

# Frequency of Distal Caries of 2<sup>nd</sup> Molar with Mesio-Angular Impaction in Subset of Karachi Population

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## ABSTRACT

**Background:** The oral cavity has four 3<sup>rd</sup> molars, commonly termed wisdom teeth. These molars may erupt in an appropriate anatomical place and become functional, or they may erupt partly or non-functionally, in which case they are known to as impacted. Therefore, the study aimed to measure the frequency of distal caries of 2<sup>nd</sup> molars in the presence of mesio-angular impacted 3<sup>rd</sup> molars and its association with the other type of impactions among patients.

**Methods:** It was a retrospective cross-sectional study done at the Oral Medicine and Diagnosis Department of Ziauddin University Hospital in Karachi, Pakistan. The study comprised 201 radiographs of individuals aged 21 to 45 years, of both genders, who visited a dental OPD between 2017 and 2020 and had erupted 2<sup>nd</sup> molar teeth and impacted 3<sup>rd</sup> molar teeth in the same quadrant. Patients with inadequate diagnostic quality and distortion on their OPGs were excluded from the research. All collected data were analyzed using SPSS 25.

**Results:** The frequency of distal caries of 2<sup>nd</sup> molars was observed to be 122 (60.7%). A total of 103 of the 201 subjects had mesio-angular impaction causing caries in the 2<sup>nd</sup> molars (84.4%). There was a statistically significant relationship between impaction type and distal caries of 2<sup>nd</sup> molars ( $p=0.001$ ). The type of impaction also showed a significant association with gender ( $p=0.048$ ).

**Conclusion:** Higher frequency of distal caries of 2<sup>nd</sup> molars in the presence of mesio-angular impacted 3<sup>rd</sup> molars was observed. This was also significantly associated with the type of impaction ( $p<0.001$ ) and gender ( $p=0.048$ ).

**Keywords:** Dental Caries, Third Molar, Wisdom Tooth.

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## INTRODUCTION

The oral cavity has four 3rd molars, commonly termed wisdom teeth, which are the last of the 32 teeth to erupt in the mouth. The age at which eruptions occur varies greatly, and they can occur as early as 17 to 24 years old or as late as the 3<sup>rd</sup> or 5<sup>th</sup> decade of life<sup>1,2</sup>. These molars may erupt into the appropriate anatomical place and become functional, or they may erupt partly or non-functionally, in which case they are known to as impacted. The risk of impaction is significantly higher in the mandibular 3rd molar, and it is influenced by gender, age, ethnicity, lack of space, eruption and growth direction, and growth process<sup>2-4</sup>.

Due to a lack of space or barrier, third molars are often held back during an eruption, making this area less accessible for oral hygiene practices<sup>5,6</sup>. If they are enclosed or embedded, they gather plaque, increasing the odds of infection in the posterior molar region<sup>7,8</sup>. Hence, impacted 3<sup>rd</sup> molars may cause periodontal disease, pain, pericoronitis, tumor, cyst formation, distal caries, dental crowding, and angle fracture<sup>7,8</sup>.

One of the most common complications related to the topographic status of the impacted mandibular 3rd molar is distal caries of the mandibular 2nd molar and accounted for 0.5% to 20%<sup>8-12</sup>. A recent study by Altiparmak et al. reported, 38.7% of dental caries in 2<sup>nd</sup> molars developed due to neighboring impacted mandibular 3<sup>rd</sup> molars<sup>13</sup>. In a study conducted by Srivastava et al. 38% of the patients had distal caries among 2<sup>nd</sup> mandibular molars<sup>14</sup>. According to Ashar et al. prevalence of distal caries was observed to be 40.8% in the mandibular molar 2<sup>nd</sup> molar caused by impacted third molars<sup>15</sup>. Another study conducted by Rauf et al. revealed that mesio-angular impaction of the 3rd molar was the commonest impaction which caused distal caries in the neighboring 2<sup>nd</sup> molars<sup>16</sup>. Whereas, Raheem et al. found that most distal caries in the 2<sup>nd</sup> molar were due to the horizontal position of the 3<sup>rd</sup> molar<sup>17</sup>.

Evidence suggests that removal of 3rd molars at an early stage can prevent distal caries in 2nd molars, halting tooth loss<sup>15,16</sup>. There is a paucity of information on its prevalence among Karachi residents. Thus, the goal of this research was to measure the frequency of distal caries of 2<sup>nd</sup> molars in the presence of impacted 3rd molars and its association with a type of impaction among patients presented at a tertiary care hospital in Karachi, Pakistan.

## METHODS

It was retrospective cross-sectional research conducted at the Oral Medicine and Diagnosis Department of the Ziauddin University Hospital in Karachi, Pakistan. With the prevalence of distal

caries set at 40.8%<sup>15</sup>, the margin of error set at 6.8%, and the confidence level set at 95%, the sample size of 201 was computed using the Open Epi sample size online calculator. The study comprised 201 radiographs of individuals aged 21 to 45 years, either male or female, who visited a dental OPD between 2017 and 2020 and had erupted 2nd molar teeth and impacted 3rd molar teeth in the same quadrant. The OPGs with inadequate diagnostic quality and distortion were excluded from the research. A non-random convenience sampling approach was used.

The research proposal was submitted and approved by the ethical review board of Ziauddin University Hospital, Karachi, Pakistan. The ethical review board approved the research ERC no. 3590421AAOM. Each radiograph was assessed by postgraduate students from the Ziauddin University Hospital's Oral Medicine and Diagnosis Department in Karachi, Pakistan. Radiographs with impacted 3<sup>rd</sup> molars were included in the study. The incidence of distal caries in the mandibular 2nd molars was examined using radiographs with impacted 3rd molar teeth. The gender, age, and kind of impaction of these OPGs were investigated.

The data was analyzed using SPSS version 23. For age in years, the mean and standard deviation were calculated. For age groups (21 to 29 years, 30 to 39 years and 40 to 49 years), gender (male and female), kind of impaction (mesio-angular, distoangular, vertical, and horizontal), and presence of distal caries (yes or no), the frequency and percentage were computed. The association between distal caries and age, gender, and type of impaction was investigated using the Chi-square/Fisher exact test. Association between type of impaction with age and gender was also assessed using Chi-square/Fisher exact test. A  $p$ -value<0.05 was considered statistically significant. Effect modifiers such as age, and gender were addressed through stratification and post-stratification chi-square was applied.

## RESULTS

The respondents' mean age was 30.89±5.39 years, with a range of 21 to 42 years (Figure 1). There were 123 (61.2%) men and 78 (38.8%) females among the 200 participants. More than half of the participants were between the ages of 30 and 39 (54.7%), 42.8% were of age 21-29 years and only 2.5% were of age 40-49 years. The mesio-angular dimension (65.7%) and vertical dimension (22.4%) of the 3rd molar teeth were commonly affected (Table 1). A total of 200 patients with impacted 3<sup>rd</sup> molar teeth were evaluated, and among them, the frequency of distal caries of 2<sup>nd</sup> molars was observed to be 122 (60.7%) (Figure 2).

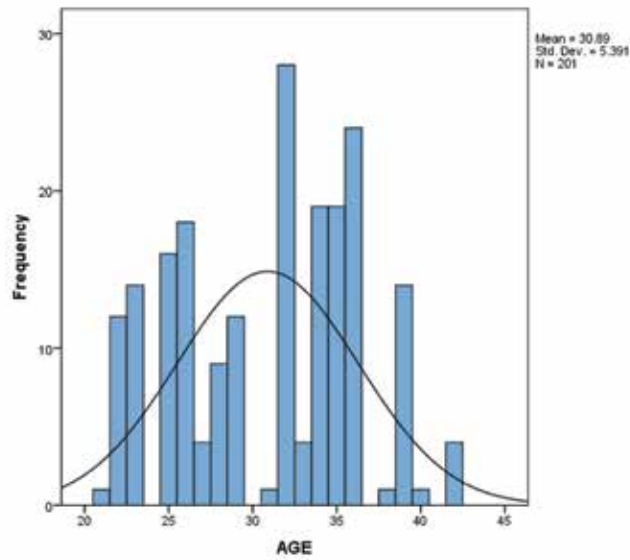


Figure 1: Descriptive statistics of age in years.

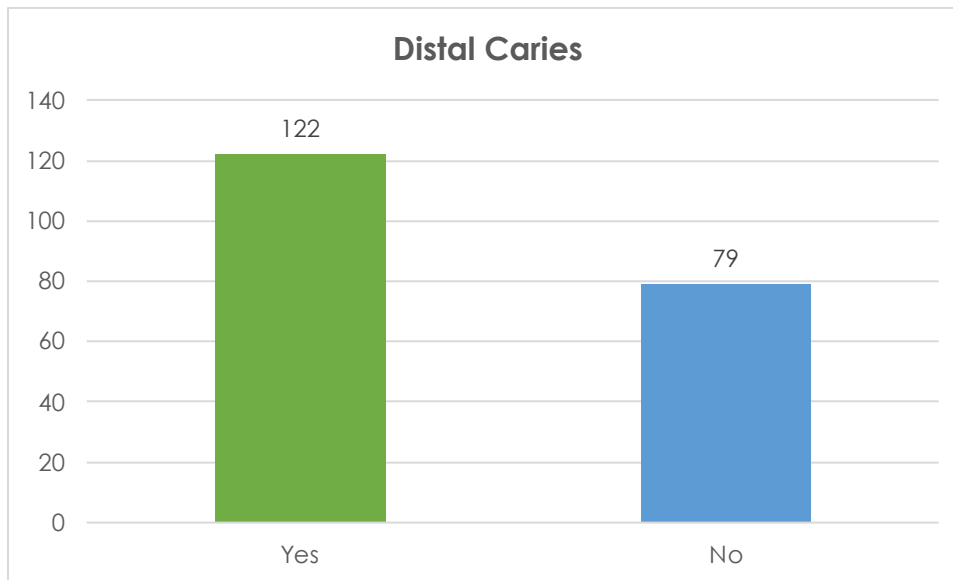


Figure 2: Frequency of distal caries of 2<sup>nd</sup> molar in the presence of 3<sup>rd</sup> molars.

The highest frequency of distal caries of 2<sup>nd</sup> molars was observed in the age bracket 30-39 years (56.6%), however, the relationship between distal caries and age groups was statistically insignificant ( $p=0.594$ ). As compared to females, the frequency of distal caries of 2<sup>nd</sup> molar was more in males, but the relationship between gender and distal caries was statistically insignificant ( $p=0.554$ ). A total of 103

of the 200 subjects had mesio-angular impaction causing caries in the 2<sup>nd</sup> molars (84.4%). Whereas, horizontal and distoangular impaction caused the least distal caries in the 2<sup>nd</sup> molars (4.9% each). There was a statistically significant relationship between impaction type and distal caries of 2<sup>nd</sup> molars ( $p=0.001$ ) (Table 1).

**Table 1: Baseline characteristics of study participants Association between distal caries of 2<sup>nd</sup> molar and age, gender and type of impaction.**

Variables	Frequency n (%)	Distal Caries		Overall	p-Value
		Yes	No		
<b>Age Groups</b>					
21-29 years	86 (42.8)	50 (41)	36 (45.6)	86 (42.8)	0.594
30-39 years	110 (54.7)	69 (56.6)	41 (51.9)	110 (54.7)	
40-49 years	5 (2.5)	3 (2.5)	2 (2.5)	5 (2.5)	
<b>Gender</b>					
Male	123 (61.2)	77 (63.1)	46 (58.2)	123 (61.2)	0.554
Female	78 (38.8)	45 (36.9)	33 (41.8)	78 (38.8)	
<b>Type of Impaction</b>					
Mesio-angular	45 (22.4)	103 (84.4)	29 (36.7)	132 (65.7)	0.001*
Distoangular	132 (65.7)	6 (4.9)	7 (8.9)	13 (6.5)	
Vertical	11 (5.5)	7 (5.7)	38 (48.1)	45 (22.4)	
Horizontal	13 (6.5)	6 (4.9)	5 (6.3)	11 (5.5)	

Presented as n (%), Chi-square/Fisher exact test was applied, \*significant at 5% level of significance, data presented as n (%).

The highest frequency of vertical impaction, mesio-angular impaction, horizontal impaction and disto-angular impaction was observed in the age range 30-39 years, however, the relationship between the type of impaction and age groups was statistically insignificant ( $p=0.791$ ). As compared to females, the

frequency of mesio-angular impaction and disto-angular impaction was more in males, whereas the frequency of vertical impaction and horizontal impaction was higher in females than males. The relationship between the type of impaction and gender was statistically significant ( $p=0.048$ ) (Table 2).

**Table 2: Comparison of type of impaction with age groups and gender.**

Variables	Type of Impaction				p-Value
	Vertical Impaction	Mesio-angular Impaction	Horizontal Impaction	Distoangular Impaction	
<b>Age Groups</b>					
21-29 years	20 (44.4)	56 (42.4)	5 (45.5)	5 (38.5)	0.791
30-39 years	23 (51.1)	74 (56.1)	6 (54.5)	7 (53.8)	
40-49 years	2 (4.4)	2 (1.5)	0	1 (7.7)	
<b>Gender</b>					
Male	22 (48.9)	89 (67.4)	4 (36.4)	8 (61.5)	0.048*
Female	23 (51.1)	43 (32.6)	7 (63.6)	5 (38.5)	

Presented as n (%) Chi-square/Fisher exact test was applied, \*significant at 5% level of significance.

Comparison between distal caries of 2<sup>nd</sup> permanent molar and angulation of the 3<sup>rd</sup> permanent impacted molar revealed statistically significant results ( $p=0.00$ ), while comparison between angulation of 3<sup>rd</sup> permanent impacted molar with mesial caries in 3<sup>rd</sup> permanent impacted molar was statistically insignificant ( $p=0.188$ ). When the relationship between distal caries of 2<sup>nd</sup> permanent molar and root canal treatment was determined it was observed that the results were statistically

insignificant ( $p=0.563$ ). Moreover, the relationship between distal caries in 2<sup>nd</sup> permanent molar and extraction was also found to be statistically insignificant ( $p=0.664$ ).

Some respondents were advised to get their 2<sup>nd</sup> and 3<sup>rd</sup> permanent molar extracted while others were advised to get root canal treatment of 2<sup>nd</sup> permanent molar according to the condition of the tooth (Table 3). A total of 200 patients with

impacted 3<sup>rd</sup> molar underwent extraction. 46.5%, a total of 93 patients underwent root canal treatment

for 2<sup>nd</sup> permanent molar while, 53.5%, the remaining 108 patients got their tooth extracted (Table 3).

**Table 3: Association between root canal of 2<sup>nd</sup> molar and age, gender and type of impaction.**

Variables	RCT of 2 <sup>nd</sup> Molar		Overall	p-Value	Extraction of 2 <sup>nd</sup> Molar		Overall	p-Value
	Yes	No			Yes	No		
<b>Age Groups</b>								
21-29 years	40(37.3)	46(49.4)	86 (43)	.437	47(50)	39(36.7)	86(43)	0.472
30-39 years	65(60.7)	44(47.3)	109(65)		44(46.8)	65(61.3)	109(87)	
40-49 years	2(1.86)	3(3.2)	5(2.5)		3(3.1)	2(1.8)	5(2.5)	
<b>Gender</b>								
Male	62(57.9)	60(64.5)	122(62.3)	.384	60(63.8)	62(58.4)	122(61)	0.470
Female	45(42)	33(35.4)	78(45)		34(36.1)	44(41.5)	78(39)	
<b>Type of Impaction</b>								
Mesio-angular	5(4.6)	8(8.6)	13(6.5)	.709	8(8.5)	5(4.7)	13(6.5)	0.741
Distoangular	6(5.6)	5(5.3)	11(5.5)		5(5.3)	6(5.6)	11(5.5)	
Vertical	73(68.2)	59(63.4)	132(66)		60(63.8)	72(67.9)	132(66)	
Horizontal	23(21.4)	21(22.5)	44(22)		21(22.3)	23(21.6)	44(22)	

Presented as n (%), Chi-square/Fisher exact test was applied. \*significant at a 5% level of significance.

**DISCUSSION**

In this study, the most common age involved was the third decade. Different parameters such as root canal treatment and extraction of the respective molars were also assessed in this article. There was male predominance in our study. When a tooth's eruption path is hindered, it is said to be impacted, with the third molar being the most commonly impacted tooth. Obstruction in the route of an eruption of the third molar has been observed due to a variety of reasons, including adjacent teeth, bone, and soft tissue. The pathogenesis of third molar impaction has been linked to a lack of space in the dental arch for the third molar to form, as well as pathological lesions, slowed growth of tooth germs due to nutritional inadequacy, irradiation, and physical trauma<sup>1,2,18</sup>. Hence, in the current study, we evaluated the frequency of distal caries and assessed the association of distal caries with age, gender and type of impaction. We also assessed the association of type of impaction with age groups and gender.

Mandibular 3<sup>rd</sup> molars are the last teeth to emerge inside the oral cavity. Primarily, they are common in the age range of 17 to 24 years or as late as the 3<sup>rd</sup> or 5<sup>th</sup> decade of life<sup>1,2,18</sup>. In the present study, the majority of the subjects were in the age range of 30 to 39 years (54.7%), followed by 21 to 29 years (42.8%), respectively and 2.5% were of age 40 to 49 years. This is similar to the study conducted in Saudi Arabia and Iran<sup>19,20</sup>. While in a similar Pakistani study conducted by Ashar et al. reported that most of the participants were of 23 to 29 years (39.7%), followed

by 17 to 22 years (33.08%).<sup>15</sup> Another Pakistani study by Rauf et al. also reported the highest frequency of 3<sup>rd</sup> molar impaction in the 2<sup>nd</sup> and 3<sup>rd</sup> decades of life and every few people were of age greater than 40 years<sup>16</sup>. This might be because of the increasing knowledge about early extraction of impacted 3<sup>rd</sup> molars and oral health<sup>16</sup>.

In the current study, males had a high frequency of impacted 3<sup>rd</sup> molars than females (61.2%, 38.8%). This is similar to the previous study conducted by Syed et al. and Asif and colleagues<sup>20,21</sup>. Whereas, evidence shows a significantly greater frequency of impacted 3<sup>rd</sup> molars in females than in males. These findings are not aligned with the theory of Hellman which stated that the growth of females' jaws stops when 3<sup>rd</sup> molars just start to erupt, while males' jaws continue to grow beyond the eruption time of 3<sup>rd</sup> molars, leading to a reduction in the incidence of impaction of 3<sup>rd</sup> molars in males than females<sup>16,19,21</sup>.

In the current study, the commonest type of impaction was mesio-angular impaction which is similar to previous studies conducted among different ethnicity and populations<sup>22,23</sup>. Previous Pakistani studies also revealed that mesio-angular impaction was the most common type of impaction<sup>15, 24</sup>. The prevalence of dental caries in the second molar adjacent to 3<sup>rd</sup> molars has been estimated to be as less as 1% to 5% to as high as 15% to 51% in previous studies<sup>5-7,15</sup>. In our study, we also found slightly higher frequency as 61% of distal caries of 2<sup>nd</sup> molars in the presence of impacted 3<sup>rd</sup> molars. Ashar et al. found the frequency of distal

caries of the 2<sup>nd</sup> molar was estimated as 40.8% to 42.5% in the presence of impacted mandibular 3<sup>rd</sup> molars<sup>15,24</sup>. The variations in the prevalence might be due to regional, racial and/or social-cultural factors<sup>13</sup>.

In this study, the highest frequency of distal caries was observed among mesio-angular impaction (84.4%). This result is similar to many previous studies showing similar patterns<sup>25-27</sup>. In an Indian study by Srivastava et al. mesio-angular impaction was significantly associated with distal caries of 2<sup>nd</sup> molars<sup>14</sup>. Another study by Sheikh et al. also revealed that the high frequency of caries was related to mesio-angular impaction (41% to 56.3%)<sup>15,24</sup>. Hence, mesio-angular impaction of the 3<sup>rd</sup> molars can cause accumulation of plaque, which resulted in distal caries in the 2<sup>nd</sup> molars. Thus, the extraction of mesio-angular impaction before the incidence of distal caries could be beneficial for the oral health of the patient.

In the current study, the mesio-angular impaction and disto-angular were more common in males than females. We also observed a significant association between the type of impaction and gender ( $p=0.048$ ). Other research studies reported a higher frequency of mesio-angular impaction among males, whereas the most frequent impactions reported among females were disto-angular<sup>15,24-27</sup>. Mesio-angular impactions were frequently found followed by Vertical impactions. Extraction following mesial caries of 3<sup>rd</sup> permanent molar was found to be prevalent. In this retrospective analysis of OPGs, nutritional and dietary patterns of the patients, co-morbid, and smoking history were not recorded. Overall, oral hygiene status and DMFT score were not calculated in this study. Future studies should be done to see the impact of these etiologies and oral hygiene on the frequency of distal surface of the mandibular 2<sup>nd</sup> molar in the presence of the impacted 3<sup>rd</sup> molars. However, further study can be carried out on a large sample size.

## CONCLUSION

The frequency of 2<sup>nd</sup> molar distal caries was high in the presence of mesio-angular impacted 3<sup>rd</sup> molars, and it was linked to the type of impaction. As a result, preventative measures like oral hygiene maintenance and 3<sup>rd</sup> molar extraction in presence of mesio-angular impaction should be implemented to avoid 2<sup>nd</sup> molar distal caries.

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## CONFLICT OF INTEREST

The authors declared no conflict of interest.

## ETHICS APPROVAL

The ethical review committee of Ziauddin University has accepted the request for a waiver as there is no patient contact, no new tests are done and confidentiality is maintained (Reference Code: 3590421AAOM).

## AUTHORS' CONTRIBUTION

AA conceived the idea and design of the study; AR did the write-up for the original draft. AB did the data analysis and interpretation, SS revised the manuscript, and NN and AA performed the data collection.

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