

# The evaluation of the clinical and radiographic records of the first molar teeth in pediatric patients

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## Abstract

**Aim:** This study aimed to determine the status, the need for treatment, and the performed treatments in the first permanent molars, together with the general health status, in pediatric patients.

**Material and Methods:** A total of 5996 teeth from 1499 children were included in the study. The first permanent molars were evaluated by panoramic radiography and patient recording system. The teeth were classified according to the following data: age, gender, jaw, side, teeth requiring therapy, preventive and interventional implementations.

**Results:** It was determined that 45.7% of the first permanent molars were healthy and 54.3% were necessitating treatment. The rate of the healthy teeth was determined to decrease with increasing age ( $p < 0.001$ ). The rate of healthy teeth in boys was higher than girls and the healthy teeth in maxilla were higher than mandible ( $p < 0.001$ ). Applications for preventive treatment were most frequently performed between group 1 ( $p < 0.001$ ). Preventive treatments were performed higher in boys than girls ( $p < 0.001$ ). Mean age of first restorative treatment, endodontic treatment and extraction on first permanent molars were 10 years 7 months 18 days, 11 years 1 month 8 days and 11 years 5 months 13 days, respectively.

**Conclusion:** Since the awareness of the families on the first permanent molars, which are among the first erupted permanent teeth, is low, and the oral hygiene of children is inadequate, caries and tooth loss are encountered very frequently in these teeth. In spite of developing dentistry technologies and ease of access, dental health is very dramatic in developing countries.

**Keywords:** First permanent molar; caries; dental treatment; preventive treatment.

## INTRODUCTION

First permanent molars (FPMs) guide the permanent teeth that will persist after them to be in the state of normal occlusion by establishing the basis for occlusal and masticatory function. These teeth have significant roles regarding the maintenance of occlusal function and balance in masticatory movements, preservation of vertical face length, together with mandibular and facial traumas and orthodontic treatments (1,2).

FPMs are among the teeth that are affected by caries most (3-5). FPMs forming after primary dentition period with active caries tend to decay rapidly (3,6-8). Additionally, the incidence of caries in FPMs is elevated with increasing age in children (4,5,9,10). The FPMs left untreated in the mouth may need to be extracted. However, the early extraction of one or more FPMs leads to elongation of the corresponding teeth, the displacement of the adjacent

teeth to the extraction space, and occlusion disorders in addition to difficult, time-consuming and costly orthodontic treatments (11,12). Therefore, the assessment of caries risk has great importance in early diagnosis, prevention, and treatment planning of caries, preservation of the tooth structure, as well as the prevention of time and financial losses in pediatric dentistry.

National health insurance system, especially in developing countries, is inadequate by reasons such a low socioeconomic status and increased request for dental treatment. This situation is similar in our country, especially in rural populations. It can also be associated with lack of awareness about dental health care (13,14).

**Objectives:** This study aimed to determine status and treatment needs of FPMs, the performed treatments, together with their general health status in pediatric patients.

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## MATERIAL and METHODS

In our study, the clinical follow-up records and anamnesis form of randomly chosen patients admitted to the Inonu University, Faculty of Dentistry, Department of Pedodontics in the city of Malatya in Turkey between the years of 2011 and 2016 were used together with their panoramic radiographs (PRs) obtained for various causes. The records of children in whom a PR was previously obtained for diagnostic or therapeutic purposes were used. Data was collected and recorded by investigators according to the cross-sectional research methodology, and for these purposes, no other PR was obtained in any patient. The required permission and consent documents required for viewing and analyzing the data records of the patients involved in the study were obtained from Inonu University, Scientific Research, and Publishing Ethics Committee before the onset of the study (2016/10-3). For the standardization of study; images were evaluated in a low-light X-ray room, the contrast and brightness of the images were adjusted using the image processing tool to ensure optimal visualization. In order to ensure the reliability of the study, 10% of the patients (radiographs and clinical records) were evaluated by observers in different rooms and Cohen's kappa test was applied (0.92).

Children without any developmental, systemic, or metabolic bone disorder, aged under 18 years, and having organized clinical and radiographic data were included in the study. Individuals over 18 years of age and having systemic or developmental bone disorder, together with patients whose records were not qualified as enough for evaluation or if their obtained records were erased or lost were excluded from the study. 950 patients out of scanned 2449 were excluded from the study since they were admitted to our clinic due to causes such as primary dentition problems or supernumerary teeth. A total of 1499 patients constituted our total patient group since a prophylactic and/or conservative procedure was performed on their FPM. While preparing the clinical data of patients was used patient record system, PRs were used for radiographic data. The age ranges of the children included in the study were grouped. Group 1, group 2 and group 3 that as from 5 years to 8 years old (excluding 8 years old, including 5 years old), from 8 years to 12 years old (excluding 12 years old, including 8 years old), from 12 years to 18 years old (excluding 18 years old, including 12 years old), were defined respectively.

### Collection and Preparation of the Data

Interventional treatments were determined as restorative treatment, endodontic treatment and extraction. Preventive treatments were evaluated as fluoride application and fissure sealant application. Non-caries and no restoration teeth were accepted as healthy teeth without any interventional procedures (restorative treatment, endodontic treatment, extraction).

In our study, METASOFT DentAssist Version 3.0.172 system and anamnesis forms that routinely taken from patients admitted to our clinic were used in the preparation of the

clinical data of the patients, and the software program of Planmeca Romexis® (Helsinki, Finland, 2015) was used for interpretation of the radiographic data. Microsoft Excel 2010 software was used for data collection and evaluation. Statistical analysis of the data was performed using SPSS 21.0 (IBM, Chicago, USA). Kolmogorov-Smirnov, Pearson correlation, Chi-square, Kruskal Wallis, and ANOVA tests, were used for statistical analysis.

## RESULTS

The data showing the demographic information of the parents' of the children that applied to our clinic are shown in Table1. There was correlation between the education level of parents and the FPMs' health levels at children ( $r=0.78$   $p<0.05$ ).

It was determined that, out of 5996 FPMs evaluated in the study, 2774 (45.7%) were healthy, and 3252 (54.3%) needed treatment. Of 1728 teeth evaluated in the group 1, 66.8% were determined to be healthy, and 33.2% required interventional treatment. Of 3180 teeth evaluated in the group 2, 41.4% were determined to be healthy, and 58.6% required interventional treatment. Of 1088 teeth evaluated in the group 3, 24.9% were determined to be healthy, and 75.1% required interventional treatment (Table2). When the teeth located in the maxilla and mandible were evaluated separately, the maxilla location involved healthy teeth with a percentage of 52.4%, whereas the ratio was reduced to 39.1% in the mandible. Additionally, 47.6% of the maxillary teeth was determined to need interventional treatment, whereas this ratio was 60.9% in the mandible ( $p<0.001$ ) (Table2). Of 2869 teeth evaluated in boys, 49.3% was found to be healthy, and 50.7% was determined to require interventional treatment. When girls were evaluated, it was found that 42.4% of 3127 evaluated teeth were healthy, and interventional treatment was required in 57.6% (Table2). Right and left sides of the jaws were evaluated separately; healthy teeth were found with the rates of 45.6% and 45.9% on the right and left sides, respectively. Also, the results of both sides were similar regarding the need for interventional treatment ( $p>0.05$ ) (Table2).

Data regarding age, gender, and results according to the jaws and regions were shown in Table3. Of the teeth in group 1, 417 were determined to have restoration, 44 had undergone endodontic treatment, and 22 had tooth loss. Of the teeth in group 2, 1071 were determined to have restoration, 154 had undergone endodontic treatment, and 102 had tooth loss. Of the teeth in group 3, 369 were determined to have restoration, 69 had undergone endodontic treatment, and 64 had tooth loss; the differences among the groups were statistically significant ( $p<0.001$ ) (Table3).

Applications for preventive treatment were performed most frequently in children within the group 1, followed by the group 2 and group 3, respectively ( $p<0.001$ ) (Table4). The numbers of both the healthy teeth and the teeth in which preventive treatments had been performed were found to be significantly higher in boys when compared to the girls ( $p<0.001$ ) (Table4).

It was determined that preventive applications and treatments of the teeth in children admitted to our clinic had been averagely performed within the age range of mixed dentition (group 2) period. When the first interventional treatment ages are evaluated, it was determined that mean age of first restorative treatment on first permanent tooth was 10 years 7 months 18 days. Similarly it found that age

of first endodontic treatment on first permanent tooth was 11 years 1 month 8 days (mean). Age of first extraction on FPM was 11 years 5 months 13 days(mean) (Table5). When the ages of the girls and boys when preventive applications had been performed were compared, it was determined that preventive treatment had been performed in girls in smaller ages (p<0.05).

**Table 1. Demographic information of the parents'**

	N		%			N		%			N		%	
<b>Age</b>	20-29	260	17.3		<b>≤ High</b>	730	48.7							
	30-39	603	40.2			<b>Graduate</b>	492	32.8		<b>Female</b>	850	56.7		
	40-49	452	30.2		<b>Postgraduate</b>		277	18.5			<b>Male</b>	649	43.3	
	≥50	184	12.3											
	<b>Total</b>	<b>1499</b>	<b>100</b>			<b>Total</b>	<b>1499</b>	<b>100</b>		<b>Total</b>	<b>1499</b>	<b>100</b>		

**N: Number of parents, % : percent**

**Table 2. The numeric and percentage distribution of interventional treatment and health status of teeth by age, gender, jaw, and sides**

	Age				Jaws		Gender			Sides			
	Group1 n (%)	Group2 n (%)	Group3 n (%)	Total n (%)	Maxilla n (%)	Mandible n (%)	Total n (%)	Boys n (%)	Girls n (%)	Total n (%)	Right n (%)	Left n(%)	Total n (%)
<b>Healthy teeth</b>	1155 (66.8)	1318 (41.4)	271 (24.9)	2744 (45.7)	1572 (52.4)	1172 (39.1)	2744 (45.7)	1416 (49.3)	1328 (42.4)	2744 (45.7)	1368 (45.6)	1376 (45.9)	2744 (45.7)
<b>Requiring interventional treatment</b>	573 (33.2)	1862 (58.6)	817 (75.1)	3252 (54.3)	1426 (47.6)	1826 (60.9)	3252 (54.3)	1453 (50.7)	1799 (57.6)	3252 (54.3)	1630 (54.4)	1622 (54.1)	3252 (54.3)
<b>Total</b>	1728 (100)	3180 (100)	1088 (100)	5996 (100)	2998 (100)	2998 (100)	5996 (100)	2869 (100)	3127 (100)	5996 (100)	2998 (100)	2998 (100)	5996 (100)

**n: Number of teeth, % :percent**

Table 3. The results according to age, gender, jaw, and side

		Teeth requiring restorative therapy		Restorative treated teeth		Teeth requiring endodontic therapy		Endodontically treated teeth		Teeth requiring extraction		Missing teeth	
		n%	P	n%	P	n%	P	n%	P	n%	P	n%	P
Age	Group1	501 (19.1)		417 (22.4)		54 (13.02)		44 (16.5)		18 (8.4)		22 (11.7)	
	Group2	1530 (58.3)	.000*	1071 (57.8)	.000*	232 (55.9)	.000*	154 (57.7)	.000*	100 (46.7)	.000*	102 (54.3)	.000*
	Group3	592 (22.6)		369 (19.8)		129 (31.08)		69 (25.8)		96 (44.9)		64 (34)	
Gender	Girls	1479 (56.4)	.000*	1039 (55.9)	.000*	219 (52.8)	.793	139 (52.1)	.976	101 (47.2)	.139	92 (48.9)	.370
	Boys	1144 (43.6)		818 (44.1)		196 (47.2)		128 (47.9)		113 (52.8)		96 (51.1)	
Jaw	Maxilla	1225 (46.7)	.000*	811 (43.8)	.000*	144 (37.7)	.000*	82 (30.7)	.000*	57 (26.6)	.000*	50 (26.6)	.000*
	Mandible	1398 (53.3)		1046 (56.2)		271 (65.3)		185 (69.3)		157 (73.4)		138 (73.4)	
Side	Right	1322 (50.4)	.585	919 (49.5)	.775	204 (49.2)	.722	126 (47.2)	.348	104 (48.6)	.676	93 (49.5)	.882
	Left	1301 (49.6)		938 (50.5)		211 (50.8)		141 (52.8)		110 (51.4)		95 (50.5)	

According to Chi-square \*: p<0.001, N: Number of teeth % :percent

Table 4. The numeric and percentage distribution of conservative implementations and health status of teeth by age, gender, jaw, and sides

		Healthy teeth		Teeth applied with fissure sealant		Teeth applied with flor	
		n%	P	n%	P	n%	P
Age	Group1	1155 (42.1)		519 (48.9)		1948 (53.9)	
	Group2	1318 (48)	.000*	490 (46.2)	.000*	1484 (41.1)	.000*
	Group3	271 (9.9)		52 (4.9)		180 (5)	
Gender	Girls	1328 (48.4)	.000*	479 (45.1)		1807 (50.1)	.000*
	Boys	1416 (51.6)		582 (54.9)		1805 (49.9)	
Jaw	Maxilla	1572 (57.3)	.000*	531 (50)	.973	1806 (50)	1.000
	Mandible	1172 (42.7)		530 (50)		1806 (50)	
Side	Right	1368 (49.9)	.836	540 (50.9)	.520	1806 (50)	1.000
	Left	1376 (50.1)		521 (49.1)		1806 (50)	

\*According to Chi-square \*: p<0.001, n: Number of teeth

Table 5. Distribution of patient's ages by the procedures implemented

	Teeth (n)	Minimum Age (Days)	Maximum Age (Days)	Mean Age (Days)	Standard Deviation
Age of First Fissure Sealant	1061	1911 (5 years 2 months 26 days)	5512 (15 years 1 month 7 days)	3382.98 (9 years 3 months 7 days)	710.05
Age of First Fluorine	3612	1825 (5 years 0 month 0 day)	5715 (15 years 8 months 0 day)	3274.67 (8 years 11 months 24 days)	825.44
Age of First Restorative Treatment	1857	1930 (5 years 3 months 15 days)	6446 (17 years 8 months 1 day)	3878.90 (10 years 7 months 18 days)	876.94
Age of Endo-dontic Treatment	267	2347 (6 years 5 months 7 days)	6422 (17 years 7 months 7 days)	4053.74 (11 years 1 month 8 days)	883.14
Age of Tooth Extraction	188	2494 (6 years 10 months 4 days)	6446 (17 years 8 months 1 day)	4178.24 (11 years 5 months 13 days)	794.48

\*n: Number of teeth

## DISCUSSION

Even though significant progress has been made in our country regarding the protection of oral-dental health in children, the diagnosis, treatment, and prognosis of dental caries are currently significant problems in developing countries (13). The parents being informed on the age of tooth development, eruption and order of appearance of the teeth, maintenance of oral hygiene, and beneficial effects of preventive applications have vital importance regarding early diagnosis and treatment of dental caries. Since it is considered that most of the behaviors and attitudes regarding general health that are to be carried to the further periods of life are attained during childhood, oral health habits should be provided to be gained starting from early ages in children (14).

It was reported in the studies investigating the relationship between the tooth eruption periods and dental caries that, in the FPMs, the period just following the eruption of the teeth, in other words, the following 1-1.5 years, was the riskiest period regarding dental caries (7). In conducted studies, caries in primary dentition was considered as a risk factor regarding dental caries in FPMs, and it was reported that following primary tooth eruption with active caries, the decay of the FPMs just after eruption might lead to the transfer of cariogenic infection to permanent dentition, and consecutively erupting permanent teeth to encounter caries risk (3,7,8). In our study, the patient population in eastern Anatolia region of Turkey was investigated using radiographs and clinical records for the evaluation of FPMs. The study is the most comprehensive study in this respect in terms of the number of investigated teeth in our country.

The FPMs are among the permanent teeth affected most by dental caries in childhood (3-5,15-17). The dental caries prevalence in FPMs has been reported as 26.6%

in Saudi Arabia (4), 57.2% in Mexico (18) and 47.49% (3) and 26.50% (5) in studies conducted in various regions of China; it was determined as 45.7% in our study.

The prevalence of caries in FPMs has been shown to increase significantly with age (4,5,10). In the study conducted by Riziwaguli et al. in the Urumqi Province of China and investigating the prevalence of caries in FPMs of Uyghur children, the caries prevalence was found to be significantly higher in children of 9 years of age compared to those within the 7-8 years age groups (5). In our study also, the FPMs were determined to be affected by caries within the group 2 more than the group 1; this result might be related to the inadequate oral hygiene of children due to the presence of both primary and permanent teeth within the mouth during the mixed dentition period, corresponding to the average 8-12 years age range, and additionally, the prolongation of intraoral stay of teeth according to their eruption times.

It was reported that teeth should be covered with a fissure sealant as soon as possible after eruption, such preventive applications would be more beneficial in this period, the caries prevalence would increase with age, and the fissure sealants would be more effective in individuals with high DMFT score (19). In the study conducted by Alwayli et al., investigating the caries prevalence in FPMs and fissure sealant applications, a total of 58140 teeth in 17891 children were evaluated and fissure sealant use was determined in at least one tooth of 1.3% of children and 0.8% of teeth in total (4). In our study, 5996 teeth were investigated, and a fissure sealant was determined to be applied in 17.7% of the teeth and in terms of preventive applications this is a very small percentage.

In the studies investigating the prevalence of caries in FPMs according to gender, girls were determined to have a higher caries prevalence compared to boys (3,5,20). In our

study also, the need for interventional treatment of FPMs was higher in girls (57.6%) compared to boys (50.7%). In the study conducted by Eskeli et al. on 1577 children within the 5-16 years age group in Finland, it was reported that tooth eruption initiated earlier in girls compared to boys (21). Girls reaching puberty earlier than boys, and thus, the prolonged stay of the FPMs in the mouth due to their earlier eruption might have led to such a situation. Also, in other studies, the FPMs located in the mandible have been found to decay quickly, and permanent mandibular FPMs were affected more by caries compared to the maxillary teeth (4,20,22,23); these results were similar to our findings.

In the study of Phipps et al. investigating the eruption of FPMs and decay patterns, caries, restorative treatment, and extraction were found in 7% of FPMs in kindergarten children, followed by prevalence of 20%, 30%, and 38% in children attending the first year, second year, and the third year of school, respectively(10). In our study, restorative treatment, endodontic treatment, and extraction were determined to be performed in 28%, 41.7%, and 46.1% of the evaluated teeth in children within the age ranges of group 1, group 2, and group 3, respectively. In the study conducted by Virtanen and Larmas on children within the 3-21 age range, the age for the first restorative treatment performed at the occlusal region of the FPMs was found to be 6.5-7 years(24). In our study, the age that the first restorative treatment application in the FPM had been performed was 10 years, 7 months and 18 days in average, with a minimum of 5 years, 3 months and 15 days. When the age range for performing the first restoration procedure was considered, 22.4% of children were determined to be within the group 1. In spite of developing dentistry technologies and ease of access, dental health is very dramatic in our country.

Eichenberger, in their article reviewing the ideal time for extraction of the unrestorable FPMs aiming to reduce the need for orthodontic treatment in the future, reported that the most ideal time for extraction of FPMs was 8-10.5 years in average for maxilla, with an excellent clinical outcome in 72% of them. Regarding mandible, successful outcome following extraction was found as 50% within the 8-10.5 years age range, 59% within the 10.5-11.5 years age range, 44% in children aged over 11.5 years, and 34% in children under 8 years of age (25). When we evaluated the extraction ages in our study, we found the percentage of the extracted tooth as 11.7% in the group 1, 54.2% in group 2, and 34.1% in group 3.

In the studies conducted by Gjermeo (26) and Halicioğlu (27) both investigating the FPM extractions, it was determined that the number of extracted teeth was higher in the mandible compared to the maxilla, and in boys compared to girls; similar results were obtained in our study.

The PR employed in present study enables the examination of all the FPMs in a single graph. Although using periapical radiography is recommended in examining a regional zone, the PR offers better access to more patients, since

the PR is generally requested from patients for diagnosis and treatment purposes (23). In the present study, not only the images obtained from PR method were used, but also the data in information system of hospitals and patient anamnesis forms, in which the patient records are kept, were utilized. This allows us to save more reliable records, in which the radiographic records of FPMs can be supported with clinical archives.

In a study evaluated of DMFT scores of the first molars (28) was not found statistically different relationship between parental education levels and mean DMFT scores of the first molars of children. However, it is emphasized that oral health of children develops as parents' awareness increases (28,29) and this finding is similar to our study.

## CONCLUSION

The health status of FPMs significantly declines with increasing age. The riskiest duration is the group 2 regarding the decay occurring in these teeth. Mean age of first restorative treatment, endodontic treatment and extraction on FPMs were 10 years 7 months 18 days, 11 years 1 month 8 days and 11 years 5 months 13 days, respectively. Mandibular teeth are affected more than the maxillary teeth regarding caries, restorative treatment, endodontic treatment, and extraction, with no difference between the right and left sides.

In the light of all these findings, and aiming protection of the FPMs, the parents and children should be enlightened on oral care starting from very early ages. The parents should be informed about the permanent status of FPMs, and their awareness should be increased. In our country also, the increase in preventive measures and awareness, together with more comprehensive studies on this subject are needed.

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