

# Investigation of the Radiological Status of First Permanent Molars in a Turkish Subpopulation

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## ABSTRACT

**Objective:** Missing or filled first permanent molars (FPMs) affects occlusal status and oral health. This study aims to determine the prevalence of missing, restored FPMs (filling, root canal treatment, prosthetic restoration), and dental implants in the first molar region.

**Methods:** In our study, panoramic radiographs of 1765 female and 1230 male patients were evaluated. Patients were divided into three age groups: 15-34 years old, 35-54 years old, and >55 years old. The maxillary and mandibular FPMs status is divided into two groups presence (caries, filled, root treatment, prosthetic restoration, root treatment + prosthetic restoration, and healthy) or absence (empty, radix relicta, dental implant, and dental bridge).

**Results:** In the evaluated images, 36.92% of maxillary FPMs and 27.39% of mandibular FPMs were healthy. FPMs on the right or left side of the jaws did not affect their clinical status, while their presence on the lower or upper jaw affected their clinical status.

**Conclusion:** Most of the FPMs (67.85%) were with caries or restorations. The number of healthy FPMs decreases with increasing age. The study indicates an important result regarding protecting FPMs and preventive dentistry.

**Keywords:** First permanent molar, panoramic radiography, health status

## 1. INTRODUCTION

As in all countries around the world, oral and dental diseases are one of the leading health problems in our country. However, the health service potential of countries can not meet all the needs of the society. Therefore, the World Health Organization (WHO) stated that preventive dentistry practices, therapeutic practices, and sometimes preventive services should be prioritized and emphasized to reduce the prevalence of oral and dental diseases (1-3). Tooth decay, one of the oral and dental diseases, is now considered the second most common disease after the common cold (1, 4).

Many factors must come together for tooth decay to occur. Although factors such as diet, microorganisms, tooth morphology, and saliva are influential in forming dental caries, it has been stated that environmental, cultural, and social factors are also effective (5-7). The presence of first permanent molars (FPMs) in the mouth is significant as they are more effective in chewing with their large occlusal surface that plays a crucial role in occlusion and coordinates

the horizontal, anterior-posterior, and transverse growth of both jaws, facial development and facial height (6, 7).

FPMs are more prone to dental caries and the most frequently extracted teeth due to caries (8, 9). Being the first permanent tooth to erupt in the mouth, being adjacent to primary teeth for a long time, having recesses, pits, and fissures in its morphological structure, and insufficient cleaning of the posterior teeth in childhood cause a high prevalence of caries in FPMs (6, 10, 11).

Panoramic radiography is a technique that provides a single image of the maxillary and mandibular arches and their supporting facial structures and is widely used to evaluate oral health. The main advantage of panoramic radiography is less exposure time to radiation than cone-beam computed tomography (CBCT). The reliability of panoramic radiography has been evaluated based on CBCT images by several authors, who suggest that panoramic radiography is an invaluable tool with the best cost-information ratio (12, 13). In addition, CBCT may not be available in clinics, despite its

advantages such as providing 3D imaging, high resolution, and no magnification (14).

It is known that patients' dentist visits are mainly for emergencies and pain relief, not for preventive medicine. Therefore, this study aims to emphasize the importance of preventive medicine by radiologically determining the prevalence of FPMs in a Turkish subpopulation in terms of missing, dental implants, and restoration (filling, root canal treatment, prosthetic rehabilitation).

## 2. METHODS

The Research Ethics Committee of Necmettin Erbakan University approved this study (approval date and number: 29.04.2021; 2021/04-50) which was conducted according to the guidelines of the Declaration of Helsinki. All patients signed informed consent.

This retrospective study evaluated the panoramic radiographs of patients who applied to Necmettin Erbakan University Faculty of Dentistry, Department of Oral and Maxillofacial Radiology with various dental problems between January 2020 and March 2021. A total of 9850 FPMs (2610 upper right FPMs; 2538 upper left FPMs; 2368 lower left FPMs; 2334 lower right FPMs) in 2995 panoramic radiographs were examined.

Within the scope of the study, panoramic radiographs acquired from individuals without systemic disease were included. In the evaluated radiographs, attention was paid to the fact that the root apex of the teeth was closed, there was no pathology associated with the teeth, and the image was clear and free of artifacts. First, FPMs were classified as present or absent. If the FPMs were present, it was categorized as healthy, decayed, filled, root treatment (RT), prosthetic restoration (PR), root treatment, and prosthetic restoration (RT+PR) (**Figure 1**). Missing FPM cases were grouped as empty, radix relict, dental implant, and pontic.

All the panoramic images were obtained with the Morita Veraviewepocs 3D R100-P (J Morita MFG Corp., Kyoto, Japan). The acquisition protocol was chosen following the manufacturer's instructions and was determined as 6 mA, 66 kVp, and 7.5 sec. Images were analyzed by two examiners (maxillofacial radiologists with 2 and 7 years of experience) on an LCD monitor under ambient light. After an inter-observer consensus, the final classification was recorded.

Statistical Package for the Social Science (SPSS) (IBM Corp. Released 2012. IBM SPSS Statistics for Windows, Version 21.0, IBM Corp., Armonk, NY, USA) software was used for statistical analysis. Descriptive statistics were calculated for all parameters in the study. The chi-square test was used to

determine the relationships between categorical variables, and it was considered significant at the  $p < .05$  level.

## 3. RESULTS

A total of 2995 patients (1765 female and 1230 male) between the ages of 15 to 81 ( $34.42 \pm 12.44$ ) were evaluated in this study. Regarding gender, the prevalence of no missing FPMs was 33.9% for females and 22% for males (Table 1). In the 31-55 age group, the number of tooth loss was higher than in other groups ( $p < .05$ ). However, no statistically significant difference was found between the gender and missing FPM ( $p > .05$ ) (Table 1).

Of the total study sample, 13.4% of patients had endodontically and prosthodontically restored upper right FPMs (316 RT, 84 RT + PR), this rate was 13.3%, 14.1%, and 14% for upper left, lower left, and lower right FPMs, respectively (Table 2).

For teeth #16, #26, #36, and #46, healthy teeth prevalence rates in patients aged 15-34 were 43.30%, 40.64%, 30.04% and 30.35%, respectively (Table 3). When evaluated according to age groups, there was a decrease in the frequency of healthy teeth in the advanced age group ( $p < .05$ ). (Table 3). The prevalence of patients with healthy teeth in the 55+ age range was 27.03%, 28.75%, 22.31%, and 21.45% for teeth 16, 26, 36, and 46, respectively.

The missing teeth in the lower jaw were found to be 20.56% (16.60% single tooth, 3.96% two teeth) in women and 27.72% (20.57% single tooth, 7.15% two teeth) in men. In the upper jaw, it was found to be 32.80% (21.81% single tooth, 10.99% two teeth) in women and 32.19% (22.52% single tooth, 9.66% two teeth) in men (Table 4). The difference in missing teeth in the upper jaw by gender was not statistically significant ( $p > .05$ ), this difference was statistically significant in the lower jaw ( $p < .001$ ). Missing teeth rate increases with age in both jaws and a statistically significant difference was found between age groups ( $p < .05$ ) (Table 4).

According to the results of our study, an increase in the prevalence of missing teeth, dental implants, or dental bridges was observed in advanced age groups compared to other age groups ( $p < .01$ ) (Table 5).

32.65% of the right maxillary and mandibular teeth were healthy, and 31.66% of the left maxillary and mandibular teeth were found to be healthy. There was no statistically significant relationship between radiological tooth conditions and the right-left position of the tooth ( $p > .05$ ) (Table 6). 36.92% of maxillary FPMs were healthy, and 27.39% of mandibular FPMs were found to be healthy. There is a statistically significant difference between the presence of permanent first molars in the maxilla or mandible and its radiological status ( $p < .001$ ) (Table 6).

**Table 1.** Frequency of teeth missing according to age-groups and gender

		No Missing	One Missing	Two Missing	Three Missing	Four Missing	Total	p value
<b>Gender</b>								
Female	n	1016	389	265	93	2	1765	.293
	%	33.9	13	8.8	3.1	0.1	58.9	
Male	n	659	295	200	75	1	1230	
	%	22	9.8	6.7	2.5	0.01	41.1	
Total	n	1675	684	465	168	3	2995	
	%	55.9	22.8	15.5	5.6	0.1	10000%	
<b>Age</b>								
15-34	n	1206	293	94	21	0	1614	.000**
	%	40.3	9.8	3.1	0.7	0%	53.9	
35-54	n	428	340	287	91	2	1148	
	%	14.3	11.4	9.6	3	0.1	38.3	
55+	n	41	51	84	56	1	233	
	%	1.4	1.7	2.8	1.9	0	7.8	
Total	n	1675	684	465	168	3	2995	
	%	55.9	22.8	15.5	5.6	0.1	10000%	

n: Number, %: Percent, \*\*: p<.01

**Table 2.** Radiological situations for first permanent molars according to the gender

Tooth Number	Gender		Caries	Filled	Root Treatment (RT)	Porcelain Restoration (PR)	RT + PR	Healthy	Empty	Total	p value
16	Female	n	209	389	171	65	52	687	192	1765	.000**
		%	7	13	5.7	2.2	1.7	22.9	6.4	58.9	
	Male	n	161	208	145	51	32	440	193	1230	
		%	5.4	6.9	4.8	1.7	1.1	14.7	6.4	41.1	
	Total	n	370	597	316	116	84	1127	385	2995	
		%	12.4	19.9	10.6	3.9	2.8	37.6	12.9	100	
26	Female	n	205	364	190	58	51	656	241	1765	.017*
		%	6.8	12.2	6.3	1.9	1.7	22.9	6.4	58.9	
	Male	n	169	216	119	42	39	429	216	1230	
		%	5.6	7.2	4	1.4	1.3	14.3	7.2	41.1	
	Total	n	374	580	309	100	90	1085	457	2995	
		%	12.5	19.4	10.3	3.3	3	36.2	15.3	100	
36	Female	n	242	419	203	36	46	445	374	1765	.016*
		%	8.1	14	6.8	1.2	1.5	14.9	12.5	58.9	
	Male	n	167	240	128	31	44	367	253	1230	
		%	5.6	8	4.3	1	1.5	12.3	8.4	41.1	
	Total	n	409	659	331	67	90	812	627	2995	
		%	13.7	22	11.1	2.2	3	27.1	20.9	100	
46	Female	n	210	382	203	54	57	460	399	1765	.02*
		%	7	12.8	6.8	1.8	1.9	15.4	13.3	58.9	
	Male	n	181	228	126	32	32	369	262	1230	
		%	6	7.6	4.2	1.1	1.1	12.3	8.7	41.1	
	Total	n	391	610	329	86	89	829	661	2995	
		%	13.1	20.4	11	2.2	3	27.7	22.1	100	

n: Number, %: Percent, \*\*: p<0.01,

16: Right Superior First Molar Tooth, 26: Left Superior First Molar Tooth, 36: Left Inferior First Molar Tooth, 46: Right Inferior First Molar Tooth

**Table 3.** Radiological situations for first permanent molars according to the age groups

Tooth Number	Age Groups		Caries	Filled	Root Treatment (RT)	Porcelain Restoration (PR)	RT + PR	Healthy	Empty	Total	p value
16	15-34	n	255	353	184	17	31	699	75	1614	.000**
		%	8.5	11.8	6.1	0.6	0.1	23.3	2.5	53.9	
	35-54	n	102	226	119	69	47	365	220	1148	
		%	3.4	7.5	4	2.3	1.6	12.2	7.3	38.3	
	55+	n	13	18	13	30	6	63	90	233	
		%	0.4	0.6	0.4	0.1	0.2	2.1	3	7.8	
	Total	n	370	597	316	116	84	1127	385	2995	
		%	12.4	19.9	10.6	3.9	2.8	37.6	12.9	100	
26	15-34	n	276	325	182	13	28	680	110	1614	.000**
		%	9.2	10.9	6.1	0.4	0.9	22.7	3.7	53.9	
	35-54	n	83	234	121	65	51	338	256	1148	
		%	2.8	7.85	4	2.2	1.7	11.3	8.5	38.3	
	55+	n	15	21	6	22	11	67	91	233	
		%	0.5	0.7	0.2	0.7	0.4	2.2	3	7.8	
	Total	n	374	580	309	100	90	1085	457	2995	
		%	12.5	19.4	10.3	3.3	3	36.2	15.3	100	
36	15-34	n	289	417	210	8	30	485	175	1614	.000**
		%	9.6	13.9	7	0.3	1	16.2	5.8	53.9	
	35-54	n	101	222	110	39	50	275	351	1148	
		%	3.4	7.4	3.7	1.3	1.7	9.2	11.7	38.3	
	55+	n	19	20	11	20	10	52	101	233	
		%	0.6	0.7	0.4	0.7	0.3	1.7	3.4	7.8	
	Total	n	409	659	331	67	90	812	627	2995	
		%	13.7	22	11.1	2.2	3	27.1	20.9	100	
46	15-34	n	311	385	201	9	34	490	184	1614	.000**
		%	10.4	12.9	6.7	0.3	1	16.4	6.1	53.9	
	35-54	n	68	206	114	57	46	289	368	1148	
		%	2.3	6.9	3.8	1.9	1.5	9.6	12.3	38.3	
	55+	n	12	19	14	20	9	50	109	233	
		%	0.4	0.6	0.5	0.7	0.3	1.7	3.6	7.8	
	Total	n	391	610	329	86	89	829	661	2995	
		%	13.1	20.4	11	2.2	3	27.7	22.1	100	

n: Number, %: Percent, \*\*:  $p < 0.01$ ,

16: Right Superior First Molar Tooth, 26: Left Superior First Molar Tooth, 36: Left Inferior First Molar Tooth, 46: Right Inferior First Molar Tooth

**Table 4.** Distribution of tooth loss in maxilla and mandible by gender and age

		No Missing	One Missing	Two Missing	Total	p value	
Maxilla	<b>Gender</b>					.495	
	Female	n	1186	385	194		1765
		%	39.6	12.9	6.5		58.9
	Male	n	834	277	119		1230
		%	28	9.2	4		41.1
	Total	n	2020	662	313		2995
		%	67.4	22.1	10.5	100.0	
	<b>Age</b>					.000**	
	15-34	n	1315	239	60		1614
		%	43.9	8	2		53.9
35-54	n	618	341	189	1148		
	%	20.6	11.4	6.3	38.3		
55+	n	87	82	64	233		
	%	2.9	2.7	2.1	7.8		
Total	n	2020	662	313	2995		
	%	67.4	22.1	10.5	100.0		
Mandibula	<b>Gender</b>					.000**	
	Female	n	1402	293	70		1765
		%	46.8	9.8	2.3		58.9
	Male	n	889	253	78		1230
		%	30	8.4	2.6		41.1
	Total	n	2301	546	148		2995
		%	76.8	18.2	4.9	100.0	
	<b>Age</b>					.000**	
	15-34	n	1449	146	19		1614
		%	48.4	4.9	0.7		53.9
35-54	n	759	301	88	1148		
	%	25.3	10.1	2.9	38.3		
55+	n	93	99	41	233		
	%	3.1	3.3	1.4	7.8		
Total	n	2301	546	148	2995		
	%	76.8	18.2	4.9	100.0		

n: Number, %: Percent, \*\*: p&lt;.01

**Table 5.** Cross-table of radiological situations in missing teeth by gender and age groups

		No Missing	Empty	Radix Relicta	Dental Implant	Dental Bridge	Total	p value
<b>Gender</b>								
Female	n	5854	736	22	49	399	7060	<b>.008**</b>
	%	82.9	10.4	0.3	0.7	5.7	100.0	
Male	n	3996	582	32	32	278	4920	
	%	81.2	11.1	0.7	0.7	5.7	100.0	
Total	n	9850	1318	54	81	677	11980	
	%	82.2	11.0	0.5	0.7	5.7	100.0	
<b>Age</b>								
15-34	n	5912	442	31	9	62	6456	<b>.000**</b>
	%	91.6	6.8	0.5	0.1	1.0	100.0	
35-54	n	3397	716	19	39	421	4592	
	%	74.0	15.6	0.4	0.8	9.2	100.0	
55+	n	541	160	4	33	194	932	
	%	58.0	17.2	0.4	3.5	20.8	100.0	
Total	n	9850	1318	54	81	677	11980	
	%	82.2	11.0	0.5	0.7	5.7	100.0	

*n*: Number, %: Percent, \*\*:  $p < .01$

**Table 6.** Cross table of first molars for jaws and right-left sides

		Radiological Status							
		Caries	Filled	Root Treatment (RT)	Porcelain Restoration (PR)	RT + PR	Healthy	Empty	Total
Maxilla	Right	370	597	316	116	84	1127	385	2995
	Left	374	580	309	100	90	1085	457	2995
Mandible	Right	391	610	329	86	89	829	661	2995
	Left	409	659	331	67	90	812	627	2995
Total		1544	2446	1285	369	353	3853	2130	11980

*Right-Left Jaw*  $p = .536$   
*Maxilla-mandible*  $p = .00007^{**}$   
*RT+PR: Root Treatment + Porcelain Restoration*

#### 4. DISCUSSION

This retrospective study, which was carried out using the data of Necmettin Erbakan University Faculty of Dentistry, especially focused on FPMs. Because these teeth play an important role in the dental and general health of the individual. The FPMs are the first permanent teeth to erupt in the mouth and have an important role in the alignment of both anterior and posterior teeth that will erupt later, as the other teeth are positioned relative to the previously erupted first molar and come into occlusion. The FPMs are also the largest tooth in the oral cavity and bear the greatest occlusal load. It affects the vertical distance, occlusal height, and aesthetic ratios between the maxilla and mandible. Considering these, an evaluation of the health status of these

teeth provides us with sufficient information about the oral health of a population (15).

It is important to protect these teeth, especially since the early loss of FPMs causes many problems such as asymmetry of teeth, deterioration of occlusal relations, and lack of space in the jaws. In addition, determining the number of patients who lost their teeth early in the community will be useful in determining treatment plans and health policies (16). In the population studied, at least one FPM deficiency was found to be 57.56% in females and 53.57% in males. In the 15-34 age group, at least one missing tooth was determined as 25.27%. This rate was determined by Rezaie et al (5) found to be 40% in their study, while İncebeyaz et al (7) similar to our study, it was found it to be 55% in both women and men. Özmen (16),

on the other hand, found that at least one FPM deficiency was 9.70% in women and 6.37% in men, in a study performed on a population aged 7-17 years. The differences between the results may be due to the different sample numbers and age groups, and the differences in protective measures based on countries. In addition, the lack of FPM in this study was evaluated in a wide age range and a large sample size.

Dental implants are a very common treatment option for partial or complete edentulism for a long time (15). In the 55+ age group, 3.5% of the FPM tooth loss was treated with an implant, while 20.8% was treated with fixed prosthetic restoration. The rate of those who did not receive any treatment was found to be 17.2%. In the 35-54 age group, the rate of treatment with implants is 0.8%, while the rate of fixed restoration is 9.2%. In the study of Aksoy et al (15) on the preference for implant restorations in the Turkish population, covering all oral regions, the rate of patients over the age of 60 was found to be 23%. Considering the results of this study and other studies in the literature (7,8), it was observed that the incidence of those who provided treatment for missing teeth was low. Considering the possible consequences of missing teeth, patients should be informed about the complication of missing teeth and should be referred for any prosthetic treatment.

Root canal treatment aims to prevent the spread of the disease in the pulpal tissues to the periapical tissues and to treat the existing periapical disease. When endodontic treatment is applied to teeth that can be restored in terms of tissue loss, the relevant tooth does not need to be extracted, and aesthetic and functional loss is prevented by keeping the tooth in the mouth (17). In the present study, the rate of root canal treatment in FPMs was 13.4%, 13.3%, 14.1%, and 14% for teeth 16, 26, 36, and 46, respectively. In the study of Çobankara et al (18), in which they examined the incidence of root canal treatment according to age groups, they found that 35% of FPMs had root canal-treated teeth. While the permanent teeth in the upper jaw constitute 17% of this rate, the permanent teeth in the lower jaw constitute 18%. In an epidemiological study conducted in Taiwan (19), endodontic treatment was detected in 27% of all molars. There is a limited number of studies in the literature on this subject. However, the results of these two studies show that the rates of root canal treatment are also low. Therefore, it is important to increase the patient population with teeth in the mouth over time and to raise awareness of the patients about keeping their teeth in the mouth instead of the prosthetic approach.

In the literature, it has been stated that the incidence of caries is higher in these teeth because the depth of the sulci in the occlusal morphology of FPMs is suitable for food retention and the eruption times coincide with the primary dentition period. Another factor is the earlier eruption of FPMs compared to maxillary molars, which has been argued to be effective in higher tooth loss (7). Incebeyaz et al (7) found an FPMs deficiency with a rate of 38.6% in the upper jaw and 43.9% in the lower jaw. In the present study, contrary to their study, a higher rate of missing teeth was found in the upper

jaw (32.55% in the upper jaw, 23.17% in the lower jaw). The difference between these studies may be due to the different age ranges evaluated and the number of samples.

In the literature, the frequency of dental caries is from most to low; lower and upper FPMs, lower and upper second molars, upper second premolars, lower second premolars, upper first premolars, lower first premolars, upper central and lateral teeth, upper and lower canines and lower incisors have been reported (20). FPMs being the first permanent teeth, early exposure to caries attacks and fissure morphology are the predisposing and important factors for caries formation (4). Although only the FPMs were examined in the present study, only 32.15% of the detected teeth were healthy. The lower rate (67.85%) of actively caries or processed teeth compared to other studies (21, 22) (78.3% and 74.4%) can be thought to be due to social differences, examination of FPMs only, and initial caries not showing on radiography.

In the present study, a statistically significant relationship was found between gender and dental status. Both decayed and filled or root canal-treated teeth are relatively more common in women. In previous studies, it has been reported that more caries are seen in women than in men, which is consistent with our study (20-22). It was thought that the early onset of permanent dentition in women, the effect of hormonal changes on the oral state, and the early onset of hormonal changes in women and biological differences were effective in the high incidence of caries (22-24).

According to the study's results, the presence of FPMs on the right-left side is not a significant variable. In contrast, their presence in the maxilla or mandible is an important parameter affecting the status of the teeth. In studies conducted with different age groups, it has been reported that the right or left side of the teeth is not effective in the formation of caries (20-25). Manji and Fejerskov (26) reported that mandibular molars are the most affected teeth in all teeth, being affected more frequently than upper molars. However, in the study by Demirci et al (27) and Zemaitene et al (22), it was reported that maxillary teeth develop more caries than mandibular teeth. Although there is no consensus among researchers, in the present study, it was determined that mandibular FPMs were affected and processed (filled, root treatment, porcelain treatment, extracted) more than the FPMs in the opposite jaw.

The present study found that mandibular FPMs showed a higher caries prevalence than maxillary FPMs. These findings were consistent with the previous studies (28,29). This can be attributed to various factors such as more complex pit and fissure morphology of mandibular molars, earlier eruption, and different salivary effects (30).

Duman et al. (31) evaluated the status of 5996 molar teeth in the radiology records of 1499 pediatric patients. It was determined that 45.7% of the FPMs were healthy, and 54.3% required treatment. Consistent with the results of our study, it was determined that the rate of healthy teeth decreased with age ( $p < .001$ ). Similar to the present study's results,

boys were found to have more healthy FPMs than girls in their study. In the literature, studies conducted in similar age groups indicate that the FPMs of girls are more affected, and this is because girls enter puberty before boys, and FPMs erupt earlier in girls than boys (32). In line with the results of the present study, it was observed that the FPMs in the maxilla were less treated than the FPMs in the mandible.

Gjeramo et al. (33) and Halicioğlu et al. (34) evaluated FPMs extractions. Contrary to the results of the present study, it was observed that the number of teeth extracted was higher in the mandible than in the maxilla and that the number of teeth was higher in boys than in girls. These differences may be due to the samples's different ethnic origins and different age distribution.

The present study was carried out retrospectively on panoramic images. To evaluate the health status of the tooth holistically, it should also be evaluated clinically. Therefore, future studies should be conducted on a larger sample size by evaluating radiological and clinical findings together.

## 5. CONCLUSION

The following conclusions were reached with the findings of the study:

- 67.85% of permanent first molars consist of decayed or treated teeth.
- The incidence of healthy teeth appearance in permanent first molars decreases with age.
- The presence of teeth on the right or left side does not affect the clinical status of the FPMs, however, their presence in the maxilla or mandible affects their clinical status.

This study reveals that preventive practices and oral hygiene motivations are important in reducing the need for restoration, extraction, dental implants, and dental bridges, and ensuring the continuity of stomatognathic systems, especially in elderly individuals.

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