Does the Type of Impacted Third Molar Induce the Formation of Caries on the Distal Surface of the Second Molar? A Different Outcome and Interpretation

Musa Kazım ÜÇÜNCÜ[1] , Raghıb SURADI[2]

Abstract

Aim Investigators have different ideas about whether or not the third molars should be extracted as a preventive measure. The aim of this study is to evaluate the relationship of impacted third molar with the frequency of caries on the distal surface of the second molar.
Material and method In this prospectively designed study, oral examination and panoramic radiographic images of 438 patients were performed. All of the second and third molars on the mandible are classificated by the eruption levels and angulation degrees. The presence of caries on the distal surface of the second molars was determined with the help of ICDAS-II criteria. Pearson Chi-Square and McNemar test was used to compare categorical variables and both segments.
Results The participants in the study ranged in age from 18 to 62, with a mean age of 28.33± 9.2 years. While a total of 1752 teeth were examined and both segments were evaluated for angulation type and level of eruption. The most frequent angulation type was vertical, and the most frequent eruption level was A. Mesioangulation was the most common type of angulation associated with caries in adjacent teeth.There was a statistically significant variation in the prevalence of caries between the two segments ($p<0.001$; $\chi 2=0.241$). More caries was seen in adjacent teeth with vertical on the right segment and mesioangulation on the left.
Conclusion Prophylactic extraction of third molars should be considered comprehensively. The fact that different types of angulation increase caries susceptibility in both segments highlights the need to evaluate all caries development factors concurrently.

Keywords Dental caries, Digital radiography, Impacted third molar, Mesioangulation, Prospective study

Introduction

Among teeth that are impacted owing to pathological problems such as another tooth or a cyst, surgery of the third molars is one of the most often done interventional operations in the mouth, jaw, and face region (1). Third molars, which are the most frequently impacted teeth (2), are found to be impacted in various types of positions by clinical and radiographic examination and have caused irreversible pathologies in the surrounding tissues and teeth (3) such as pericoronitis, periodontitis, cystic lesions, mandibular fractures, and dental caries on the distal surface of second molar (4,5).

In the 1990s, preventive excision of the third molar was refuted in a variety of scientific fields (6,7). In recent years, however, researchers have examined whether the eruption level and angulation type of the third molar are connected with caries production in the distal second molar (3,5,8–11).

Correspondence: Musa Kazım ÜÇÜNCÜ, ucuncumusakazim@gmail.com

[1] Altınbaş University, Faculty of Dentistry, Depatment of Restorative Dentistry, Istanbul, Turkiye

[2] Biruni University, Faculty of Dentistry, Department of Restorative Dentistry, Istanbul, Turkiye

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Previous studies exploring the relationship between lower third molar angulation degrees and caries frequency were predominantly retrospective (11–13). In addition, it was revealed that there was no research comparing segments and that there were just a few prospective investigations (3,14).

From this perspective, the purpose of this study is to determine if there is a relationship between the impacted type and angulation degrees of the lower third molar and the distal caries of the lower second molar. The following hypotheses are established: 1) The frequency of distal surface caries of the lower second molar tooth is associated with the impacted type and angulation of the lower third molar. 2) The mesioangular lower third molar is the most common source of caries on the distal surface of the second lower molar. 3) According to the segments, the incidence of caries on the distal surface of the lower second molar did not considerably change.

Material and Methods

Ethics approval and sample calculation

After receiving approval from the ethics committee (2022/68-20), the universe sample calculation was conducted using “Cohen’s effect size coefficients” (5). Assuming that the assessments will have a small effect size (d=0.20), the power of the study is stated as 1-ß (ß = Type II error probability) to calculate the sample size; a: It was determined that the sample size must be at least 416 in order to reach a power of 95% at the 0.01 level.

Design of study

Patients who applied to the Biruni University Faculty of Dentistry between April and November 2022 comprised the research group. Initially, oral and radiographic examination was performed by two clinicians. Before beginning the trial, two clinicians with at least five years of dental experience were calibrated for caries diagnosis (15) and identification of the third molar tooth (16). Self-calibrated clinicians examined 30 patients twice with a 1-week delay between examinations to identify caries. Moreover, the interclass coefficients of the two clinicians were calculated (Table I). In the study, clinical and radiographic data of the mandibular second and third molars were conducted on subjects older than 18 years. The investigation comprised 438 participants older than the age of 18 whose panoramic radiographic images (Orthophos XG Sirona, Dentsply, Bensheim, Germany) and dental anamnesis were complete. Patients under the age of 18, those undergoing orthodontic treatment, those with a systemic disease or condition, and those with pathology in the alveolar bone were excluded from the research. Those whose radiographic data were faulty for an assortment of reasons were also excluded. Exclusion criteria include a history of dental treatment, a periapical lesion, or abnormalities in any of the teeth to be examined (4.7, 4.8; 3.7, 3.8). The intraoral eruption types and angulation degrees of teeth 4.8 and 3.8 were determined. The distal surfaces of teeth 4.7 and 3.7, as well as the mesial surfaces of teeth 4.8 and 3.8, were evaluated for the presence of caries.

Table 1: Intraclass and Interclass Correlation Coefficient

Intraclass Correlation Coefficient	Cronbach's Alpha	%95 Confidence Interval		Kappa	
		Lower Bound	Upper Bound	Value	Approx T.
XXX	0.972	0.943	0.987	0.874	9.746
XX	0.947	0.879	0.972		

Detection of dental caries and classification impact third molar

Archer's and Shiller's methods were used to determine the impact type and angulations of the impact third molars. While determining the type of impacted lower third molars by Archer's classification (17) (Figure 1a-1c), the angulation degree was determined with the help of Shiller's (18) method (Figure 2a-2d). Levels of eruption according to Archer's classification A: The occlusal surface of the lower wisdom tooth is at or above the other teeth; B: The occlusal surface of the lower wisdom tooth is above the occlusal level of the second molar but below the occlusal level; C: The occlusal surface of the lower wisdom tooth is the below the level of the cementoenamel junction. Rare angulation forms such as buccolingual, mesoinversion, distoinversion, and distohorizontal were categorized as "others" and excluded from the study.

By using software (Paint 96 DPI, Windows 10 Pro 64 Bit, Microsoft, Redmond Washington, USA), the panoramic radiographic images were processed in a digital environment, and drawings were created to assess the categorization. The angle of angulation was formed by intersecting lines drawn parallel to the occlusal surfaces of the lower second and third molars. The "online protractor" was utilized to calculate the angulation angle (Figure 3a-3b). Thanks to that, using a protractor on the picture, the angulations were determined. 110 to 790 degrees were classified as mesioangular; -100 to 100 degrees as vertical; horizontal values between 800 and 1000 degrees were classified as distoangular.

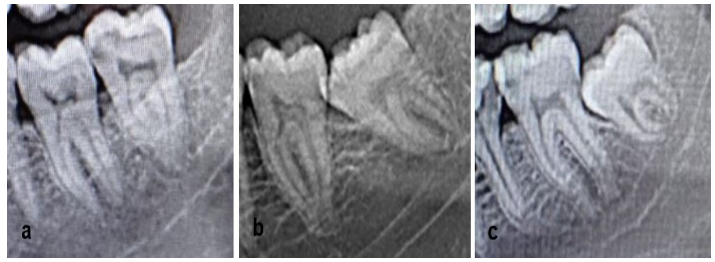

Figure 1: The level of impacted third molar by Archer's Classification. a: the eruption level is "A", b: the eruption level is "B", c: the eruption level is "C"

In the study, the ICDAS-II scale was employed to diagnose caries in the second lower molar. In the first stage of the ICDAS-II scale's two-stage coding process, the kind of restorative material on the affected tooth is specified. In this study, the initial value was considered to be 0 since untreated teeth were evaluated. In the second phase, a numerical definition of caries ranging from 0 to 6 was created based on the depth and characteristic of caries. Teeth having values of 0, 1, 2, and 3 were considered to have "no caries," whereas those with values of 4.5 and 6 were considered to have "caries." (15). The crown surfaces of the teeth categorized as A and B by Archer classification were evaluated and their ICDAS scores were established. Due to the inability to do an oral examination on class C teeth, caries was diagnosed using panoramic radiography. Teeth having D1, D2, and D3 levels were described as having "caries," but teeth with a D0 value were described as having "no caries."(19).

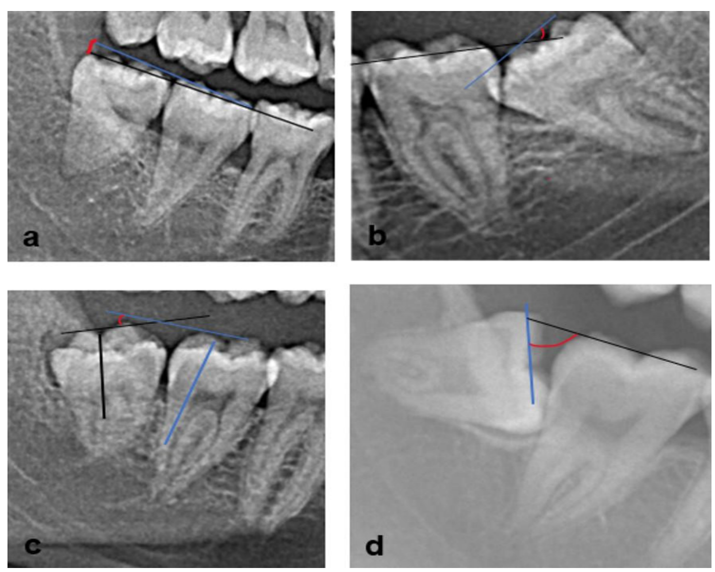

Figure 2: Determining the type of angulation by Schiller's Method. a: Verical, b: Mesioangular, c: Distoangular, d: Horizontal

Statistical methods (mean, standard deviation, median, frequency, and ratio) were used while evaluating the study data, and the SPSS (version 22, IBM Corporation, New York, USA) package program was used. Pearson Chi-Square test was used to compare categorical variables, and the data were analyzed statistically. McNemar test was used when comparing both segments. The statistical significance level was accepted as p<0.05.

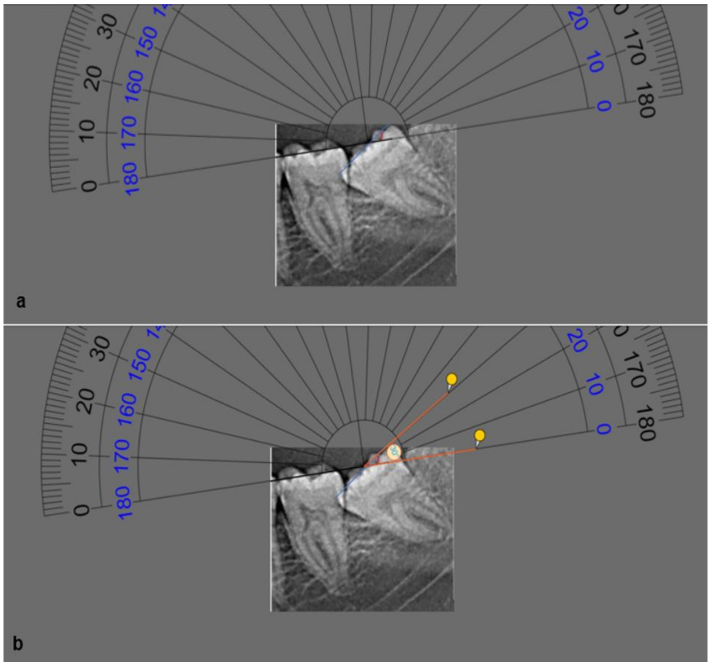

Figure 3: A line parallel to the occlusal surface of both teeth was drawn, and then the online protractor was placed by digital cursor. Fig. 3b: The angle formed at the intersection of the lines was measured digitally with the online protractor.

Results

The research comprised individuals between the ages of 18 and 62, with a mean age of 28.33± 9.2 years. While a total of 1752 teeth were investigated and both segments were assessed combined as angulation type, the most prevalent angulation type was vertical (55.1%), followed by mesioangular (38.2%). Distoangular and horizontal were quite uncommon, accounting for 2.7% and 3.9%, respectively (Table II). While the type of A was the most common type of impacted in both segments (71.1%), the type of C was the least (8%). Caries were observed in 31.3% (n=137) of the lower left second molars; on the right, this rate was 18.5% (n=81). Caries are seen in 18.5% of the lower left third molars; on the right, this rate was found to be 19.2% (n=84). Angulation types, eruption levels, and the presence of caries in all of the examined teeth are shown in Tables III and IV, according to age and gender.

There was a relationship between the angulation and impaction type of the lower right third molar and the frequency of caries in the lower right second molar (p=0.039; p=0.025), respectively. There was no relationship between the prevalence of caries in both teeth (p=0.306) (Table II). In addition, there was no link between the type of angulation of the third molar and the frequency of caries in the third molar (p=0.977) (Table V); the degree of impacted type had a statistically significant effect on the frequency of caries (p<0.05). There was no statistically significant relationship between caries occurrence around both teeth at right segment (p= 0.625) (Table VI).

There was a strong association between the angulation and level of impaction of the lower left third molar and the prevalence of caries in the lower left second molar (p<0.001; p=0.004). In addition, a statistically significant relationship was found between the occurrence of caries around both teeth (p<0.001) (Table VI).

Table 2: Relationship of all the examined teeth with each other

	(4.8) impacted level and angulation degree n (%)	(4.7) prevalence of caries on distal surface n (%)		(3.7) prevalence of caries on distal surface n (%)		(3.8) impacted level and angulation degree n (%)
		Caries (-)	Caries (+)	Caries (-)	Caries (+)	
Mesioangular	163 (37.2%)	131 (30%)	32 (7%)	92 (21%)	80 (18%)	172(39.3%)
Vertical	246 (56.2%)	212 (48%)	34 (7%)	195 (44%)	42 (9%)	237(54.1%)
Distoangular	17 (3.9%)	17 (3%)	0 (0%)	7 (1%)	0 (0%)	7(1.6%)
Horizontal	12 (2.7%)	10 (2%)	2 (1%)	7 (1%)	15 (3%)	22(5%)
p	a: p=0.039* (χ2=4.261)			b: p<0.001** (χ2=44.472)		
A	311(71%)	271 (62%)	40 (9%)	229 (53%)	83 (18%)	312(71.2%)
B	94(21.5%)	71 (17%)	23 (5%)	49 (12%)	36 (8%)	85(19.4%)
C	33(7.5%)	28 (6%)	5 (1%)	23 (5%)	18 (4%)	41(9.4%)
	c: p=0.025* (χ2=7.418)			d: p=0.04* (χ2=11.063)		

a: the relationship between the type of angulation (4.8) and the frequency of dental caries on distal surface (4.7);
b: the relationship between the type of angulation (3.8) and the frequency of dental caries on distal surface (3.7);
c: the relationship between the impacted level (4.8) and the frequency of dental caries on distal surface (4.7);
d: the relationship between the impacted level (3.8) and the frequency of dental caries on distal surface (3.7);

*Pearson Chi-Square Test *p<0.05 **p<0.001*

Table 3: The relationship of angulation and impacted level with caries frequency in both segments according to gender

Segmentation	Angulation and impacted level	Female n(%)	Male (n%)	p
Fourth segment	Mesioangular	94 (22%)	69 (15%)	0.520 (χ2=2.264)
	Vertical	154 (36%)	92 (22%)	
	Distoangular	8 (1%)	9 (2%)	
	Horizontal	7(1%)	5(1%)	
	A	188 (43%)	123 (27%)	0.945 (χ2=0.114)
	B	56 (13%)	38 (9%)	
	C	19 (4%)	14 (3%)	
	No caries (4.7)	220	150	0.328 (χ2=0.341)
	Caries (4.7)	43	25	
Third segment	Mesioangular	98 (23%)	74 (17%)	0.530 (χ2=1.270)
	Vertical	148 (34%)	89 (21%)	
	Distoangular	4 (1%)	3 (1%)	
	Horizontal	13 (2%)	9 (2%)	
	A	183 (41%)	129 (29%)	0.596 (χ2=1.036)
	B	55 (13%)	30 (7%)	
	C	25 (6%)	16 (4%)	
	No caries (3.7)	169 (38%)	132 (31%)	0.009 (χ2=6.099)
	Caries (3.7)	94 (22%)	43 (9%)	

*Pearson Chi-Square Test *p<0.05 **p<0.001*

There was no relationship between the angulation type of the third molar and the frequency of caries in the third molar (p=0.196). In contrast, the impacted level of the lower left third molar considerably increases the prevalence of caries on the distal surface of the lower left second molar (p<0.001) (Table V). In addition, there was a statistically significant difference in the occurrence of caries in the lower second molars between the two segments (χ2=5,187, p<0.001) (Table VII).

Table 4: The relationship of angulation and impacted level with caries frequency in both segments according to age

	Angulation and impacted level	18-30 n(%)	31-40 n(%)	41< n(%)	p
Fourth segment	Mesioangular	128 (30%)	23 (5%)	12 (2%)	0.008* (χ2=13.734)
	Vertical	152 (35%)	66 (16%)	28 (6%)	
	Distoangular	10 (2%)	5 (1%)	2 (1%)	
	Horizontal	12 (2%)	0	0	
	A	208 (48%)	75 (18%)	28 (6%)	<0.001** (χ2=20.060)
	B	78 (18%)	10 (2%)	6 (1%)	
	C	16 (3%)	9 (2%)	8 (2%)	
Third segment	Mesioangular	137 (33%)	18 (4%)	17 (3%)	<0.001** (χ2=41.344)
	Vertical	143 (33%)	76 (17%)	18 (4%)	
	Distoangular	5 (1%)	0	2 (1%)	
	Horizontal	17 (3%)	0	5 (1%)	
	A	200 (46%)	81 (18%)	31 (7%)	<0.001** (χ2=23.972)
	B	75 (18%)	7 (1%)	3 (1%)	
	C	27 (6%)	6 (1%)	8 (2%)	

*Pearson Chi-Square Test *p<0.05 **p<0.001*

Table 5: The relationship between the third molars in both segments

	(4.8) impacted level and angulation degree n (%)	(4.8) prevalence of caries on distal surface n (%)		(3.8) prevalence of caries on distal surface n (%)		(3.8) impacted level and angulation degree n (%)
		Caries (-)	Caries (+)	Caries (-)	Caries (+)	
Mesioangular	163(37.2%)	132 (30%)	31 (7%)	147 (33%)	25 (5%)	172(39.3%)
Vertical	246(56.2%)	199 (45%)	47 (10%)	186 (42%)	51 (11%)	237(54.1%)
Distoangular	17(3.9%)	11(2%)	6 (1%)	7(1%)	0 (0%)	7(1.6%)
Horizontal	12(2.7%)	12 (2%)	0 (0%)	17 (3%)	5 (1%)	22(5%)
p	a: p=0.977 (χ2=0.046)			b: 0.196 (χ2=3.258)		
A	311(71%)	241 (55%)	70 (15%)	236(53%)	76(17%)	312(71.2%)
B	94(21.5%)	86 (20%)	8(1%)	85(19%)	0 (0%)	85(19.4%)
C	33(7.5%)	27 (6%)	6 (1%)	36(8%)	5(1%)	41(9.4%)
	c: p=0.01* (χ2= 9.147)			d: p<0.001** (χ2=27.487)		

a: the relationship between the type of angulation (4.8) and the frequency of dental caries on (4.7); b: the relationship between the type of angulation (3.8) and the frequency of dental caries on (3.8); c: the relationship between the impacted level (4.8) and the frequency of dental caries on (4.8); d: the relationship between the impacted level (3.8) and the frequency of dental caries on distal surface (3.8)

*Pearson Chi-Square Test *p<0.05 **p<0.001*

Table 6: Frequency of dental caries in all examined teeth

The prevalence of dental caries (4.8) n	The prevalence of dental caries (4.7) n		The prevalence of dental caries (3.7) n		The prevalence of dental caries (3.8) n
	Caries (-)	Caries (+)	Caries (-)	Caries (+)	
No caries	301	53	264	93	No caries
Caries	69	15	37	44	Caries
p	0.625a (χ2=0.239)		<0.001b** (χ2=24.548)		

[a]The minimum expected count is 13.04 (Continuity Correction)

*[b] The minimum expected count is 25.34 (Pearson Chi-Square) ** p<0.001*

Table 7: Calculating the difference between the two segments

The prevalence of dental caries (4.7) n	The prevalence of dental caries (4.7) n	
	Caries (-)	Caries (+)
No caries	272	98
Caries	29	39
p	<0.001a** (χ2=0.241)	

[a]Binomial distribution used (McNemar) ** p<0.001

Discussion

The first and second hypotheses were verified in light of the facts gathered; however, the third hypothesis was rejected. In this study, it was discovered that there was a statistically significant difference between the 3rd segment and the 4th segment in terms of caries incidence (χ2=5.187, p<0.001). In the light of existing knowledge, it is impossible to declare if this difference is clinically relevant, as there is not enough research on this subject.

In the previous researches, retrospective (5,11–13) and prospective (3,14,20) designs are employed. A cohort consists of a group of patients who were observed over time; it is classified as retrospective, prospective, or ambidirectional. In the retrospective approach, which is a study design that extends beyond a set point in time, researchers examine historical records based on a specific year range (21). In retrospective research, the utilization of records from 2-6 years prior to the inquiry date (5,12) cannot offer insight on the present. For instance, caries was not detectable in the distal region of the second molar close to the mesioangulate-impacted third molar six years ago. However, this does not indicate whether or not mesioangulation would produce caries in subsequent years. It is unknown what occurred in the procedure beyond that point. It should not be forgotten that caries development is a complicated process influenced by several variables (22). It is inappropriate to draw conclusions about the future from historical data. In such instances, prospective research on similar patients should be performed based on retrospective data in order to acquire more reliable results.

It has been established that there is a significant relationship between the ICDAS criteria and the histology of caries (23). ICDAS-II criteria may be utilized as the gold standard in research assessing laser fluorescence for the diagnosis of occlusal caries because of this substantial association (24). Moreover, when the radiography findings of the ICDAS-II criteria were examined, it was shown that the sensitivity of ICDAS-II was higher and its specificity was lower than radiography. Consequently, radiography recommends the use of ICDAS-II for caries diagnosis in people with a high caries risk (25). Considering the caries risk of our country, although it is observed that DMFT values plummeted to moderately low levels from 2004 to 2018, in between the age group of 35-44 in our society (DMFT=8.8) (26), this value is extremely close to the moderate cut-off (DMFT=9) and an increase in DMFT values is observed in individuals aged 15 years. In the 35-44 age bracket in industrialized nations, high DMFT values (>13.9) have been found when global caries severity indicators are evaluated (27). In view of such information (26), it was believed that it would be more accurate to diagnose caries in mandibular second and third molars using ICDAS-II criteria.

It was discovered that the prevalence of caries in lower third molars in both segments was connected with the eruption level, with the majority of dental caries occurring at level A in both segments. According to the literature, the frequency of caries increases with age as a result of the length of time teeth remain in the mouth (28). Since the formation of dental caries is a consequence of biofilm-induced demineralization and remineralization in the tooth's hard tissue, the caries process may be said to begin when the dental crown begins to emerge in the mouth (22). This can be explained by the fact that our study identified more cavities at the "A" eruption level of the third molar (29). Considering the previous studies on angulation types, vertical (10,30,31) and mesioangulation (9,32,33) were found to be the most prevalent kinds of angulation. In addition, earlier research that assessed the prevalence of caries in the second molar based on the third molar reported varied numbers (3,11,20,34,35). According to Lysell et al., the proportion of caries in the lower second molars was 17% (34) however, a research indicated that only 5% of caries were identified on the distal surface of those molars (20). From a study conducted in Jordan, this value was 7.9%, and the third molars had a higher frequency of caries than the second molars (35). In retrospective research done in our nation, the value of the lower second molars was determined to be 18.9% (11). According to Punwitikorn et al., the incidence of caries in unerupted third molars was 12.9% (36). In our research, these percentages were greater and comparable in both sectors (3.8% = 18.5%; 4.8% = 19.2%). In addition, it was noted, concurrently with our study, that incompletely erupted third lower molars were more prevalent in the 18-30 age group than in other age groups (36). In contrast, Knuttson et al. discovered 31% dental caries in third molars that had not fully erupted (20). In the formation of such variances, it is possible that geographical and racial characteristics, as well as the nature of the research population, are distinct.

In our investigation, the right segment housed the vertical that generated the highest frequency of caries in the second lower molar. Dental caries, on the other hand, was more prevalent near the mesioangulate lower third molar on the left. According to research conducted in terms of angulation degree (3,5,9,37), the most prevalent angulation degrees that induce caries differ from one another, such as 46º-60º (3), 11º-70º (37), 30º-70º (9). In our study, the mesioangular group was not divided into subgroups in itself and was determined as 11º-79º. This is one of the limitations of the study. The mesioangulate third molar is the angulation type that causes the most caries on the distal surface of the lower second molar (80/438; 18.2%) on the left segment. On the contrary, it was determined that the vertical third molar (34/438; 7%) was the most prevalent cause of caries on the right segment. This circumstance and the statistical difference between the two segments ($\chi2=5.187$, $p<0.001$) are unprecedented in the scientific literature. The socioeconomic status of the location where the study was done and the varying significance patients place on dental hygiene may have contributed to this disparity. This result highlights an additional drawback of the study. The study did not determine the oral hygiene behaviors of the participants, the oral hygiene equipment they use, how they wash their teeth, or which hand they use more frequently (38). There is a presumption that this difference is connected to hand use. Numerous studies have evaluated the occurrence of impacted lower third molars in our nation. According to Etoz et al., B was the most prevalent eruption level (76%). Goksu et al. (46%), Yuce et al. (57.6%), and Yildirim et al. (67.3%) identified type "A" as the most frequent (11,39,40). In our analysis, the third molar with an "A" eruption level of more than 70% was discovered in both segments. It should be noted that the aforementioned studies were conducted using a retrospective design, and that the use of classifications in some studies other than those we used, as well as the determination of eruption status based on the ramus or the cement-enamel junction of the lower second and lower third molars, may have resulted in several values.

All of these findings raise the question of whether wisdom teeth should be extracted prophylactically or not. In several studies (41,42), pericoronitis and dental caries are the indications for the extraction of the lower third molar. However, there is no consensus on prophylactic withdrawal in the indication guidelines (43,44). The increase in morbidity associated with the lower third molar, as shown by age-related research, indicates that the extraction of these teeth has risen to the forefront as a means of maintaining oral and dental health over the long term (45). Due to the continuous discussion around the extraction of impacted third molars, a document titled NICE outlining the extraction indications for these teeth has been released in England and Wales (46). However, it was stated that the lack of evidence-based studies in the guideline was felt (47). Due to the mesioangular position of the lower third molars, adverse effects such as nutrient embedding and plaque retention may be observed, particularly on the distal surface of the lower second molar (5). In cases where there is no indication for extraction but there is a need for preventive measures to prevent decay formation in second molars, patients' oral hygiene status can be measured through various plaque indices. In preventive dentistry, various scales are used to effectively measure oral hygiene status, and new scales are also emerging in the literature (48). API (49) and various PI scales have been used for evaluating oral hygiene status for many years (50). API is a two-stage scale, but it lacks flexibility. Therefore, it can be challenging to achieve low API values even in patients with excellent oral hygiene (48,51). The selection of the index to be used in plaque indices generally varies depending on sample size, study method, study duration, expected objectives, and hypotheses (50). Additionally, most used indices have a non-linear structure (52). Since indices calculate plaque quantity based on the area covered by plaque or the thickness of the plaque, relying solely on the plaque index for interpretation in patients without extraction decisions may be insufficient for preventive purposes. If plaque is the sole concern, individual oral hygiene education is provided to the patient to minimize plaque levels. However, apart from that, a caries risk assessment scale, which is a synthesis of many concepts for evaluating the patient's caries risk, classifying the risk, and determining how to manage it, can be used (53). After the patient's risk analysis, if the patient is in the low-risk group: Fluoridated toothpaste (twice a day; at least 1000 ppm), regular oral care, access to fluoridated water; if the patient is in the high-risk group: Oral care with 1450-1500 ppm fluoride toothpaste (twice a day), motivational intervention to reduce sugar intake in the diet, use of fissure sealants on high-risk surfaces, and other preventive measures can be taken (53).

In relation to the position of the lower third molar, the emergence of inflammatory mediators (54) and microbial species (55), which may be effective in the development of both second and third molar caries and periodontitis, has been proven by various studies. Although it has been reported that the lower third molar may harm the lower second molar, the research did not account for other factors that may raise the risk factor. It has been argued that it is not feasible to talk about a prevalence based on the general population, since such studies were done in a hospital context, and the dental caries found on the distal surface of the second molars is truly a global phenomenon (56). When dental caries development is analyzed in terms of epidemiology and the caries process, it is evident that it is influenced by several factors (22).

Although the frequency of caries in the distal lower second molar is six times greater in the vicinity of mesioangular and horizontally angulated third molars (56), our investigation found that the vertically positioned third molars also generated significant levels of caries. In our study, the odds ratio value was not computed since various types of angulated teeth in both segments produced caries. The removal of third molars for preventive purposes may carry additional risks and be costly. The prevalence of caries should be assessed from a larger viewpoint, taking into consideration all the elements that might induce caries, rather than focusing on a single component (one tooth impacts the other). The present cannot be adequately reflected in retrospective investigations. In this regard, firstly, retrospective screening should be performed, followed by the adoption of prospective studies and the abandonment of only retrospective investigations. According to the records obtained in the retrospective scan, the examined individuals should be contacted once more, and this should be deemed the starting point. At least six months following the initial assessment, the individuals should be undergone a second oral and digital examination of the pertinent teeth. To achieve standardization, individuals with similar ages and levels of oral hygiene should be included in the study as much as possible. For instance, if one of two individuals with a similar mesioangulated third lower molar uses an instrument for the interproximal cleaning of the second and third molars and provides more effective interproximal hygiene, this individual is expected to have a lower incidence of caries on the distal surface of lower second molar. Obviously, the value of the odds ratio in relation to caries avoidance may differ for this individual.

In present study, an examination of patients' oral hygiene habits was not conducted, and the potential effects of oral hygiene habits, oral hygiene awareness, and socioeconomic factors on distal second molar were overlooked. Dental caries formation is a process, and this study does not encompass the entire process; rather, interpretations were made based on the data and observations obtained at that moment. Furthermore, dental caries classification was performed using the ICDAS-II, which is a visual examination method, without utilizing caries detection agents or devices with features such as quantitative light-induced fluorescence, fiber-optic illumination, or laser fluorescence. Additionally, when determining the eruption level and angulation of third molars, only panoramic radiographic images were utilized, and no additional images (such as bite-wings) or more advanced three-dimensional imaging were employed. All of these factors constitute the limitations of the study.

Conclusion

In retrospective studies, only the radiographic examination is insufficient to determine if third molars can be extracted prophylactically. All new studies in this field should be designed with forward-looking methods, hereby standardization in terms of oral hygiene and oral hygiene practices among individuals may lead to the most accurate result. In addition, doing these investigations as population-wide multicenter research will yield more reliable data.

Declarations

Author Contributions: *Conception/Design of Study- M.K.Ü., R.S.; Data Acquisition- M.K.Ü., R.S.; Data Analysis/Interpretation- M.K.Ü., R.S.; Drafting Manuscript- M.K.Ü., R.S.; Critical Revision of Manuscript- M.K.Ü., R.S.; Final Approval and Accountability- M.K.Ü., R.S.; Material and Technical Support- M.K.Ü., R.S.; Supervision- M.K.Ü.*

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