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Investigating permanent first molars of a Turkish pediatric sample in the eastern mediterranean region: A radiagraphic study

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Abstract

The early loss of first permanent molars (FPMs) may cause various problems in the dentofacial region. In the present study, it was aimed to evaluate the conditions of FPMs of a Turkish pediatric sample living in the Eastern Mediterranean Region. Dental panoramic radiographs (DPR) with good diagnostic quality and demographic characteristics of patients aged 7-17 years were retrospectively reviewed. Accordingly, affected teeth were evaluated by caries, filling, root canal treatment, retained root, apical lesion, and extraction. FPMs were compared by mandible, maxilla, and right-left jaw positions. The study was carried out with a total of 929 children, 442 (47.60) females and 487 (52.40) males. The participants were between the ages of 7-17 (M=12.10 ± 2.92). Among 3,974 FPMs evaluated, 2,018 (50.79%) were determined to be healthy, while 1,956 (49.21%) were affected. DC1 and F1 were the most common conditions of all evaluated FPMs. Regarding mandibular and maxillary FPMs, 1.137 of the FPMs1+FPMs2 and 881 of the FPMs3+FPMs4 were discovered to be healthy, and the difference was statistically significant ($p<0.001$). However, any significant differences were not found between right and left FPMs by treatment. While FPMs remained healthy significantly more in the age group of 7-9 years (Group-I), extraction, root canal treatment, and apical treatment were significantly higher in the age group of 16-17 years (Group-IV) ($p< 0.001$). Ultimately, it was concluded that FPMs start to be affected from early ages and that incidences of root canal treatment, extraction, and apical lesions become more prevalent with advancing age. This situation emphasizes the importance of applying preventive therapies as soon as the eruption of these teeth in children and attempting to increase relevant awareness among families.

Keywords: dental caries, FPMs, dental panoramic radiography, child, adolescent, oral health

1. Introduction

First permanent molars (FPMs) are the first erupted permanent teeth in the posterior (1). Yet, these teeth are frequently affected because they are susceptible to caries attacks (2, 3). Among other permanent teeth, there are multiple factors causing FPMs to have the highest prevalence of caries and/or extractions: the anatomical form of teeth (pit and fissure structure), their earlier eruption compared to other permanent teeth, exposure to the oral cavity, the neglect of their care due to their co-existence with the deciduous teeth, and knowledge gap in parents (e.g., mistaking these teeth with deciduous teeth) (4, 5). On the other hand, it was previously reported that early caries might occur in FPMs in cases such as early childhood caries and caries in the second molars (2). FPMs have essential roles in maintaining regular mastication function and dentofacial compliance (3, 6). Some of these roles are to support muscles, hold the vertical axis, and determine the occlusal relation in the vertical plane, and guide force distribution and the eruption of other permanent teeth (6).

Early loss of FPMs may cause many problems such as localized reduction in mastication force, osteoporotic alterations to the trabecular bone, a premature eruption of permanent second and third molars, increased overbite and rotation, tilting and rotation of adjacent teeth, and temporomandibular discomfort (TMD) (3, 7, 8). In the literature, it was reported that fissure sealants, as well as oral hygiene practices and fluoride, are effective in preventing caries in permanent posterior teeth (9, 10). Therefore the premature loss of FPMs should be prevented because it may cause many problems. For this purpose, it is needed to identify the caries risk and treatment needs of FPMs in different populations, which may contribute to planning preventive measures and appropriate distribution of treatment services in the country. Besides, the World Health Organization has recently updated its oral health targets.

These updates emphasize that the recommendations are not equally applicable to all countries and populations and that there should be regional and national oral health targets (11).

The relevant literature hosts research evaluating FPMs

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among different age groups in different geographical regions (12-16).

Ultimately, recruiting dental panoramic radiographs (DPR) from Kahramanmaraş Sütçü İmam University School of Dentistry, to which almost all pediatric patients with various socioeconomic statuses were referred, the present study aimed to evaluate FPMs (condition, caries, filling, extraction by mandible, maxilla, and right-left jaw positions) of a Turkish patient sample aged 7-17 years living in the Eastern Mediterranean region.

2. Materials and Methods

The ethical approval to the present study was granted by the Ethics Committee of Kahramanmaraş Sütçü İmam University Non-Interventional Clinical Research (Session No: 2021/16; Decision No: 06). DPRs with good diagnostic quality of healthy patients aged 7-17 years, who applied to Kahramanmaraş Sütçü İmam University School of Dentistry for dental treatments between 2019-2021, were systemically selected and retrospectively analyzed along with the demographic characteristics of the patients. No additional radiographs were required from the patients for this study. Children with a systemic, congenital disease, syndromic children, and children who did not have erupted permanent first molars, and those receiving orthodontic treatment were excluded from the study. Although the eruption of these teeth starts about at the age of 6, the minimum age limit was determined to be 7 in this study to exclude those without fully erupted teeth better. While the radiographs were evaluated by the oral maxillofacial radiologist, the pediatric dentist was consulted in cases where she was in dilemma.

DPRs were taken on GENDEX GDP -700 device (Kavo Kerr, Biberach, Germany) at 66 kVp, 6.3 mA and 14 sec. DPRs of a total of 929 patients (3,974 FPMs) were reviewed. FPMs were investigated by dividing the patients into four age groups: 7-9 years (Group-I), 10-12 years (Group-II), 13-15 years (Group-III), and 16-17 years (Group-IV).

Right permanent maxillary first molars (FPMs1), left permanent maxillary first molars (FPMs2), left permanent mandibular first molars (FPMs3), and right permanent mandibular first molars (FPMs4) were considered in DPRs. All permanent first molars in the maxilla and mandible were categorized by their conditions. Healthy teeth were denoted by (H), extracted (E), with dentin caries (DC1, DC2, DC3), while affected teeth were categorized as those filled (F1, F2, F3), with root canal treatment (RCT), with an apical lesion (AL), and with a retained root (R) (12, 13). In addition, FPMs were evaluated by segment, sex, and age.

2.1. Statistical analysis

The data were analyzed using SPSS 16.0 (IBM, Chicago, USA) software. The Chi-square test and Pearson's correlation coefficients were considered to compare the variables. The descriptive statistics were presented in percentage, mean (±), and standard deviation. In all analyses, $p<0.05$ were accepted as statistically significant.

3. Results

A total of 929 patients, 442 females and 487 males, were included in the study (Table1). The individuals included in the study were between the ages of 7-17 years, and the mean age was 12.0 ± 2.92.

Table 1. Percentage of gender of the study

Gender	Percent (%)	Noun (n)
Female	47.60	442
Male	52.40	487

Of 3,974 FPMs evaluated, 2,018 (50.79%) were determined to be healthy, while 1,956 (49.21%) were affected (caries, filling, apical lesion, root canal treatment, extraction, and retained root) (Table2).

The distribution of healthy and affected teeth is presented in Table 3.

DC1 and F1 were the most common conditions of all evaluated FPMs. While the total number of extracted FPMs was 32 (0.80%), the number of those with root canal treatment was 74 (1.86%). The numbers of FPMs with an apical lesion and retained root were calculated to be 168 (4.22%) and 32 (0.80%), respectively (Table3).

It was realized that FPMs1 and FPMs2 remained significantly healthier ($p<0.001$). Yet, FPMs3 were significantly more affected ($p<0.001$). Besides, FPMs4 were highly affected, but a significant difference could not be obtained ($p>0.005$). It was also discovered that 1.137 of the FPMs1+FPMs2 and 881 of the FPMs3+FPMs4 remained healthy, and the differences were statistically significant ($p<0.001$). However, any significant differences were not found in the left and right FPMs by treatment (Table2).

While it was found that FPMs remained healthy significantly more in the age group of 7-9 years (Group-I), extraction, root canal treatment, and apical treatment were significantly higher in the age group of 16-17 years (Group-IV) ($p< 0.001$) (Table 4).

Finally, regarding sex, FPMs1 and FPMs2 significantly remained healthier in males and females. However, FPMs3 and FPMs4 were found to be significantly more affected in both males and females (Table 5).

Table 2. Chi-square test result in comparison of health and affected status of teeth

% (n)	FPMs1	FPMs2	FPMs3	FPMs4	Total
Healthy	59.77[a] (569)	69.43[a] (568)	40.73[b] (426)	43.91[b] (455)	%50,79 (2018)
Affected Status	40.23[b] (383)	39.57[b] (372)	59.27[a] (620)	56.08[a] (581)	% 49,21 (1956)
Chi-Square	4098.06**	4089.94**	1923.89**	2097.08	

Table 3. FPMs1, FPMs2, FPMs3, FPMs4 percentage of teeth in terms of healthy and affected status

	H % (n)	E %(n)	DC1 % (n)	DC2 %(n)	DC3 %(n)	F1 %(n)	F2 %(n)	F3 %(n)	RCT % (n)	AL %n)	R % (n)	Total (n)
FPMs1	59.80 (569)	0.50 (5)	18.60 (177)	4.00 (38)	0.40 (4)	11.90 (113)	1.60 (15)	0.40 (4)	1.40 (13)	0.60 (6)	0.50 (5)	952
FPMs2	60.40 (568)	0.10 (1)	16.60 (156)	7.60 (71)	0.70 (7)	11.40 (107)	1.20 (11)	0.20 (2)	0.40 (4)	0.50 (5)	0.60 (6)	940
FPMs3	40.70 (426)	1.00 (10)	17.10 (179)	6.00 (63)	3.10 (32)	17.10 (179)	2.00 (21)	0.70 (7)	2.80 (29)	7.80 (82)	1.10 (11)	1046
FPMs4	43.90 (455)	1.50 (16)	16.30 (169)	6.30 (65)	3.30 (34)	14.40 (149)	2.00 (21)	1.00 (10)	2.70 (28)	7.20 (75)	1.00 (10)	1036
Total	2018	32	681	237	77	548	68	23	74	168	32	

(H): Healthy teeth, (E): Extracted, (DC1, DC2, DC3): Dentin caries, (F1, F2, F3): Filled tooth, (RCT): Root canal treatment, (AL): Apical lesion, (R): Retained root.

Table 4. Comparison of healthy and affected teeth according to age groups

% (n)	Age Group I (7-9)	Age Group II (10-12)	Age Group III (13-15)	Age Group IV (16-17)
H	83.10 (779)	45.00 (519)	40.80 (489)	33.80 (231)
E	0	0.20 (2)	0.90 (11)	2.80 (19)
DC1	10.60 (99)	20.60 (237)	20.10 (241)	15.20 (104)
DC2	1.60 (15)	5.10 (59)	8.00 (96)	9.80 (67)
DC3	0.10 (1)	3.50 (40)	2.10 (25)	1.60 (11)
F1	4.40 (41)	18.00 (207)	16.30 (196)	15.20 (104)
F2	0	1.00 (12)	2.20 (26)	4.40 (30)
F3	0	0.30 (4)	0.70 (8)	1.60 (11)
RCT	0	1.00 (12)	2.50 (30)	4.70 (32)
AL	0	4.40 (51)	4.80 (57)	8.80 (60)
R	0.10 (1)	0.50 (6)	1.20 (14)	1.60 (11)
Chi-Square	3683.98**	3091.03**	2599.27**	820.32**
Toplam	936	1149	1193	680

(H): Healthy teeth, (E): Extracted, (DC1, DC2, DC3): Dentin caries, (F1, F2, F3): Filled tooth, (RCT): Root canal treatment, (AL): Apical lesion, (R): Retained root.

Table 5. Comparison of healthy and affected teeth according to gender

% (n)								
	Female	Male	Female	Male	Female	Male	Female	Male
Healthy	61.54 (272)	58.24 (297)	61.40 (264)	59.60 (304)	36.40 (182)	44.69 (244)	39.68 (196)	47.79 (259)
Affected Status	38.46 (170)	41.76 (213)	38.60 (166)	40.39 (206)	63.60 (318)	55.31 (302)	60.32 (298)	52.21 (283)
Chi-Square	1270.76**	2084.44**	1556.24**	1349.50**	850.76**	1125.34**	874.58**	1264.99**
Total	442	510	430	510	500	546	494	542

4. Discussion

The literature often reports that oral and dental health awareness is unfortunately low in developing countries. In turn, prevalent caries incidence is not surprising in these countries due to rare follow-up examination habits or visiting a dentist only upon complaints (17-20).

In this study, it was determined that 49.21% of the FPMs of a Turkish pediatric sample (7-17 years) in the Eastern Mediterranean were affected; that is, the sample had at least one of the signs of caries, extraction, filling, root canal treatment, apical lesion, and retained root. In a study evaluating FPMs among children aged 7-12 in Izmir, it was concluded that 44.1% of the participants had one or more FPMs with caries, filling, and extraction (12). In another study with children aged 8-12 years in Malatya, it was reported that 58.6% of their FPMs were affected (13). One more study in Izmir with children in a different age group (12-18 years) discovered that 58.1% of the participants had one or more FPMs with caries, filling, extraction (14). Öter et al. evaluated the treatment needs of FPMs of children aged 6-12 years who applied to clinics of dentistry faculties in

Istanbul and Ankara. They concluded that about 50% of the FPMs needed relevant treatments (21). While the findings in this study were similar to some studies investigating the rates of affected FPMs in different regions in Turkey (12, 17) this study presented lower rates of affected teeth than some other studies (13-15).

In a previous study evaluating FPMs of 12-year-old students in Iran, it was reported that caries incidence was 53.12%-66.04% (15). In another study in Saudi Arabia, caries prevalence in FPMs was reported to be 66.4% (16). Moreover, the researchers explored the conditions of FPMs of 1,538 adolescents aged 12-15 years in Mexico based on clinical examination and reported that 56.4% of the sample had healthy FPMs (22). Variation in the rates of affected FPMs may stem from the differences in the possibilities of accessing treatment by region and socio-cultural and economic differences, as well as the methodological variances in previous research. In this study, the rates of problematic conditions in FPMs were found to be as follows: extraction (0.80%), retained root (0.80%), root canal treatment (1.86%), apical lesion (4.22%). In a similar study evaluating pediatric patients aged 7-12 years in Turkey, the rates of extraction and root canal treatment were determined to be 0.8% and 0.6%, respectively (12). Similarly, in a study with 4,872 Turkish children aged 6-12 years, while the rate of extracted teeth was 0.6%, the rate of teeth with root canal treatment was 0.5% (23). In this study, the rates of extraction and retained root were the same (0.80%). Considering that retained roots also require extraction, it is not prudent to claim that the rate of children needing extraction treatment is 1.6%. Ultimately, the rates of extraction and root canal treatment in this study are similar to other studies in Turkey. On the other hand, the fact that the rate of apical lesion was higher than the other findings in the present study may be related to the wide age range of our sample. Preservation of FPMs becomes essential since these teeth play an important role in maintaining a regular mastication function and dentofacial compliance. Therefore, first, oral health education should raise awareness of the importance of oral hygiene and proper nutrition, especially to limit sugar intake and non-abrasive soft foods. Second, preventive programs should broaden their target groups to include younger children, potentially starting with prenatal education and taking appropriate precautions (3, 6).

In addition, DC1 and F1 were the most prevalent of all FPMs evaluated in this study. In parallel with the present study, many studies with pediatric samples reported occlusal surface caries to be the most prevalent problem in FPMs (14, 24). It was then found that mandibular FPMs were significantly more affected ($p<0.001$), while no significant difference was determined between right and left FPMs. The findings are consistent with many studies in the literature (12, 16, 23, 25). More caries in mandibular FPMs is often explained by their earlier and more exposure to the oral cavity and more pits and grooves in these teeth (16). On the other hand, the close positioning of the palatal salivary gland duct to the maxillary FPMs may allow these teeth to remain cleaner than their mandibular counterparts (14). Although there was no significant difference between right and left FPMs in many studies, it was reported that hand selection in tooth brushing might affect appropriate cleaning of the right or left teeth (12, 21).

It was concluded that FPMs were significantly more affected as age advanced ($p<0.001$), which is a consistent finding with the relevant literature (12, 16). Besides, extraction, root canal treatment, and apical treatment were found to be significantly more prevalent in the group aged 16-17 years (Group-IV), FPMs were significantly more healthy in the group aged 7-9 years (Group-I). In parallel with this study, Duman et al. found the highest extraction rate (34.1%) in the group aged 12-18 years (Group-III) (13). In addition, Öter et al. reported that the rates of filled and missing teeth were significantly higher in the group aged 11-12 years, while this rate was found to be significantly lower in 8-year-olds (21). Similarly, in the study of Dhar et al., the group aged 8-10 years needed more treatment than the group aged 6-7 years (26). Similar results were obtained in the study regarding FPMs in both males and females; there was no significant difference by sex. Similarly, Bulut et al. found no statistical difference between FPMs with caries, extraction, and filling by sex (12). Yet, Zhu et al. reported that the females aged 6-8 years had more caries in their FPMs than their male peers 3. Poureslami et al. also detected a higher caries rate in females (3). It was previously stated that this condition in females might develop due to earlier puberty and tooth eruption in females, anatomical diversity in teeth, sex-related nutrition, anthropological factors, and differences in saliva quality and quantity (15, 27).

This was a retrospective radiological study, which might have caused the inability to detect initial caries in the radiographs. In addition, the results cannot be generalized to the Turkish population, as they were obtained from a specific region. Further studies may adopt both radiographic and clinical examinations in a larger sample to include different regions in Turkey.

In our study, the rates of extraction, root canal treatment, apical lesion were high in direct proportion to age, which highlights the importance of brushing teeth at an early age, regular dental examination, taking preventive measures, and raising parental awareness to retain FPMs in the mouth.

Conflict of interest

The authors declared no conflict of interest.

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None to declare.

Authors' contributions

Concept: K.T.T., A.S.O., Design: K.T.T., A.S.O., Data Collection or Processing: K.T.T., A.S.O., Analysis or Interpretation: K.T.T., Literature Search: K.T.T., A.S.O., Writing: K.T.T., A.S.O.

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