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Assessment of Caries Frequency and Severity in Immature Permanent First Molar Teeth Using Panoramic Radiograph in Elazig City, Turkey

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Abstract

Aims: Considering the importance of permanent first molars (PFMs), this study aimed to evaluate the prevalence and severity of caries in immature PFMs on panoramic radiographic images, which are frequently used for diagnosis and treatment, using the Classification and Management System (ICCMS™) as a reference.
Materials and Methods: Panoramic (Planmeca OY, 00880 Helsinki, Finland) X-rays taken for diagnosis and treatment of 799 individuals in the 6-9 age group were evaluated retrospectively. The prevalence and severity of caries in immature PFMs were determined using the (ICCMS™) system. Statistical comparisons were performed using SPSS 26 (SPPS Inc., Chicago, IL, USA). Chi-square analysis was used to compare the presence of dental caries according to age, sex, and tooth position. The study determined The statistical significance level was set at $p<0.05$.
Results: There was a statistically significant difference between individual evaluations of the presence of caries according to age ($p<0.05$). While the highest number of caries was seen in 8-year-old children, the lowest number of caries was seen in 7-year-old children. There was no statistically significant difference between individuals' evaluations of the presence of caries according to their sex ($p>0.05$), and there was a statistically significant difference between individuals' evaluations of the presence of caries according to the position of their teeth ($p<0.05$). Caries were observed at a higher rate in the lower left and right teeth.
Conclusion: In this study, the prevalence of caries in PFMs was 7.0% and the rate of extensive-stage caries was 3.9% in children aged 6-9 years. Thus, PFMs decay within 1-3 years following eruption. Studies that raise awareness of this alarming situation need to be conducted.

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Key words: Caries prevalence, immature, permanent first molars, panoramic radiograph.

Introduction

Dental caries are defined as the destruction of the hard tissue of the tooth caused by external factors. Dental caries is a disease that does not cause any symptoms at first and can usually be prevented by paying attention to proper oral hygiene and preventive treatments. In developing countries, the prevalence of caries is increasing due to socio-economic reasons and lack of attention to nutrition and oral hygiene habits (1). Dental caries cause time, personal, and financial losses for diagnosis and treatment, especially if the necessary protective measures are not taken, as well as school absences due to toothaches.
It is a problem that needs to be addressed seriously in terms of public health, as it can cause a decrease in learning ability, a reduction in an individual's quality of life, increased use of emergency services, malnutrition, and psychological and spiritual effects on the child (2).

Permanent first molars (PFMs) occur in the oral cavity at approximately 6-7 years of age, without loss of primary teeth, distal to the primary second molars, and

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their root development is completed in approximately three years (3). As tooth eruption does not cause adverse effects in many children, most parents are unaware that the tooth has erupted. They also stated that these are primary teeth during dental examinations upon complaint or for control purposes (4).

PFMs are due to reasons such as diets high in carbohydrates, poor oral hygiene, parents' lack of knowledge about the eruption time of these teeth, as well as the fact that they erupt at a young age and have tooth morphologies such as profound and shallow fissures and large crowns, which pave the way for the accumulation of caries-causing bacteria. They rot early during and after eruptions. (5,6) Studies have reported that the risk of caries in PFMs is highest in the first 1–1.5 years, which is the period before the teeth reach occlusion. The risk of caries gradually decreases in the following years (7).

PFMs are the most prominent teeth in size and the most critical teeth in the dental arch. Therefore, the prevalence of caries in this tooth should be known, and necessary precautions should be taken to prevent its progression or the development of new carious lesions. The health of these teeth affects the opinions on oral health in society. This can be considered a reasonable basis for owning (8).

Panoramic radiographs are used for diagnosis and treatment in dentistry (9). Panoramic radiography is a simplified extraoral filming technique that shows the entire maxillo-mandibular region in a single frame. Panoramic radiographs play an essential role in the diagnosis and treatment planning of various dental and jaw problems. Dental panoramic radiographs are frequently used in pediatric dentistry clinics because they are noninvasive and can be tolerated more easily by pediatric patients. (10)

Considering the importance of PFMs, this study aimed to evaluate the prevalence and severity of caries in immature permanent first molars on panoramic radiographic images, which are frequently used for diagnosis and treatment, using the Classification and Management System (ICCMS^{TM}) as a reference.

Materıal and Methods

Before starting this study, **w**ith the approval of Firat University Non-Interventional Research Ethics Committee (Date: 14.09.2023, Decision No: 2023/12-27**),** all procedures were carried out according to the ethical rules and principles of the Declaration of Helsinki. Panoramic radiographs taken with the Planmeca ProMax (Planmeca OY, 00880 Helsinki, Finland) for the diagnosis and treatment of 799 individuals in the 6-9 age group were retrospectively evaluated by a single pedodontist for standardization purposes. The exposure parameters were 85 kVp and 10 mA with an exposure time of 14 s.

Individuals with erupted PFMs and open tooth apices were included in this study. Individuals who lost PFMs, did not erupt PFMs, or had and unclear radiography were excluded from the study.

Assessment of Caries Severity

Classification of caries severity in immature PFMs was determined according to the following radiographic features (ICCMS^{TM}) system (11):
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 dentin
RB: Moderate stages
4 = Radiolucency reaching middle third of dentin
RC: Extensive stage
5 = Radiolucency reaching the inner third of the dentin, clinically cavitated
6 = Radiolucency in the pulp, clinically with cavitation
Teeth were classified as no caries, initial, moderate, and advanced caries.

Analysis of Data

Within the scope of the study, teeth 16, 26, 36, and 46 of the 799 participants were examined. Statistical comparisons were performed using SPSS 26 (SPPS Inc., Chicago, IL, USA). Chi-square analysis was used to compare the presence of dental caries according to age, sex, and tooth position. The study determined The statistical significance level was set at $p<0.05$.

Results

Within the scope of this study, caries was examined according to the age of the individuals. According to the results, there was a statistically significant difference between the participants' evaluations of the presence of caries according to age ($p <0.05$). While the highest number of caries was seen in 8-year-old children (10,8%), the lowest number of caries

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was seen in 7-year-old children (3,7%). The presence of caries increases at the age of 8-9. (Table 1)

In this study, the rotten presence of individuals was examined according to sex. According to the results obtained, there was no statistically significant difference between individuals' evaluations of the presence of caries according to their sex (p>0.05). However, a relatively higher rate of tooth decay was observed in boys (7,3%) (Table 2).

The presence of caries was examined based on the position of the individual's teeth. According to the results, there was a statistically significant difference between individuals' evaluations of the presence of caries according to the position of their teeth (p<0.05). The presence of caries was observed at a higher rate in the lower left (n = 36) and lower right (n = 46) teeth. Extensive-level caries was more common in teeth 36 (5,0%) and 46 (6,6%). (table 3)

Table 1. Comparison of Caries Presence by Age.

		Caries Present		P
		Yes n (%)	No n (%)	
Age (years)	6	507 (95,3%)	25 (4,7%)	0,001*
	7	1121 (96,3%)	43 (3,7%)	
	8	1017 (89,2%)	123 (10,8%)	
	9	326 (90,6%)	34 (9,4%)	
Total		2971 (93,0%)	225 (7,0%)	

Chi-squared test, *: p<0.05

Table 2. Comparison of caries presence by gender.

		Caries Present		P
		Yes n (%)	No n (%)	
Gender	Male	1802 (92,7%)	142 (7,3%)	0,737
	Female	1169 (93,4%)	83 (6,6%)	
	Total	2971 (93,0%)	225 (7,0%)	

Table 3. Comparison of the presence of caries according to tooth position.

	Presence of caries				
	No caries	RA (Initial Stage)	RB (Moderate Stage)	RC (Extensive Stage)	P
Upper Right	764 (95,6%)	14 (1,8%)	6 (0,8%)	15 (1,9%)	0,001
Upper Left	763 (95,5%)	13 (1,6%)	6 (0,8%)	17 (2,1%)	
Lower Left	722 (90,4%)	17 (2,1%)	20 (2,5%)	40 (5,0%)	
Lower Right	722 (90,4%)	14 (1,8%)	10 (1,3%)	53 (6,6%)	
Total	2971 (93,0%)	58 (1,8%)	42 (1,3%)	125 (3,9%)	

Discussion

This study evaluated the prevalence and severity of dental caries in immature PFMs in children aged 6-9 years in the Turkish community living in Elazığ city. PFMs are the earliest permanent teeth to erupt in the mouth and play a key role in maintaining the vertical dimension of the face, along with occlusion and chewing function. We also focused on immature teeth because of the high risk of decay within 1–1.5 years after eruption. If early caries detection is not made in immature PFMs and the necessary interventions are not made, the severity of caries will increase very quickly, and its treatment will become increasingly difficult.

In a study covering the 14-17 age group in India, 62.6% had caries in the permanent first molar, whereas this rate was 67.6% in the 18-25 age group, 59.7% in the 26-35 age group, and 51% in individuals over 36 years of age. This has been observed previously (12). In a study conducted in Arabia of 432 children aged 9-12, the prevalence of permanent first molar caries was 75.5% (3). Another study found that children between the ages of 6 and 12 years had 85.4% caries in PFMs (13). Considering these studies, it has been observed that the frequency of caries in the permanent first molar is high in individuals of all age groups. The reasons for this may be that these teeth have a large surface area where bacteria can adhere because of their morphological structure, their eruption time is early, the child's oral hygiene habits are not fully established, and parents do not pay the necessary attention because they do not have sufficient information about this tooth.

Studies have also been conducted on this subject in our country. A survey conducted in Erzurum in the 7-15 age group observed that 25.2 rate of individuals had caries in their permanent first molars. In addition, the

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study found a significant increase in the rate of caries from the age of 8 years, and the frequency of caries in children aged 12 years increased to 34% (14). Bulucu et al. (15) conducted a study in a 6-12 age group. At age 6, the percentage of caries was 9%, and at age 12, it was 68%. Balkaya et al. Another study determined that the rate of caries in permanent first molars was 44.86% and 7.92% in the 11-14 age group (16).

In a study conducted by Carvalho et al. (6), they stated that the period until the tooth erupts and is completely occluded is the most critical period in terms of preserving the health of the permanent first molars, and that the risk of caries is highest between the ages of 6 and 9. Many studies have stated that the riskiest period for permanent first molars in caries is between 6-9 (7,14,15,17). Considering these studies, we chose ages between 6 and 9 years, where the risk of caries is high in this study.

Dimitrovska et al. (7) found that 36% of newly erupted permanent first molars of 127 children aged 6–7 years had caries. In another comprehensive study conducted in Mexico between 1999 and 2001, it was observed that 21.7% of the permanent first molars of 452 children between the ages of 6 and 9 had caries (18). Akıncı evaluated the permanent teeth of 600 children in the 4-12 age group and found that the prevalence of caries in permanent first molars was 7.69% in the 6-year-old group, increasing with age, reaching 73.89% in the 9-year-old group and 78.98% in the 12-year-old group (19). Our study broadly supports Akıncı's findings. In this study, the highest prevalence of caries was seen in 8-year-old children, while the lowest was seen in 7-year-old children. The presence of caries increases at the age of 8-9. Additionally, caries in immature PFMs were observed at 7%. Bulucu et al. (15) found this rate to be 9% in 6-year-old child groups. In a study conducted by Aras and Dogan in Sanlıurfa, the prevalence of caries in immature PFMs was 51.2% (20). We think that the reason why this rate is lower in our study may be because the children in these regions are at different socioeconomic levels.

In addition, in a study conducted by Aras and Dogan, the prevalence of caries in immature PFM teeth was found to be 41.2%, 51.6%, and 60.4% in 7-, 8-, and 9-year-old children, respectively (20).

This study found that The rates were 4.7%, 3.7%, and 10.8% at the ages of 6, 7, 8, and 9 years, respectively.

Güler et al. (21) Their study in Malatya determined that girls attach more importance to brushing frequency than boys. In addition, in a survey conducted by Akıncı, it was observed that those who brushed their teeth more often had better oral and dental health (22). Individuals who brushed their teeth once a day experienced more tooth loss than those who brushed their teeth two or more times a day. Several types of caries have been reported (23).

In this study, although there was no statistically significant difference between individuals' evaluations of the presence of caries according to their sex, it was observed that boys had a relatively higher rate of tooth decay. Therefore, in this study, Güler et al. This may be related to the fact that girls care more about oral and dental health, which supports her study.

In a study conducted by Aras and Dogan, it was observed that in immature PFM teeth, the lower molars had more advanced caries than the upper teeth (20). The results of our study were consistent with those of this study. Advanced caries (RC) occurs primarily in the teeth number 46. This finding was confirmed by Ahmed et al. This can be explained by the fact that the lower teeth are more prone to caries due to differences in the morphology of the teeth and eruption period (24).

The limitations of our study are the poor quality of panoramic radiography or the fact that initial caries were not observed on panoramic radiography. Despite these limitations, panoramic radiography with good image quality is preferred. Additionally, panoramic radiography facilitated a retrospective analysis because of the number of children in the study.

Conclusion

In our country, PFMs decay, are restored, or are lost at a very early age. In this study, the incidence of caries in PFMs was 7.0% and that of advanced caries was 3.9% in children aged 6-9. Thus, PFMs decay within 1-3 years following eruption. Therefore, if the necessary precautions are not taken, the dental treatment of teeth with open roots may be more complex. More extensive studies on this subject need to be conducted in our country, and societal awareness of this issue needs to be increased. In addition, it is recommended that parents need special care and attention, especially for oral hygiene education of the 6-7 age group, and that these children should be brought under regular dentist control and preventive treatments should be performed when necessary.

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Compliance with ethical standards

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