

A retrospective study on root canal treatment of first permanent molars in children aged 8-16 years

Ayşe Günay^{1*}, Ezgi Eroğlu Çakmakoglu², Emine Tatar Şatiroğlu³, Sema Celenk¹

¹Department of Pediatric Dentistry, Faculty of Dentistry, Dicle University, Diyarbakir, Turkey

²Department of Pediatric Dentistry, Faculty of Dentistry, Bingöl University, Bingöl, Turkey

³Department of Pediatric Dentistry, Faculty of Dentistry, Kahramanmaraş Sütçü İmam University, Kahramanmaraş, Turkey

Abstract

Background: This retrospective study aimed to investigate the distribution of root canal treatment (RCT) procedures performed on first permanent molars according to age, sex, mandible, maxilla, right jaw, and left jaw in a group of children.

Methods: The records of RCT of a total of 6286 first permanent molar teeth of 5432 patients aged 8-16 years who visited the Department of Pediatric Dentistry, Faculty of Dentistry, Dicle University, Turkey from 2013 to 2018 were examined. Moreover, parameters such as age, gender, lower jaw, upper jaw, right jaw, and left jaw were evaluated. Frequency analysis and Pearson correlation test were used for statistical analysis and the level of significance was set at $P < 0.05$.

Results: The results of this study indicated that most of the boys (31.97%) received RCT of the lower left first molar tooth and most of the girls (34.21%) received RCT of the lower right first molar tooth. The tooth most receiving RCT was the mandibular right first permanent molar (33.09%). The tooth least receiving RCT was the maxillary right first permanent molar tooth (16.59%). In general, RCT was performed on the maxillary jaw less than on the mandibular.

Conclusion: RCT of first permanent molars showed variability according to age and position of jaws. RCT was performed more on the mandibular jaw than on the maxillary. It was observed that the incidence of RCT generally increased with age.

Keywords: First permanent molar, Root canal treatment, Caries

Citation: Günay A, Çakmakoglu EE, Şatiroğlu ET, Celenk S. A retrospective study on root canal treatment of first permanent molars in children aged 8-16 years. *J Oral Health Oral Epidemiol.* 2022;11(3):146-150. doi:10.34172/johoe.2022.04

Received: December 28, 2020, **Accepted:** October 9, 2021, **ePublished:** October 4, 2022

Introduction

Mixed dentition begins at around age 6 with the eruption of first permanent molars. However, permanent teeth are most exposed to caries due to inadequate brushing of the posterior teeth. It has been thought that 'post-eruptive maturation' plays a significant role in decreasing caries susceptibility in the post-eruptive period (1). In children and adolescents, decay mostly occurs in the occlusal surfaces of posterior teeth (2). Deep and narrow morphology of pits and fissures of posterior teeth could be another important reason for tooth decay. Hence, a large proportion of caries occurs at occlusal surfaces due to being highly vulnerable to the adhesion of microorganisms (3). Although the total caries rate has decreased in developed countries, the percentage of caries lesions in posterior teeth has not diminished. For that reason, immature permanent teeth are especially susceptible and early development of occlusal caries lesions in first permanent molars causes some short- and long-term complications for children (4).

Many parents think that the first molars are the primary molars and ignore the initial caries. Therefore,

dental caries is usually not treated until great cavitation occurs and pain is felt (5,6). In particular, pulpal infection can cause periapical abscess or apical periodontitis and may spread to other tissues with cellulitis or might lead to other complications. If these localized complications are not treated, there may be cases that may lead to hospitalization (7). Root canal treatment (RCT) is used for children for a number of reasons like trauma or dental caries (8). If tooth extraction is preferred over RCT, this may have some consequences. In case of the first permanent molars early extraction; elongation of the opposite teeth, tilting of the adjacent teeth towards the extraction cavity, and rotation of teeth are observed. Moreover, the closure of these teeth in neutral occlusion will guide the permanent teeth to normal occlusion and early removal may lead to malocclusion, cross-bite of posterior teeth, gingival recession, and difficult, costly and long-lasting orthodontic treatments (9,10).

Endodontic treatments are an indispensable part of comprehensive dental treatments to keep the teeth in the mouth uneventfully as a functional unit of the dental arch. Technological advances and developments



on instruments and materials used in treatment have made modern endodontic treatment a highly successful treatment procedure (11). Examples of this are the use of magnification tools, the use of machine methods, and changes in root canal irrigation solutions. In a study conducted in 2011, manual methods and machine methods were compared and the effectiveness of both was found to be similar, but machine methods were found to be more advantageous than other methods (12). In another study by Kula et al (13) in 2021, it was concluded that the use of modern techniques has increased.

This study aims to investigate the distribution of RCT procedures performed on first permanent molars according to age, sex, mandible, maxilla, right jaw, and left jaw in a group of children who were treated at the Department of Pediatric Dentistry, Faculty of Dentistry, Dicle University, Turkey.

Methods

This retrospective study which examined the RCT data for first permanent molar teeth was approved by the ethics committee of the Faculty of Dentistry of Dicle University 2019/58. A total of 111 943 patients between 8-16 years of age visited the Department of Pediatric Dentistry, Faculty of Dentistry, Dicle University, Turkey, for various dental treatments from 2013 to 2018. The records of all RCTs including apexification of a total of 6286 first permanent molar teeth of 5432 patients aged 8-16 who visited the clinic were examined. The first permanent molars without RCT and patients outside the specified age range were excluded from the study. In this retrospective study using computer data, when the patients visited the clinic, an anamnesis was taken and examined by the dentists. As a result of the examination, parameters such as age, gender, mandibular jaw, maxillary jaw, right jaw, and left jaw were evaluated retrospectively.

The minimum sample size of this study was determined as 377 at 5% measuring error, 57.2% prevalence, and 95% confidence interval (1- α) (14). The data obtained in this study were analyzed with IBM SPSS Statistics version 21 package program. Using frequency analysis, all results were stated as numbers and percentages and interpreted under the related tables. Pearson correlation test was used to examine the relationship between the values. The results were interpreted at the 0.05 level of significance. When $P < 0.05$, the relationship was considered significant.

Results

A total of 6286 teeth of 5432 patients were included in this study. Of the 5432 patients who participated in the study, 3132 (57.66%) were female and 2300 (42.34%) were male. A total of 3587 teeth belonged to girls and 2699 teeth belonged to boys.

The results of this study showed that most of the boys (31.97%) were treated with RCT on the lower left first

molar tooth and most of the girls (34.21%) were treated with RCT on the lower right first molar tooth.

The RCT was most performed on the mandibular right first permanent molar tooth (33.09%) and least on the maxillary right first permanent molar tooth (16.59%). The general examination showed RCT was performed on the maxillary jaw (2159 teeth) less than on the mandibular (4,127 teeth). The detailed examination indicated that the RCT was performed on the maxillary first molar tooth (1043) on right but on the maxillary first molar tooth (1116) on left. Moreover, RCT was performed less on the mandibular left first molar tooth (2047) than on the mandibular right first molar tooth (2080).

The results also demonstrated RCT was performed in 84.48% of boys on one tooth, in 13.74% on two teeth, in 1.74% on three teeth, and in 0.04% of boys on four teeth. Moreover, RCT was performed in 86.69% of girls on one tooth, in 12.23% on two teeth, in 0.96% on three teeth, and in 0.13% of girls on four teeth. Multiple teeth of 417 girls and 357 boys who participated in the study were treated (Table 1).

Moreover, the individuals were treated with RCT mostly when they were 14 years old, and the number of those who need RCT up to the age of 14 is increasing (Table 2).

The results also showed that there was a statistically significant relationship between age and number of RCTs ($P < 0.05$). This relationship was negative and low ($r = -0,065$). As the age increases, the number of teeth with RCT decreases (Table 3).

In the 8-year-old group, mandibular left first molar tooth was most frequently treated by RCT (43.48%). In the 9-year-old group, mandibular right first molar tooth was most frequently treated by RCT (42.55%). In the 10-year-old group, mandibular right first molar tooth was most frequently treated by RCT (41.33%). In the 11-year-old group, mandibular right first molar tooth was most frequently treated by RCT (36.76%). In the 12-year-old group, mandibular left first molar tooth was most frequently treated by RCT (35.55%). In the 13-year-old group, mandibular right and mandibular left first molars were equally treated by RCT (32.08%). In the 14-year-old group, mandibular left first molar tooth was most frequently treated by RCT (32.01%). In the 15-year-old group, mandibular left first molar tooth was most frequently treated by RCT (31.71%). In the 16-year-old group, mandibular right first molar tooth was most frequently treated by RCT (29.57%) (Table 2).

Discussion

The analysis of the epidemiological studies to determine the status of the first molars showed that these teeth are most affected by caries (15-17). The reason for the eruption of these teeth at a very early age is that they remain in the mouth for a while, thus, often thought to be

Table 1. Distribution of the number of root canal treatments according to gender

		Male		Female		Total	
		No.	%	No.	%	No.	%
Root canal treatment	1	1943	84.48	2715	86.69	4658	85.75
	2	316	13.74	383	12.23	699	12.87
	3	40	1.74	30	0.96	70	1.29
	4	1	0.04	4	0.13	5	0.09
	Total	2300	100	3132	100	5432	100

Table 2. Distribution of root canal treatments according to age

		Tooth number				Total
		16	26	36	46	
8	No.	3	3	10	7	23
	%	13.04	13.04	43.48	30.43	100
9	No.	13	16	52	60	141
	%	9.22	11.35	36.88	42.55	100
10	No.	57	55	152	186	450
	%	12.67	12.22	33.78	41.33	100
11	No.	91	99	228	243	661
	%	13.77	14.98	34.49	36.76	100
12	No.	140	133	321	309	903
	%	15.5	14.73	35.55	34.22	100
13	No.	180	181	323	323	1007
	%	17.87	17.97	32.08	32.08	100
14	No.	188	210	346	337	1081
	%	17.39	19.43	32.01	31.17	100
15	No.	163	210	320	316	1009
	%	16.15	20.81	31.71	31.32	100
16	No.	208	209	295	299	1011
	%	20.57	20.67	29.18	29.57	100
Total	No.	1043	1116	2047	2080	6286
	%	16.59	17.75	32.56	33.09	100

Table 3. Changes in age and number of root canal treatments

	Root canal treatment number	
	Age	<i>r</i>
	<i>P</i>	0.001
	<i>n</i>	5432

^a Correlation is significant at the 0.01 level (2-tailed).

primary teeth and do not receive sufficient care (16,18).

The main causes of first permanent molar caries are deep and narrow fissures, bacterial plaque accumulation and inability to clear the bacterial colonization from these fissures, being more susceptible to caries of the enamel not yet fully matured, and the fact that the occlusal surfaces of these teeth cannot be cleaned effectively by children during the first molar eruption (14,16,19). There are quite a few studies evaluating only the frequency of caries in first permanent molars (20-23).

In their study on children aged 7-8 years in Poland, Baginska et al (24) reported that they examined 14.8% to 17.3% caries in first permanent molars. Su et al (25) showed that the rate of caries increases fast in children aged 7-12 years. Moreover, caries prevalence in mandibular first permanent molars is significantly higher than in maxillary first permanent molars ($P < 0.01$).

Early extraction of these teeth may increase the need for physiological, aesthetic, orthodontic, and prosthetic treatments. Apposition could be seen in the adjacent teeth due to the loss of first permanent molars before the completion of the dentition (10). Therefore, the frequency of endodontic treatment in molar teeth has been higher than in other teeth (26,27).

Concerning the distribution of first permanent molar teeth according to mandibular-maxillary and right-left position of jaw, Faisal et al (26) in a study conducted in 2012 showed 56.25% of mandibular and 43.75% of maxillary teeth received RCT. It was reported that RCT was most often performed on mandibular right first molars (9.12%) and mandibular left first molars (7.07%). Tareen et al (27) reported in a study on the age range of 13-70 years that mandibular teeth receive more RCT than maxillary teeth. They determined the frequency of RCT as follows: on mandibular right first molars: 12.75%, maxillary left first molars: 10.34%, mandibular left first molars: 10%, mandibular left second molars: 8.72%, and mandibular right second molars: 7.24%. On the other hand, Yousuf et al (28) determined the frequency of RCT as follows: on mandibular right first permanent molars: 11.3%, mandibular left first permanent molars: 10.0%, maxillary right first permanent molars: 7.0%, and maxillary left first permanent molars: 6.5%. A study examining the need for endodontic treatment indicated that RCT was most often performed on mandibular right first molars (9.12%) and mandibular left first molars (7.07%) (29). Demirbuga et al (30) found in their study on children aged 6-16 years that RCT was received more by mandibular than maxillary teeth. There was detected no significant distinction between right and left jaws. However, they indicated that left mandibular most often received RCT which was different from the results of other studies.

In line with these studies, general examination in the present study revealed RCT was applied less to the maxillary (2159 teeth) than the mandibular jaw (4127 teeth). The RCT was most performed on lower right (33.09%) and least on maxillary right teeth (16.59%). The results of this study also demonstrated that while the RCT which was applied to the right first permanent molar was less than left first permanent molar on maxilla, the RCT applied to left first permanent molar was less than right first permanent molar on mandible. It is thought that the number of caries and/or RCT in the maxillary first permanent molars is less than in the mandibular first

molars. This might be due to the cleaning effect of salivary gland canal opening on buccal surface of these teeth.

There are some studies (26,28-30) proving the relationship between gender and the number of RCTs performed on first permanent molars suggesting that women receive RCT more. On the other hand, there are also some studies showing that men receive more RCT (27). In a study examining the frequency of extraction, it was found that women had more extractions than men ($P > 0.05$) (31).

About 57.66% of the patients who participated in the present study were girls. As seen in previous studies, no direct relationship was established between gender and RCT incidence. However, it is thought that concerning the reasons suggesting that the need for RCT is higher in girls than boys, parameters such as hormonal changes, saliva content, and consistency can be effective. Moreover, girls treat their teeth more as their aesthetic concerns are more than boys.

Concerning the relationship between the frequency of caries and age, Mohammed (23) evaluated first permanent molars of a group of children in terms of caries and concluded that DMFT (decayed, missing, filled teeth) was significantly higher in children aged 10-12 years than in children aged 6-9 years and DMFT increases with age. In a study examining caries prevalence in the first permanent molars of children aged 7-10 years, it was concluded that caries increases with age (20). Another study investigating the distribution of RCT on children aged 6-16 years indicated that RCT was most often performed on children aged 15-16 years (30). In the present study, it was found that RCT was more often performed on first permanent molars with increasing age and it was used most at the age of 14 (929 patients) and least at 8 years of age (22 patients).

It has been reported in many studies that first permanent molars have the most extraction, caries, and RCT (26,29,31). Thus, first permanent molar teeth should be always kept under control at regular intervals both during and after eruption.

This study had some limitations. It was carried out in only one center and RCTs were determined using the available computer data. Moreover, due to budget constraints and overexposure to radiation, patients could not be recalled. Therefore, further studies are recommended with larger sample sizes in different centers to provide more precise data on the incidence of RCT on first permanent molars.

Conclusion

The results of this study showed RCT of first permanent molars varied according to age and position of jaws. RCT was performed more on the mandibular jaw than on the maxillary. Besides, the incidence of RCT generally increased with age. The early first permanent molars

caries leads to negative results in children regarding both their dental and general health. Furthermore, financial resources, time, and effort are spent on the restoration of these teeth. Therefore, families should be properly informed about dental care during mixed dentition and protective practices should be adopted.

Acknowledgments

Nil.

Conflict of Interests

The authors declared no conflict of interest.

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