

4-27-2020

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Recommended Citation

Aras, A., & Dogan, M. S. Caries Prevalence and Severity in Immature Permanent First Molar Teeth in Sanliurfa City, Turkey. *J Dent Indones.* 2020;27(1): 13-16

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ORIGINAL ARTICLE

Caries Prevalence and Severity in Immature Permanent First Molar Teeth in Sanliurfa City, Turkey

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ABSTRACT

Objectives: The prevalence of dental caries, a major public health problem in high-income countries, is gradually increasing in many low- and middle-income countries. The aim of this study is to evaluate the prevalence and severity of caries in the immature permanent first molars (PFMs) of children aged 7–9 years. **Methods:** This work is a retrospective analysis of caries in immature PFMs as observed from the panoramic radiographs of patients aged 7–9 years who presented to the pediatric clinic. The mean number of decayed, missing, or filled teeth (DMFT) and caries severity of immature PFMs were assessed. **Results:** A total of 3,112 PFMs from 778 patients were included in the study; 51.2% of the patients had at least one carious PFM. When caries prevalence was stratified by age, prevalences of 41.2%, 51.6%, and 60.4% were observed for children aged 7, 8, and 9 years, respectively. The relationship between age and presence of caries was statistically significant ($p < 0.01$). The ratio of teeth with extensive-stage caries relative to all PFMs was 10.5%. **Conclusions:** In this study, the prevalence of caries in the immature PFMs of children aged 7–9 years was 51.2%, and the mean DMFT was 1.19. The finding that approximately 10% of PFMs exhibit extensive caries within 2–3 years after eruption is a serious concern.

Key words: caries, immature, permanent first molar, radiography

How to cite this article: Aras A, Dogan MS. Caries prevalence and severity in immature permanent first molar teeth in Sanliurfa city, Turkey. *J Dent Indones.* 2020;27(1):13-16.

INTRODUCTION

Dental caries is a disease that causes destruction of the hard tissue of the tooth due to external factors; while it does not show early symptoms, it can often be prevented by observing proper oral hygiene.¹ The prevalence of caries, an important public health problem in high-income countries, is gradually increasing in low- and middle-income countries.² The disease can often lead to high cost of treatment, absenteeism from school, reduced learning ability due to pain, increased use of hospital and emergency services, reduced quality of life, difficulty eating, and reluctance to smile.³

Permanent first molars (PFMs) are the teeth most vulnerable to caries because of their morphological and functional characteristics in combination with environmental factors.^{4,5} PFMs are the most important teeth in the dental arch and typically erupt at 6–7 years of age. The high prevalence of caries in PFMs is potentially related to the presence of deep pits and

fissures on the occlusal surface of teeth, the presence of large crowns that allow acid-producing bacteria to accumulate, and the occurrence of premature tooth eruption.⁶ High-carbohydrate nutrition, poor oral hygiene, lack of parental knowledge regarding the eruption of PFMs, and a history of dental caries are other factors that could contribute to the development of dental caries in teeth.⁷ PFMs are important for chewing food and the most important teeth for maintaining of the vertical dimension of the face. They also play an important role in the formation of occlusions and are used for anchoring in orthodontic treatments. PFM have strong control over teeth that will subsequently erupt from the mesial and distal sides.^{8,9} Because of the key role of PFMs in occlusion, their early loss due to caries exerts a major impact on an individual's future oral and dental health.⁶

Prior studies have shown that first molars are at serious risk of developing caries in the years immediately following their eruption.^{1,10} PFMs show incomplete

coalescence of fissures, which permits the retention of a biofilm at the base of the defect that could increase the risk of caries lesions.¹¹ If early intervention for early decaying PFMs cannot be achieved, pulp necrosis may occur before root formation is complete. The development of pulp necrosis in immature permanent teeth leads to cessation of root development and formation of teeth with an open apex.¹² Treatment of necrotic immature permanent teeth is often difficult because of incomplete root formation, an unfavorable crown-root ratio, and poor long-term prognosis.¹³

Epidemiological studies worldwide often focus on the prevalence of dental caries.⁸ Sanliurfa City is one of the highest birth-rate cities of Turkey. Indeed, the child population of this city is much higher compared with that of other cities in the country. In addition, the rate of education and oral hygiene habits in Sanliurfa City is fairly low on account of its low socioeconomic status. Hence, we believe that children in this city have a higher rate of caries incidence compared with children in other regions.

In the present study, the characteristics of caries were examined in immature PFM teeth because these teeth often begin decaying shortly after eruption and the treatment of extensive caries is difficult. The aim of this study is to evaluate the prevalence and severity of caries in the immature PFMs of children aged 7–9 years using radiographic assessment in accordance with the International Caries Classification and Management System (ICCMS™) system.

METHODS

The study protocol was approved by the Clinical Research Ethics Committee of Harran University (HRU-190317). For this retrospective study, the diagnostic radiographs of patients aged 7–9 years who presented to the Department of Pedodontics of the Faculty of Dentistry of Harran University between October 2018 and October 2019 were reviewed. Panoramic images were acquired by a radiology assistant using a panoramic system (PCH-2500, Vatech, Gyeonggi-do, Korea) at 65–90 kVp and 10 mA with a total filtration of 2.8 mm aluminum. The exposure parameters were selected as 65 kVp and 10 mA, and the exposure time was 18 s.

For standardization, a pediatric dentist with over 5 years of experience evaluated all digital radiographs. Out of 944 radiographs, 778 were included in the study; 166 were excluded because the patients had unerupted PFMs, closed tooth apices, and/or unclear radiography. Only PFMs were evaluated in the present study. The caries status and number of decayed, missing due to caries, and filled teeth (DMFT) of immature PFMs were assessed. Moreover, information on age, sex, jaw, and direction of caries was recorded for each individual.

Examination of caries severity

Caries severity in immature PFMs was determined in accordance with the ICCMS™ system, which classifies tooth surfaces according to the following radiographic features¹⁴:

0 = No radiolucency

RA: Initial stages

1 = Radiolucency in the outer half of the enamel

2 = Radiolucency in the inner half of the enamel

3 = Radiolucency limited to the outer third of the dentin

RB: Moderate stages

4 = Radiolucency reaching the middle third of the dentin

RC: Extensive stages

5 = Radiolucency reaching the inner third of the dentin, clinically cavitated

6 = Radiolucency into the pulp, clinically cavitated

The teeth were classified as no caries, initial-stage caries, moderate-stage caries, and extensive-stage caries.

Statistical analysis

Descriptive statistics, independent t-test, and the chi-squared test were carried out for statistical analysis of the recorded data at a level of significance of 0.05 using IBM SPSS v23 (Chicago, IL, USA).

RESULTS

The mean age of the 778 patients (420 boys, 358 girls) included in this study was 8 years, and a total of 3,112 immature PFMs from these patients were examined. Approximately 51.2% of the patients had at least one carious PFM. When caries prevalence was stratified by age, prevalences of 41.2%, 51.6%, and 60.4% were observed among children aged 7, 8, and 9 years, respectively (Table 1). The relationship between age and presence of caries was statistically significant (chi-squared test, $p < 0.01$). The mean number of DMFT for PFMs in these patients was 1.19, and the mean DMFTs were 1.35 in girls and 1.05 in boys. Sex-based differences in mean DMFT were statistically significant (independent t-test, $p < 0.01$). Extracted and filled teeth were not included in calculations to determine caries severity. Of the 3,112 teeth examined, 11 were extracted and 55 were filled. Of the remaining 3,046 PFMs, 2,188 had no caries, 321 had initial-stage caries, 216 had moderate-stage caries, and 321 had extensive-stage caries. In total, 48.4% of the decayed PFMs were observed in the maxilla and 51.6% were observed in the mandible. Caries severity levels according to the tooth location are shown in Table 2. Extensive-stage caries was mostly present in mandibular molar teeth at a rate that was significantly different from that of other teeth ($p < 0.05$).

DISCUSSION

The present research investigated the prevalence and severity of dental caries in immature PFMs among children aged 7–9 years in a Turkish population. We focused exclusively on immature PFMs because these teeth play a crucial role in the maintenance of oral and dental health. When immature PFMs decay over a short period of time, treatment becomes increasingly difficult as the severity of caries increases.

We evaluated panoramic radiographs because a retrospective analysis could be achieved more readily than a prospective analysis considering the number of children included in this study. Our study showed that 51.2% of 778 patients had at least one carious PFM. We examined the prevalence of caries in the 2–3-year period following PFM eruption and discovered that, during this short period of time, at least one PFM was decayed in one of every two children. This high rate of caries incidence significantly increased with age.

The time between initial eruption and complete occlusion of a tooth is the most critical period for maintaining the health of PFM teeth; thus, the risk of developing caries is highest at 6–9 years of age.¹ High rates of caries development have been observed in several other studies. In a study of 12-year-old children, for example, the proportion of individuals with caries and/or filled PFMs was 68.6%.⁹ In a Saudi population⁶ the rate of caries and/or filled PFMs was 75% in children aged 9–12 years. In yet another study,¹⁵ 85.4% of children aged 6–12 years revealed caries and/or filled PFMs. We noted that these previous studies adopted a wider age range and featured a higher mean age compared with the corresponding values found in our study. These factors could contribute to the higher prevalence of caries observed in these studies. Previous researchers found that the rates of caries development in children aged 6–12 years were 9% at 6 years of age and 68% at 12 years of age.¹⁶ In the same study, the period with the greatest risk for caries development in PFMs was determined to be 9–10 years of age. Although a statistically significant relationship between age and number of carious PFMs was found, this relationship diminished after 10 years of age. In another study, the rate of carious PFMs in 9-year-old children was 67% and carious PFMs were present in 70.5%, 82%, and 83.5% of children aged 10, 11, and 12 years, respectively.⁶

Consistent with the findings of prior studies, our research showed that carious PFMs were present in 41.2%, 51.6%, and 60.4% of children aged 7, 8, and 9 years, respectively. Thus, the rate of caries development increases with age, and this relationship is statistically significant. Changes in nutritional habits and increased colonization of *Streptococcus mutans* in the oral cavity with age are among the factors contributing to caries development in PFMs.

Table 1. Presence of caries in permanent first molars stratified by age

		Caries Present		P Value
		No n (%)	Yes n (%)	
Age (years)	7	137 (58.8)	96 (41.2)	0.000*
	8	150 (48.4)	160 (51.6)	
	9	93 (39.6)	142 (60.4)	
Total		380 (48.8)	398 (51.2)	

Chi-squared test, *: p<0.01

Table 2. Severity of caries in permanent first molars

	Caries Severity				Total
	No Caries (0)	Initial Stage (RA)	Moderate Stage (RB)	Extensive Stage (RC)	
Upper Right	564	95	55	57	771
Upper Left	563	108	47	53	771
Lower Left	529	55	64	101	749
Lower Right	532	63	50	110	755
Total	2188	321	216	321	3046

The DMFT index is one of the most important indicators in determining caries risk and frequently used in studies of caries prevalence.¹⁷ In a study of 12-year-old children, the DMFT rate in PFMs was reported to be 1.9.9 Similarly, 12- and 18-year-old children in Turkey revealed DMFT rates of 1.9 and 1.95.1,¹⁸ Khodadadi et al. reported a DMFT rate of 1.59 for 12-year-old children.¹⁹ In our study, the mean DMFT for PFMs was 1.19; this low rate relative to that in other studies conducted in Turkey may be related to the age of the children included in our work. Although Sadeghi⁹ did not find a statistically significant relationship between sex and DMFT rate, we observed that the DMFT rate in girls (1.35) was significantly higher than that in boys (1.05).

Finally, of the 3,046 immature PFMs examined in this study, excluding extracted and filled teeth, 321 had extensive-stage caries. Thus, the ratio of teeth with extensive-stage caries relative to the total number of PFMs was 10.5%. The finding that approximately 10% of the PFMs examined in this work exhibited extensive caries within 2–3 years after eruption is a serious concern. Extensive-stage caries were mostly present in mandibular molar teeth at a rate that was significantly different from that of other teeth. This finding may be attributed to the unique morphology and eruption time of teeth.⁴ The increased presence of

pits and fissures in mandibular molar teeth compared with that in other teeth and the resulting increase in food retention, in combination with earlier eruption of mandibular PFMs compared with maxillary PFMs and, thus, longer exposure to the oral environment, may have contributed to our findings.

CONCLUSION

In conclusion, our results provide evidence that PFMs rapidly decay over a 2–3-year period following eruption. In this study, the prevalence of caries in the PFMs of children aged 7–9 years was 51.2% and the mean DMFT was 1.19. Approximately 10% of the teeth examined exhibited extensive-stage caries. Because root development has not been completed in the PFMs of the age group we examined, treatment of extensive-stage caries may be difficult. To avoid such problems, preventive dentistry is important following the eruption of PFMs; frequent dentist visits are needed until maturation is achieved. The high prevalence of caries in PFMs indicates the need for further research to clarify the most important factors contributing to this disease.

CONFLICT OF INTEREST

The authors declare that they have no competing interest.

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(Received December 24, 2019; Accepted April 5, 2020)