total sample size was calculated as 611 (G*Power: Statistical Power Analyses for Windows; Dusseldorf, Germany).

2.2. Impacted Tooth Classification

With this study, it was explored the association between the positions of impacted mandibular and maxillary third molars and the presence of caries on the distal surface of the SMs. The classification systems of Pell & Gregory[22] and Winter[23] were utilized to categorize maxillary and mandibular ITMs. Mandibular third molars were classified into vertical and horizontal positions based on the Pell & Gregory system, whereas maxillary third molars were classified exclusively by vertical position.

a. Vertical position according to Pell & Gregory classification (**Figure 1**):

Position A indicates that the imaginary line passing through the occlusal plane of the ITM aligns with or is superior to the occlusal plane of the adjacent SM.

Position B signifies that the imaginary line is situated between the occlusal plane of the ITM and the cemento-enamel junction of the adjacent SM.

Position C denotes that the imaginary line is at or inferior to the cemento-enamel junction of the adjacent SM.

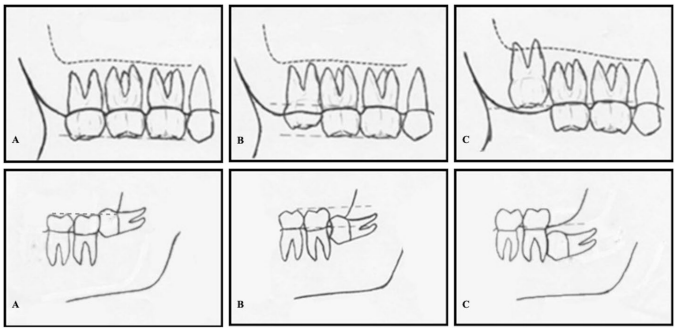

Figure 1. Vertical classification of maxillary and mandibular ITMs according to the Pell and Gregory classification. **A**: Position A, **B**: Position B, **C**: Position C.

b. Horizontal position according to Pell & Gregory classification (**Figure 2**):

Class 1: The distance from the ramus to the distal aspect of the SM is equal to or greater than the mesiodistal length of the third molar.

Class 2: The distance from the ramus to the distal aspect of the SM is less than the mesiodistal length of the third molar.

Class 3: These cases involve the third molar being entirely or mostly within the mandibular ramus.

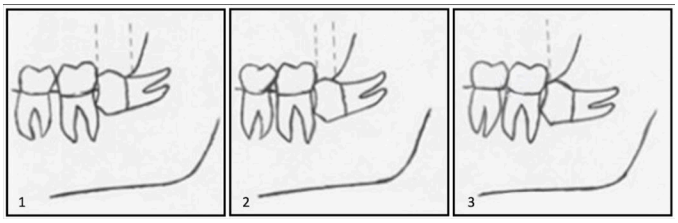

Figure 2. Classification of mandibular ITMs in horizontal directions according to the Pell and Gregory classification. **1**: Class 1, **2**: Class 2, **3**: Class 3.

c. Winter classification

Impacted teeth are divided into six classes: vertical, mesioangular, horizontal, distoangular, buccolingual, and inversion, determined by the angle formed between the long axis of ITM and that of the adjacent SM (**Figure 3**).

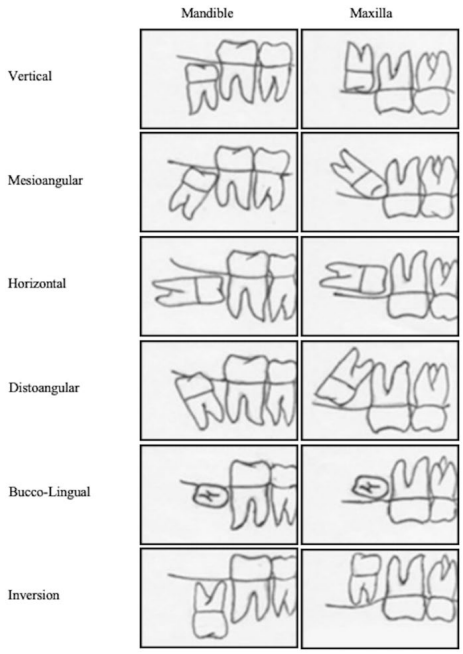

Figure 3. Classification of ITMs in the maxilla and mandible according to the Winter Classification

All ITMs were classified according to their position and angulation using the Winter and Pell & Gregory classifications. Only the classes of the mandibular ITMs were categorized according to the Pell & Gregory classification.

2.3. Detection of the Distal Caries on the Adjacent Second Molar

Only caries on the distal surfaces of maxillary and mandibular SM were evaluated. The caries assessments on the panoramic radiographs of all patients were completed using brightness, contrast and magnifying tools, provided by the radiography imaging program with a monitor (23.8-inch, 1920 X 1080 resolution) in a dark and silent environment. Detection of distal caries on SM and classification of the ITMs were performed by a research assistant in Oral and Maxillofacial Radiology with 3 years of experience.

2.4. Statistical Analysis

The study was conducted by examining the demographic data and radiographic data of the patients and recording them in the Microsoft Excel program. Evaluations were repeated 2 weeks later. Intraobserver agreement was examined with the Goodman - Kruskal tau coefficient. After all examinations were completed and recorded, the data were imported into the statistical program (SPSS version 26, for Mac, Chicago, IL). Frequency analysis was performed on all data examined. Statistical relationships between categorical data were examined with chi-square tests. Z test was applied for data with a statistically significant relationship. The significance level was 0.05 ($p < 0.05$) and the confidence level was 95%.

3. Results

The correlation between the two different evaluations was excellent (>0.90). The second observation was used for statistical analysis. 705 of the 3320 panoramic radiographs examined were included in the study. A total of 1493 ITMs were classified. 554 of the ITMs were in the maxilla and 939 in the mandible. 434 of the patients were women and 271 were men. ITMs were observed mostly in one quadrant in female patients and in two quadrants in male patients. The number of patients with ITMs in all four quadrants was lowest in both genders (**Table 1**).

Table 1. Gender, age group and number of quadrants with ITMs

		Number of quadrant				
		1	2	3	4	Total
Gender	Female	145	135	86	68	434 (61.56)
	Male	95	105	41	30	271 (38.44)
	Total	240	240	127	98	705 (100)
Age group	20-24	54	104	63	70	291 (41.28)
	25-29	70	57	31	18	176 (24.96)
	30-34	48	43	18	4	113 (16.03)
	35-39	58	29	13	5	105 (14.90)
	40-44	10	7	2	1	20 (2.83)
	Total	240	240	127	98	705

Patients between the ages of 20 and 44 (mean age 27.89) were divided into five equal age groups: Group 1 (20-24 years), Group 2 (25-29 years), Group 3 (30-34 years), Group 4 (35-39 years) and Group 5 (40-44 years old). The highest ITMs frequency was observed in Group 1, and the groups showing frequency values from high to low were found in Group 2, Group 3, Group 4 and Group 5, respectively. The age range with the highest rate of ITM in a single quadrant was 25-29 years of age; the rate of ITMs detected in two, three and four quadrants were highest in the 20-24 age range (**Table 1**).

Among all the ITMs seen in our study, the three most common angulation types were vertical, mesioangular and horizontal, respectively. The least common type was inversion. No distal caries was observed in any of the SMs adjacent to the ITMs with inversion type (**Table 2**). The relationship between the angulation and position of all ITMs and the distal surface caries of the SM was found statistically significant. It was observed that distal caries was found statistically significantly more frequently in the horizontal type of angulation than in all angulation types except inversion. In comparison between horizontal and inversion type angulations was not statistically significant. Furthermore, it was observed that distal caries was found statistically significantly more frequently in the mesioangular type of angulation than in the distoangular and buccolingual types. When the position situations are examined, the most common distal caries was in position A, positions B and C respectively. And the relationship between positions was statistically significant (**Table 3**).

Tablo 2. Frequency of ITM according to Winter and Pell & Gregory classifications

		Mandible	Maxilla	Total
		(n (%))	(n (%))	(n (%))
Angulation	Vertical	391 (41.6)	333(60.1)	724 (48.5)
	Horizontal	210 (22.4)	5 (0.9)	215 (14.4)
	Mesioangular	301 (32.1)	46 (8.3)	347 (23.2)
	Distoangular	7 (0.7)	139 (25.1)	146 (3.1)
	Bucco-lingual	18 (1.9)	28 (5.1)	46 (3.1)
	Inversion	12 (1.3)	3 (0.5)	15 (1.0)
Position	Position A	228 (24.3)	2 (0.4)	230 (15.4)
	Position B	536 (57.1)	85 (15.3)	621 (41.6)
	Position C	175 (18.6)	467 (84.3)	642 (43.0)
Class	1	127 (13.5)	-	-
	2	658 (70.1)		
	3	154 (16.4)		

Table 3. Relationship between the positions and angulations of maxillary and mandibular of ITMs and caries formation on the distal surface of the SM

		Caries			P value
		Absence	Presence	Total	
		(n (%))	(n (%))	(n (%))	
Angulation	Vertical[a,b]	662 (91.4)	62 (8.6)	724 (100)	0.000*
	Horizontal[c]	171 (79.5)	44 (20.5)	215 (100)	
	Mesioangular[b]	306 (88.2)	41 (11.8)	347 (100)	
	Distoangular[a]	140 (95.6)	6 (4.4)	146 (100)	
	Bucco-lingual[a]	45 (97.8)	1 (2.2)	46 (100)	
	Inversion[a,b,c]	15 (100)	0 (0)	15 (100)	
Position	Position A[a]	186 (80.9)	44 (19.1)	230 (100)	0.000*
	Position B[b]	541 (87.1)	80 (12.9)	621 (100)	
	Position C[c]	612 (95.3)	30 (4.7)	642 (100)	

*Chi-Square and Z tests are used. * p < 0.05 was considered statistically significant. There is no statistically significant difference between groups with the same superscripts.*

The relationship between different angulation groups of the mandibular ITM and distal surface caries of the SM was shown in **Table 4**. The relationship between the types of angulations and position in the mandible and the frequency of caries on the distal surface of the SM was found statistically significant. The most common type of angulation in the mandible was vertical. It was observed that distal caries was found statistically significantly more frequently in the horizontal type of angulation than in the vertical and mesioangular types. Additionally, distal caries was observed more frequently in positions A and B than in position C. There was no statistically significant relationship between Position A and Position B in terms of distal caries frequency. According to statistical results, there was not statistically significant relationship between the horizontal classification of the ITMs in the mandible and the caries on the distal surface of the SM.

The relationship between the position and angulation types of the maxillary ITMs and the caries on the distal surface of the SMs was not statistically significant (**Table 5**).

Table 4. Relationship between the angulations, positions and classes of mandibular ITMs and caries formation on the distal surface of the SM

		Caries			P value
		Absence (n (%))	Presence (n (%))	Total (n (%))	
Angulation	Vertical[a]	348 (89)	43 (11)	391 (100)	0.015*
	Horizontal[b]	166 (79)	44 (21)	210 (100)	
	Mesioangular[a]	261 (86.7)	40 (13.3)	301 (100)	
	Distoangular[a,b]	6 (85.7)	1 (14.3)	7 (100)	
	Bucco-lingual[a,b]	17 (94.4)	1 (5.6)	18 (100)	
	Inversion[a,b]	12 (100)	0 (0)	12 (100)	
Position	Position A[a]	185 (81.1)	43 (18.9)	228 (100)	0.01*
	Position B[a]	460 (85.8)	76 (14.2)	536 (100)	
	Position C[b]	165 (94.3)	10 (5.7)	175 (100)	
Class	1	108 (85)	19 (15)	127 (100)	0.064
	2	560 (85.1)	98 (14.9)	658 (100)	
	3	142 (92.2)	12 (7.8)	154 (100)	

*Chi-Square and Z tests are used. * p < 0.05 was considered statistically significant. There is no statistically significant difference between groups with the same superscripts.*

Table 5. Relationship between the positions and angulations of maxillary ITMs and caries formation on the distal surface of the SM

		Caries			P value
		Absence (n (%))	Presence (n (%))	Total (n (%))	
Angulation	Vertical	314 (94.3)	19 (5.7)	333 (100)	0.679
	Horizontal	5 (100)	0 (0)	5 (100)	
	Mesioangular	45 (97.8)	1 (2.2)	46 (100)	
	Distoangular	134 (96.4)	5 (3.6)	139 (100)	
	Bucco-lingual	28 (100)	0 (0)	28 (100)	
	Inversion	3 (100)	0 (0)	3 (100)	
Position	Position A	1 (50)	1 (50)	2 (100)	0.106
	Position B	81 (95.3)	4 (4.7)	85 (100)	
	Position C	447 (95.7)	20 (4.3)	467 (100)	

*Chi-Square and Z tests are used. * p < 0.05 was considered statistically significant.*

4. Discussion

Impacted teeth can often lead to adverse outcomes.[11] Some authors advocate for the extraction of third molars if they are likely to cause such pathologies, aiming to simplify surgical procedures and reduce morbidity.[24] It is believed that the findings of this study may aid in understanding the relationship between the location and impaction level of ITMs and the occurrence of decay in adjacent SMs. It is also thought that the result of this study may help to decide extraction or follow up of the impacted tooth.

Radiographs are regarded as the gold standard for the assessment of the location and position of ITMs. Two-dimensional radiographs are the most commonly used type of radiographs.[25] Panoramic radiography is a crucial radiographic technique that is considered a standard diagnostic tool for scheduling and planning tooth extraction. It provides a general view of the depth and angulation of the ITMs, which is useful for evaluating the various difficulties associated with the extraction of third molars.[26, 27] In this study, panoramic radiography was used, as it is the most commonly used type of two-dimensional radiograph in our clinic.

In the literature, the prevalence of ITMs ranges from 22% to 57%.[11, 28] In our study, the prevalence of ITM was found to be 21% among 3320 patients, which is close to this range reported in the literature. In our study, the prevalence of ITM was found to be highest in women, accounting for 61.56% of the cases. Variations in the prevalence of ITMs and the frequency of distal caries formation in SMs across studies can be attributed to several factors. These differences may arise from variations in jaw and tooth sizes influenced by factors such as race, individual eating habits, use of oral appliances, dental hygiene practices, and genetic factors. Furthermore, discrepancies in study outcomes may stem from differences in sample sizes, the application of various statistical methods, and variances in diagnostic and exclusion criteria.[29]

In the study conducted by Alsaegh et al.,[2] the relationship between the ITM pattern and distal caries in the SM was examined. The majority of the ITMs examined were in female patients (63.1%). In a similar study conducted by Yıldırım et al.,[12] the frequency of ITM was higher in females. In our study, 63.3% of the ITMs were in females. This situation can be explained by the fact that while jaw development in females is generally completed when the third molars begin to erupt, in males, the jaw bones continue to grow while the third molars erupt, resulting in the female jaw being smaller compared to males.

In the study conducted by Yıldırım et al.,[12] the prevalence of ITMs and their potential to induce distal caries in adjacent teeth were investigated using panoramic radiographs. The relationship between angulation of ITMs in the mandibular jaw and the distal caries presence on the SM was found to be statistically significant. Furthermore, it was also reported that the most common distal caries prevalence in impaction positioning was vertical angulation. Despite variations in prevalence across studies, the most prevalent angulation type remained consistent. In addition, in our study, women had more ITMs. Similar with their work, our study highlighted a statistically significant association between angulation and distal caries formation. The disparities in prevalence rates between studies could be attributed to regional differences and variations in patient histories that were not accounted for in the analyses.

In the study conducted by Alsaegh et al.,[2] the most prevalent angulation type was mesioangular, the position type was B, and the class type was 2. The prevalence of distal caries in the SM was found to be statistically significantly higher in mesioangular angulation and position B and class II. In the present study, ITMs were most frequently observed in the vertical angulation, position C, and class 2 groups. The next most prevalent angulation type was mesioangular. The prevalence of distal caries in the SM was found to be statistically significantly higher in the horizontal angulation and position A groups. Furthermore, no correlation was identified between the horizontal classification and distal surface caries in the SM in the present study. The notable correlation between horizontal angulation and distal caries observed in our study, in comparison to other study, may be attributed to the larger number of teeth examined. Furthermore, it is important to consider the ethnic origin and genetic differences of the patients.

In a study evaluating ITMs on panoramic radiographs in orthodontic patients,[29] mesioangular angulation was found to be the most common type and vertical angulation was found to be the second most common impaction angulation. In addition, findings in this study reported that the rate of ITM teeth in women and in the mandible was statistically higher. Additionally, caries was predominantly observed on the distal surface of the SM in cases of mesioangular and horizontal positions. In a study conducted by Falci et al.[21] on mandibular ITMs, it was found that distal caries formation was more likely to occur in horizontal and mesioangular types. In these studies, no statistical relationship was reported between mesioangular and horizontal types of angulations. In our study, vertical angulation was shown to be the most common angulation type for ITMs in both the mandible and maxilla. In addition to that, distal caries on the SM seen most in horizontal angulation type. Our findings were generally consistent with these studies. Differences in the demographic characteristics or oral health profiles of the study populations could contribute to contrasting observations regarding ITMs and their associated dental pathologies.

In a study investigating the relationship between the positions of ITMs in the mandible and the occurrence of distal surface caries on adjacent SMs, researchers observed a higher frequency of ITMs among men.[30] Their findings indicated that mesioangular angulation was the most prevalent among ITMs, with a corresponding higher incidence of distal caries in SMs observed in the mesioangular position. Notably, this study exclusively utilized bite-wing radiographs and focused specifically on mucosa-retained ITMs in the mandible. The primary difference in our study's results likely stems from these methodological distinctions. The focus on mucosa-retained ITMs and the utilization of bite-wing radiographs could influence the observed prevalence rates and associations between tooth angulation and

and distal caries occurrence.

In a study investigating pathologies associated with mandibular ITMs affecting SMs, researchers identified position C as the most common impaction position, with mesioangular angulation being predominant.[31] Furthermore, the study revealed a statistically significant incidence of caries on the distal surface of SMs in cases of mesioangular impaction. Another study by Hashemipour et al.[11] examined the locations of ITMs in both the maxilla and mandible, reporting a prevalence rate of 57%. Their findings indicated that mesioangular angulation was the most common type, followed by vertical angulation. Additionally, they observed a higher impaction rate of third molars among women and noted a predilection for mandibular impaction. These differences between studies may be attributed to genetic and racial factors, which can influence variations in dental anatomy and eruption patterns. The diverse genetic backgrounds and racial compositions of study populations can contribute to discrepancies in prevalence rates, impaction patterns, and associated dental pathologies across different studies.

Chen et al.[32] examined the correlation between the angulation of the mandibular ITM and the prevalence of distal caries on the SMs through the use of CBCT. In their study, the prevalence of distal caries was found to be 31.6%. The relationship between being impacted in the mesioangular and caries on the distal surface of the SM was found to be statistically significant. In our study, the prevalence of distal caries in relation to the ITM in the mandible was 13.7%. Although this rate was consistent with similar studies in the literature (13.4-18%),[2, 30, 31] it differed from that reported by Chen et al. Additionally, the angulation type most associated with distal caries on the SM in our study was horizontal. This discrepancy is believed to be attributable to the fact that Chen et al. limited their investigation to mesioangular ITMs. It is also important to consider that the choice of imaging method may influence the prevalence of detected caries.

Claudia et al.[33] sought to ascertain the relationship between the angulation of the mandibular third molar and the incidence of distal surface caries of the SM. The study revealed that third molars exhibiting mesioangular, horizontal, and vertical angulation were associated with distal caries of the SM. However, the statistical relationship between angulation types in terms of caries frequency differences was not addressed in their study. In the present study, the relationship between angulation type and distal caries frequency was investigated, as well as the statistical relationship between position and class with the distal caries frequency. Moreover, a statistical analysis was performed to ascertain which types exhibited a higher prevalence of distal caries within these groups. The lack of examination of the relationship between angulation types in their study may have been due to the limited data available.

In a CBCT study conducted by Tunç et al.,[34] no statistically significant relationship was identified between the angulation of the mandibular third molar and distal caries in the adjacent SM. Similarly, the prevalence of distal caries on the SM was found to be statistically higher in horizontal and mesioangular types than in other types in the study conducted by Polat et al.[13] Our study yielded similar results to those observed in the studies conducted by Polat et al., namely that distal caries was more frequently detected on the distal surface of the SM adjacent to the mesioangular ITM, with the horizontal type being the most prevalent. The aforementioned studies were conducted on individuals of the same racial group, albeit with a limited population sample. It is believed that the discrepancies in the study outcomes may be attributed to various factors, including oral hygiene, dietary habits, and socioeconomic status of the patients under examination.

In the study conducted by Kang et al.,[35] the frequency of distal caries in Position A was found to be statistically significantly higher than in Position B and C. The statistical significance rate between Position A and the frequency of distal caries was approximately 2 times higher than in Position B and 3.5 times higher than in Position C. In our study, distal caries in the SM were most frequently observed in Position A, followed by Positions B and C, respectively. Dental plaque is the primary etiological factor in the formation of distal caries. Position A facilitates the accumulation of dental plaque by creating a retention zone in contact with the adjacent tooth. Furthermore, this retention zone is more likely to occur in Position A than in Positions B and C. It is therefore plausible that the higher frequency of distal caries in may be attributed to this phenomenon.

In the study by Marques et al.,[36] in which the authors examined the mandibular ITM and distal caries in adjacent SM on panoramic radiographs, a statistically significant relationship was found. In the mesioangular type, a statistically significant higher prevalence of distal caries was observed in the adjacent SM in comparison to the other types. In our study, this relationship was observed predominantly in the horizontal type, followed by the mesioangular type. This phenomenon may be attributed to the fact that the angulation observed in the horizontal and mesioangular types creates a greater retention area compared to the other types. The investigation did not yield statistically significant findings regarding the relationship between the distance between the SM and the ramus and the incidence of distal caries in the SM. Furthermore, our study yielded no statistically significant correlation between the distance between the SM and the ramus and the incidence of distal caries in the SM.

One limitation of this study was the reliance solely on panoramic radiographs for assessing the presence of caries. The most accurate method for diagnosing caries involves a comprehensive evaluation that combines clinical examination with radiographic findings. This approach enables the detection of early carious lesions that may not be visible on radiographs alone. Additionally, the retrospective nature of the study posed another limitation. Since the study looked back at past data, it was not possible to ascertain any treatments or interventions that may have been performed on the ITMs of the patients. This lack of information about potential interventions could influence the interpretation of the study's findings and their implications. Overall, while the study provided valuable insights into the relationship between ITMs and caries formation in adjacent teeth, these limitations should be considered when interpreting the results and drawing conclusions. Future studies may benefit from employing a combination of clinical and radiographic assessments and incorporating prospective data collection to address these limitations.

5. Conclusion

In our research, we categorized ITMs in both the maxilla and mandible, examining their relationship with caries on the distal surface of the SM. We observed that vertical angulation was the most frequently encountered type, and position C being the most prevalent among the position types. Additionally, we explored the relationship between ITMs and caries formation on the distal surface of SM. Our analysis revealed that horizontal type in Winter classification, and position A in the Pell & Gregory classification, showed the highest correlation with caries occurrence on the distal surface of the SM.

In summary, our findings highlight the relationship between the angulation type and eruption status of ITMs with complications such as caries. Prophylactic removal of horizontally or mesioangularly positioned third molars, and those at the eruption level in position A, may be recommended to minimize the risk of caries development on adjacent SM.

Değerlendirme / Peer-Review

İki Dış Hakem / Çift Taraflı Körleme

Etik Beyan / Ethical statement

Bu çalışmanın hazırlanma sürecinde bilimsel ve etik ilkelere uyulduğu ve yararlanılan tüm çalışmaların kaynakçada belirtildiği beyan olunur.

It is declared that during the preparation process of this study, scientific and ethical principles were followed and all the studies benefited are stated in the bibliography.

Benzerlik Taraması / Similarity scan

Yapıldı – ithenticate

Etik Bildirim / Ethical statement

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Çıkar Çatışması / Conflict of Interest

Yazarlar çıkar çatışması bildirmemiştir. | The authors have no conflict of interest to declare.

Yazar Katkıları / Author Contributions

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Veri Toplanması l Data Acquisition: HA (%50), SSK (%50)
Veri Analizi l Data Analysis: HA (%50), SSK (%50)
Makalenin Yazımı l Writing up: HA (%50), SSK (%50)
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