

Prevalence of caries in first permanent molar among children in Saudi Arabia: a retrospective study

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Abstract. – OBJECTIVE: This study investigated the prevalence of dental caries in first permanent molars among children aged 7-14 years in Saudi Arabia.

PATIENTS AND METHODS: This retrospective cross-sectional study included 6,089 panoramic radiographs of boys and girls aged 7-14 years who visited Riyadh Elm University Dental Hospital in Riyadh. All the panoramic radiographs were examined by five calibrated examiners for caries, filling, missing, and pulp therapy in the first permanent molars (FPMs). The Chi-square test was applied at a $p < 0.05$.

RESULTS: A total of 24,356 FPMs were evaluated from the panoramic radiograph, 69.5% of FPMs were sound, 22.5% were carious, and 7.3% were treated. The prevalence of decayed FPMs was 30.5%. A statistically significant difference in the status of FPM was observed across genders. Caries in the mandibular FPM was significantly higher than those in the maxillary FPM at $p < 0.05$.

CONCLUSIONS: The prevalence of caries in the FPM was relatively high, and females had more decay than males. Additionally, the mandibular FPMs showed higher levels of caries than the upper FPMs.

Key Words:

First permanent molar, Dental caries, Prevalence.

Introduction

Dental caries is a major global health burden affecting 2.3 billion people in their permanent teeth, and more than 530 million children have caries in primary teeth¹. The development of

dental caries is predominantly dependent on the availability of bacteria, fermentable sugars, and host factors². Dental caries is typically initiated at and below the enamel, which is the result of a process where hydroxyapatite crystals are demineralized by organic acids produced by biofilm bacteria³.

The accumulation of food debris on occlusal surfaces and the retention of bacterial plaques can be related to occlusal morphological features such as large crown size, deep grooves, the posterior location in the mouth, and the operculum covering the distal half of the first permanent molars (FPMs), which increases the risk of caries⁴. Dietary habits play a role in caries, as for example a cariogenic diet, such as sweet snacks, soft drinks, low fruit intake, and high intake of flavored milk. Moreover, poor oral hygiene, tooth brushing frequency, dental care behaviors, use of fluorides, some routine medications, systemic diseases, and the existence of molar incisor hypomineralization can increase the risk of caries in permanent first molars^{5,6}. The proximity of the first permanent molar can initiate the development of caries in second permanent molars and premolars⁵.

The FPMs are important teeth in the oral cavity for the harmonious development of the dental arch, carry the maximum occlusal load, and have esthetic features⁴. Due to their eruptive age and location, they are extremely prone to early carious lesions⁵. Loss of FPMs due to dental caries has adverse effects on occlusion, and is considered expensive, time consuming and traumatic for young children⁷. Due to the clinical

importance of FPMs, several studies^{4,8-10} across the world have advocated them in their caries prevalence study design.

Globally, the reported caries prevalence in FPM in Morocco, Sudan, Taiwan, and China is high, and Saudi Arabia is not significantly different from the reported literature. The estimated prevalence of dental caries among children living in Saudi Arabia is approximately 80%¹¹. The prevalence of FPM caries in Saudi Arabia ranges from 16% to 35% in children aged 6-9 years living in Riyadh city^{12,13} and 67% in those aged 9 years living in Jeddah⁷. Among 7-8 years schoolchildren living in Skaka, 56% reported the prevalence of FPMs with caries exclusively in the enamel and a very low prevalence of caries reaching the pulp¹⁴. In Abha, 66.4% of schoolchildren aged 7-10 years had caries in the FPM¹⁵.

Data regarding FPM caries prevalence in Saudi Arabia are still limited by variations in the results published due to different indices used to measure dental caries, variation in age, number of study groups, and lack of published reports in some regions of the country. This subject of interest still needs more research to set baseline data for future national epidemiological studies. Our study aimed at evaluating the prevalence of dental caries in children aged 7-14 years who visited Riyadh Elm University clinics.

Patients and Methods

A total of 7,422 patients aged 7-14 years who attended the University Hospital of Riyadh Elm University between January 2016 and December 2019 were reviewed. The selection criteria included male and female children, not having any orthodontic appliance. Orthopantomogram (OPG) with severe overlapping, or any other cause that resulted in unreliable diagnosis were excluded. All radiographs were classified according to pa-

tient age, sex, and stage of caries. No time restrictions were imposed on the observers. Each FPM was evaluated and scored using a 9-point scale as follows: 1, sound; 2, moderate caries; 3, caries extensive (close to the pulp); 4, restored; 5, root canal treatment; 6, pulpotomized; 7, apexification; 8, remaining root; 9, missing/extracted.

Of the 7,422 patients' records, 6,089 were included in the study, 102 were excluded due to the presence of orthodontic appliance, 510 unerupted/partially erupted FPM, 275 distorted panoramic radiographs, and 446 panoramic radiographs were not found. For standardization of the measurements, all examiners were calibrated by reading 20 radiographs separately, and the examiner re-read a sample of five panoramic radiographs after 1 week, and 100% agreement was obtained.

Statistical Analysis

Descriptive statistics of frequency distribution and percentages were calculated for categorical variables, and the Chi-square test was applied to assess the difference between the variables. A value of $p < 0.05$, was considered significant for all statistical purposes. All statistical analyses were carried out using the SPSS version 25 data processing software (IBM corp., Armonk, NY, USA).

Results

A total of 6,089 OPG were evaluated; 2,827 were male and 3,262 were female (Table I). There was no significant difference between the male and female participants.

The mean age of the study sample was 10.69 ± 2.16 years. The distribution of the patients based on age groups and the frequency indicated that the highest age of the patients who frequently visited the clinics was 12 years (Figure 1).

Table I. Distribution of patients based on year and sex.

Year	Male		Female		Total	
	N	%	N	%	N	%
2016	353	12.5%	586	18.0%	939	15.4%
2017	702	24.8%	853	26.1%	1,555	25.5%
2018	994	35.2%	999	30.6%	1,993	32.7%
2019	778	27.5%	824	25.3%	1,602	26.3%
Total	2,827	100.0%	3,262	100.0%	6,089	100.0%

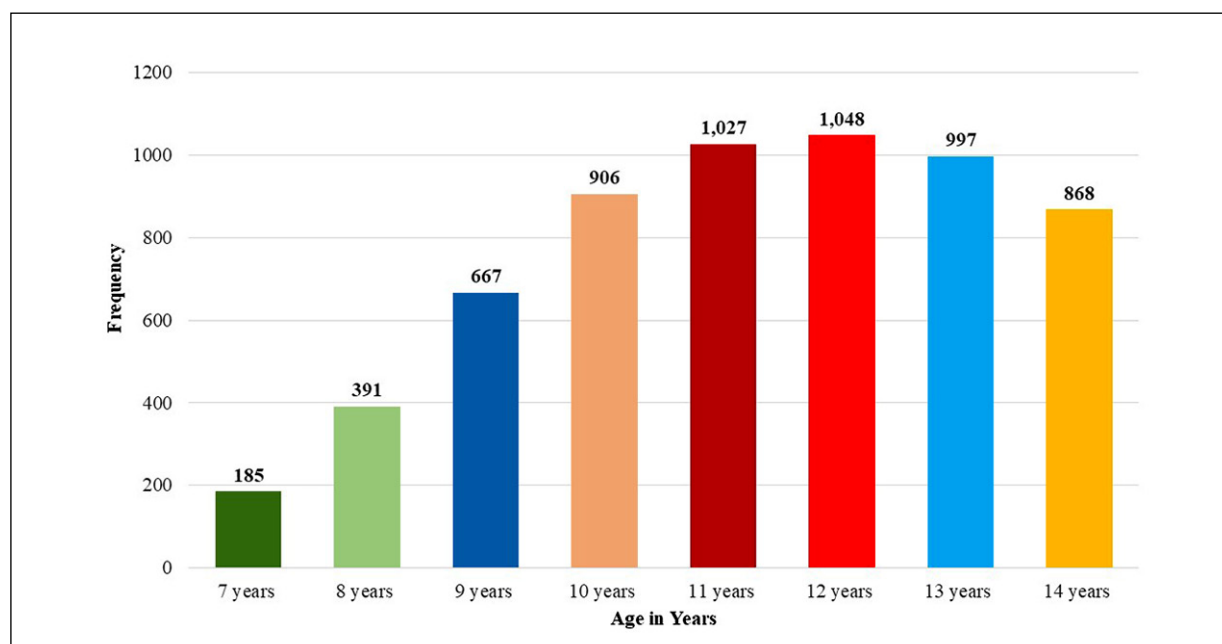


Figure 1. Distribution of the patients based on age.

Of the 24,356 FPMs examined from the OPGs, 69.5% were sound (n=16,933), 19.4% had moderate caries, 3.1% had caries reaching the pulp, 6.3% had fillings, and combined root canal treatment, apexification, and pulpotomy in the FPMs accounted for 1.4% of the total teeth examined. The percentage of missing/extracted FPMs due to caries was only 0.3% (Table II). The prevalence of decayed FPM was 30.5% (Tables III-IV).

Females had more decayed teeth than the male participants, and there was a statistically significant difference across sexes in the status of FPM at the 0.05 significance level, and the mandibular FPMs showed significantly more caries than the upper FPMs (Table V).

Table II. Distribution of the first molars based on clinical conditions.

Conditions	N	%
Sound	16,933	69.5%
Caries moderate	4,729	19.4%
Caries extensive (pulp)	749	3.1%
Restored	1,546	6.3%
Root canal treatment	185	0.8%
Pulpotomized	50	0.2%
Apexification	5	0.0%
Remaining Roots	95	0.4%
Missing/extracted	64	0.3%

Discussion

This retrospective study investigated the prevalence of dental caries, exclusively in FPMs among children aged 7-14 years who visited Riyadh Elm University clinics between 2016 and 2019, based on panoramic radiographs. Since FPMs are the first permanent molar to erupt in the oral cavity, they play a key role in establishing vertical occlusal relationships. Loss of first permanent molars, because of dental caries, negatively affects both arches and has adverse effects on occlusion. Also, early loss of first permanent molars creates periodontal problems. Moreover, the condition of these teeth can provide the overall oral health condition of the individual, as they are more susceptible to caries due to their morphological and chronological characteristics¹⁶.

The prevalence of decayed or filled FPMs in children in our study was 30.5%, which is comparable with a previous local study by Alwayli et al¹³ among 35.4% of schoolgirls and 16.5% of schoolboys in Riyadh. Locally, different prevalence rates have been reported in different regions of Saudi Arabia. Al-Samadani and Ahmad² reported a 75.7% prevalence of dental caries in children aged 9-12 years in Jeddah, Saudi Arabia. In the Eastern province, Dammam, the reported prevalence was 49.8% among children aged 8-12

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Table III. Presence of caries in the first permanent molars.

		Male		Female		p	Total	
		N	%	N	%		N	%
Status	Sound	7,977	70.5%	8,956	68.6%	0.001	16,933	69.5%
	Decayed	3,331	29.5%	4,092	31.4%		7,423	30.5%
	Total	11,308	100.0%	13,048	100.0%		24,356	100.0%

Table IV. Status of the first permanent molars in different years.

		Sound		Decayed		p	Total	
		N	%	N	%		N	%
Year	2016	2,495	14.7%	1,261	17.0%	< 0.001	3,756	15.4%
	2017	4,300	25.4%	1,920	25.9%		6,220	25.5%
	2018	5,627	33.2%	2,345	31.6%		7,972	32.7%
	2019	4,511	26.6%	1,897	25.6%		6,408	26.3%
	Total	16,933	100.0%	7,423	100.0%		24,356	100.0%

years¹⁷. In Abha, South of Saudi Arabia, 66.4% of 7-10-year-old school children had carious FPMs¹⁵. In Skaka, North of Saudi Arabia, 75% of FPMs had caries, mainly in enamel¹⁴. These differences between studies can be attributed to differences in study design, sample size, age groups, and geographic location of the study setting. Globally, the various prevalence of caries in FPMs have been reported 51.2% in Turkey¹⁸, 52% in Taiwan⁹, 61% in Sudan⁸, and 77% in Pakistan¹⁹. The differences in socioeconomic status, access to dental

services, and type of diet worldwide could be a possible explanation for the variation in caries prevalence.

Mandibular FPMs showed significantly higher caries prevalence than upper FPMs in the present study, which is consistent with previous studies^{12,15,18}. Mandibular FPM has more pits and fissures and generally erupts earlier than their maxillary counterparts. Therefore, it is exposed to the oral environment for a longer time, increasing its susceptibility to caries¹⁵.

Table V. Status of the first permanent molars in different sexes.

Status of FPM		Male		Female		p	Total	
		N	%	N	%		N	%
UR	Sound	2,090	74.2%	2,429	74.9%	0.001	4,519	74.6%
	Decayed	599	21.3%	610	18.8%		1,209	19.9%
	Treated	128	4.5%	205	6.3%		333	5.5%
	Total	2,817	100.0%	3,244	100.0%		6,061	100.0%
UL	Sound	2,138	75.9%	2,434	74.9%	0.049	4,572	75.4%
	Decayed	540	19.2%	605	18.6%		1,145	18.9%
	Treated	140	5.0%	209	6.4%		349	5.8%
	Total	2,818	100.0%	3,248	100.0%		6,066	100.0%
LL	Sound	1,851	65.9%	2,004	62.1%	< 0.001	3,855	63.9%
	Decayed	745	26.5%	892	27.7%		1,637	27.1%
	Treated	211	7.5%	329	10.2%		540	9.0%
	Total	2,807	100.0%	3,225	100.0%		6,032	100.0%
LR	Sound	1,898	67.5%	2,089	64.7%	< 0.001	3,987	66.0%
	Decayed	699	24.9%	788	24.4%		1,487	24.6%
	Treated	214	7.6%	350	10.8%		564	9.3%
	Total	2,811	100.0%	3,227	100.0%		6,038	100.0%

UR, upper right; UL, upper left; LL, lower left; LR, lower right.

In our study, decayed FPMs were present in 2% of the 7-year-old children. However, the caries experience increased with age; for example, 14-year-old children had 18.9% of carious FPMs. The role of preventative measures in children at an early age is emphasized as fissure sealants, fluoride application, good oral hygiene practices, and good dietary habits can help to reduce dental caries. The results comparable with those of our study were found by Al-Samadani and Ahmad², who reported increased caries experience with age from 9 to 12 years. Moreover, Togoo et al¹⁵ reported that the prevalence of dental caries in FPMs increased with age with caries levels of 1.88, 2.48, 2.88, and 3.04 at ages 7, 8, 9, and 10 years, respectively.

The caries experience among children was measured by Al-Sadhan²⁰ in the Riyadh region. He found that the prevalence of caries was significantly higher in boys than in girls aged 12-14 years. Akapta et al²¹ observed contrasting results in Riyadh. They found that the mean decayed missing filled teeth was higher in girls than in boys; however, the difference was not statistically significant. Similar results were observed in a study conducted by Aras and Dogan¹⁸ in Turkey, in which the number of carious teeth was significantly higher in girls than in boys.

Comparable outcomes were observed in the present study. The number of decayed and treated FPMs was 3,659 in girls and 3,276 in boys. In this study, 65% of girls and 56% of boys aged 7 years had erupted FPM. This explains the higher prevalence of carious FPMs in boys, whose eruption was found to be delayed in this study.

Limitations

Our study has some limitations. This study relied mainly on the radiography records of 7-14-year-olds from single hospital. Therefore, care must be exercised when extrapolating the results of this research to a broader child population. Furthermore, psychosocial, behavioral, and clinical characteristics related with FPMs caries in children were not included in this investigation. Hence future research should consider large multicenter studies encompassing many age groups and FPM caries-related variables.

Conclusions

The prevalence of dental caries in the FPMs is relatively high, and female children had more decay than males. Additionally, the mandibular

FPMs showed higher levels of caries than the upper FPMs. More attention to caries preventive measures is important to reduce the incidence of dental caries.

Conflict of Interest

The Authors declare that they have no conflict of interests.

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Ethics Approval

The study was conducted according to the guidelines of the Declaration of Helsinki and approved by the Research and Innovation Center of Riyadh Elm University (registration No. SRS\2020\42).

Data Availability Statement

All the data was retrieved from the university hospitals of Riyadh Elm University.

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Authors' Contribution

Sarah Mubarak: conception and design of the study, acquisition of data, analysis, and interpretation of data, drafting the article, supervision, and final approval. Rahaf AlOlyan: Acquisition of data, revising the paper, final approval. Jumana Albrekeit: Interpretation of data, revising the article, final approval. Souad AlFouzan: Acquisition of data, analysis and interpretation of data. Magdolin Abosharkh: Acquisition of data, drafting the article, final approval. Norah Alsaeri: Acquisition of data, drafting the article, final approval. Mohammad Abdul Baseer: Analysis and interpretation of data, drafting the article and final approval.

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