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Original Article

# Parents' perspective towards dental radiography for children

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## KEYWORDS

Dental radiography;  
Attitude;  
Knowledge;  
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**Abstract** *Background/purpose:* Radiographs provide critical information on developmental and eruption problems, detection of interface caries, pulpal and periapical pathologies in clinical examination. This study aimed to evaluate parents' knowledge, attitudes and behaviors towards dental radiographs.

*Materials and methods:* A cross-sectional study was conducted on the parents of 396 children who visited to the Pediatric Dentistry clinics. All participants were asked to answer a total of 26 questions. A questionnaire was developed to assess participants' attitude, behavior and knowledge toward pediatric dental radiographies and provided information on their demographic characteristics. The number of positive attitudes and correct answers was scored based on items asked to the participants. In order to analyze the effect of demographic data on the obtained scores, a multivariate linear regression model was created. The significance level was accepted as 0.05 in all analyzes.

*Results:* Children's dental radiography experience affects parents' attitude score towards dental radiographs ( $t = 4.375$ ,  $P < 0.001$ ). Parents' level of knowledge about dental radiography has a positive effect on their attitudes ( $t = 5.510$ ,  $P = 0.005$ ). The education level of the parents and the frequency of visits to the dentist have a significant effect on the knowledge level of the parents about dental radiography ( $P < 0.05$ ). When the correlation between knowledge and attitude scores is analyzed, it is observed that there is a statistically significant, weak and positive correlation between the two variables ( $r = 0.34$ ,  $P < 0.001$ ).

*Conclusion:* In conclusion, parents who did not had dental radiographs before have a more negative attitude towards dental radiographs than those who have had dental radiographs.

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## Introduction

Radiographs provide critical information on developmental and eruption problems, detection of interface caries, pulpal and periapical pathologies in clinical examination.<sup>1</sup>

Dental radiographs are used in pediatric dentistry for diagnosis in oral examination of children, as well as auxiliary diagnostic methods in the detection of caries, dental injuries, tooth development disorders, and examination of pathological conditions.<sup>2</sup> According to the AAPD, the timing of the first radiographic examination should not depend on the age of the patient, but on the individual circumstances of the child, and radiographic examination should not be performed for the detection of any disease without clinical examination.<sup>3</sup>

Bitewing radiographs from dental radiographs have a radiation dose of 5 mSv, while panoramic radiographs from extraoral radiographs have a radiation dose of 14–24 mSv.<sup>4</sup> Although this radiation dose is low in dental radiographs, it is one of the procedures that is frequently repeated in childhood.<sup>5</sup> Radiographic guidelines are available to avoid unnecessary application of dental radiographs and to identify individuals for whom radiographic examination would be beneficial.<sup>6,7</sup> ADA makes some recommendations during radiographic applications in order to minimize the cumulative effect of radiation. These are 1) using the fastest image receptor (F-speed film or digital [photostimulable phosphor {PSP} plate, charge-coupled device {CCD}]) 2) collimation of the beam to the size of the receptor whenever feasible, 3) proper film exposure and processing techniques, 4) use of protective aprons and thyroid collars, and 5) limiting the number of images to the minimum necessary to obtain essential diagnostic information.<sup>3</sup>

In today's medical and legal regulations, informed consent for x-rays is an often overlooked topic in dental care.<sup>8</sup> It is unclear whether dentists provide details on radiation safety information to the public or whether the public understands this information. The ADA states that while exposure to radiation from dental radiographs is low, it is the dentist's responsibility to follow the lowest reasonably achievable (ALARA principle) to minimize patient exposure once the decision to obtain a radiograph is made.<sup>9</sup> Parents have the right to receive information about radiography procedures during their child's dental visit.<sup>7</sup>

There are studies evaluating the radiation knowledge and attitudes of clinicians, other allied health professionals and adult patients regarding dental radiographs.<sup>10–12</sup> Especially in our country, there is not enough concrete information about parents' knowledge and attitudes towards dental radiographs applied to their children. It is not known what the parents' reservations about dental radiographs are, whether their attitudes are exaggerated or whether they are aware of and accept the effects of dental radiographs. There is also a need to identify parental knowledge regarding the protective clothing available for dental radiographs. Therefore, this survey study aimed to evaluate parents' knowledge, attitudes and practices towards Pediatric Dental Radiographs.

## Materials and methods

A cross-sectional study was conducted on the parents of 396 children who applied to the Pediatric Dentistry clinics of

Istanbul University-Cerrahpaşa and Altınbaş University Faculty of Dentistry between August–November 2022.

This cross-sectional study was completed compatible with the Helsinki Declaration presented in 1975 which is revised in 2000. Ethical approval of the study protocol was obtained from the Research Ethical Board of Altınbaş University, Faculty of Dentistry, Istanbul, Turkey (No:2022/130). The study sample number was determined as at least 384 parents, with a significance level of 0.05 and a reliability of 95%. Inclusion criteria for parents in our study were determined as follows: having at least one child aged  $\leq 14$  years, being able to give informed consent, and being willing to participate in this study. The exclusion criteria was a questionnaire that individuals had not completed, for whatever reason. All participants were asked to answer a total of 26 questions. A questionnaire was developed to assess participants' attitude, behavior and knowledge toward pediatric dental radiographies and provided information on their demographic characteristics.

## Data measurements

### Participant demographics

The distribution of basic demographic informations included participants' age, gender, education level, number of children, age of children, frequency of visits to the dentist of the parent and child, preference of dental treatment place, previous dental radiography of the children, parent accompanying the child during oral and dental examination, parent accompanying the child during dental treatments were evaluated.

### Parent's attitude toward dental radiography in children

The following 4-item scale to assess parents' attitude levels toward pediatric dental radiography was designed. The items included: (1) I think dental x-rays are safe for my child/children. (2) I think dental x-rays are beneficial for my child(s). (3) I think dental x-rays are necessary for my child(s). (4) I allow dental x-rays to be taken for my child/children. The responses of the participants to these questions were evaluated using the Likert 3-point scale: "I agree, I undecided, I disagree."

### Parent's behaviors toward dental radiography in children

The following 2-item scale to assess parents' behavior levels toward pediatric dental radiography was designed. The items included: (1) I always ask the dentist to explain why a dental X-ray is needed for the child/children. (2) I always request protective clothing (such as a lead apron) to protect my child against possible radiation while having a dental X-ray. The responses of the participants to these questions were evaluated using the Likert 3-point scale: "I agree, I undecided, I disagree."

## Parent's knowledge toward dental radiography in children

The following 10-item scale to assess parents' attitude levels toward pediatric dental radiography was designed. The responses of the participants to these questions were evaluated using the Likert 3-point scale: "I agree, I undecided, I disagree."

### Statistical analysis

Analyzes were performed in IBM SPSS Statistics 26 package software. The internal consistency of the questionnaire was checked with the Cronbach Alpha statistic. The results of preliminary testing (106 subjects) of the questionnaire were evaluated through SPSS to determine the reliability of the research (Cronbach's alpha:0.8).

The number of positive attitudes and correct answers was scored based on 4 attitude items and 10 information items asked to the participants. In order to analyze the effect of demographic data on the obtained scores, a multivariate linear regression model was created. Regression models were established with the Robust Linear Regression method. In case the assumptions could not be met, the correlation relationship was performed with Spearman's rho test, multiple comparisons for means were performed with Kruskal Wallis test, and pairwise comparisons were performed with Dunn's Post Hoc test with Bonferroni correction. The significance level was accepted as 0.05 in all analyzes.

## Results

Totally 395 parents participated in the survey. Demographic data of participants are shown in Table 1. 70.1% of the participants are female, 29.9% are male. 45.3% of the parents are university graduates. The frequency of visiting the dentist by the parents was 41.6% once a year, and the frequency of taking their children to the dentist was 41.6% once a year. Children of 58.6% of the participants have dental radiography experience. The vast majority of parents state that they accompany their child during the examination (94.4%) and dental treatment (89.6%).

The descriptive statistics of the answers given by the parents to the questions of attitude, behavior and knowledge are shown in Table 2. While 55.19% of parents state that dental radiographs are safe, 61.01% are useful, 76.20% are necessary, 80.25% state that they will allow their child to have dental radiography. When the parents' behaviors about dental radiographs are evaluated, it is seen that 75.95% of them need explanations about dental radiographs from dentists. In addition, 61.52% of parents state that they demand protective clothing for their children when dental radiography is being taken. When the knowledge level of the parents about dental radiographs was evaluated, 78.99% of the parents gave the correct answer stating that dental radiographs would help in treatment planning. It is seen that 60% of parents are aware of the possibility of protection from radiation by methods such as wearing lead aprons. Apart from these two questions, it is seen that the knowledge level of most of the parents is insufficient.

**Table 1** Demographic data of the participating parents.

N = 395		n	%
Parent's age	18–25	7	1.8
	26–30	47	11.9
	31–35	127	32.2
	36–40	117	29.6
	40<	97	24.6
Parent's gender	Female	277	70.1
	Male	118	29.9
Parent's educational level	Primary school	21	5.3
	Middle school	29	7.3
	High school	87	22.0
	University	179	45.3
	Postgraduate	79	20.0
Number of children	1	173	43.8
	2	159	40.3
	3	55	13.9
	4	5	1.3
	5	3	0.8
Frequency of parent visiting the dentist	Every 2 years or more	152	38.6
	1 per year	164	41.6
	1 in every 6 months	78	19.8
Frequency of children visiting the dentist	Every 2 years or more	111	28.2
	1 per year	160	40.6
	1 in every 6 months	123	31.2
Treatment place	State University	84	21.3
	Hospital		
	Private University	87	22.0
	Hospital		
	Private Clinic	221	55.9
	Oral and Dental Health Center	102	25.8
Has your child had a dental radiography?	No	155	39.3
	I can't remember	8	2.0
	Yes	231	58.6
Do you accompany your child's dental examination?	No	22	5.6
	Yes	373	94.4
Do you accompany your child's dental treatment?	No	41	10.4
	Yes	354	89.6

## Attitude

Children's dental radiography experience affects parents' attitude score towards dental radiographs ( $t = 4.375$ ,  $P < 0.001$ ). Parents' level of knowledge about dental radiography has a positive effect on their attitudes ( $t = 5.510$ ,  $P = 0.005$ ) (Table 3). The fact that the child has dental radiography experience creates a statistically significant difference in the mean attitude score of the parents ( $KW = 40.110$ ,  $P < 0.001$ ). It is seen that the average attitude score (224.77) of the parents whose child had dental radiographs was higher than the average (162.59) of the parents whose child did not have dental radiographs, and the average score of the parents with low knowledge (86.31) ( $P < 0.05$ ) (Tables 3 and 4). Accordingly, it has been determined that parents whose children have experienced dental radiography have a higher level of positive attitude

**Table 2** Descriptive statistics of parental attitude, behavior and knowledge.

	I don't agree		I don't know		I agree	
	n	%	n	%	n	%
<b>Attitude</b>						
I think dental x-rays are safe for my child/children.	72	18.23%	105	26.58%	218	55.19%
I think dental x-rays are beneficial for my child/children.	58	14.68%	96	24.30%	241	61.01%
I think that dental X-rays are necessary for my child/children dental treatment.	24	6.08%	70	17.72%	301	76.20%
I allow dental x-rays to be taken for my child/children.	24	6.08%	54	13.67%	317	80.25%
<b>Behavior</b>						
I always ask the dentist to explain why a dental X-ray is needed for my child.	55	13.92%	40	10.13%	300	75.95%
I always request protective clothing (such as a lead apron) to protect my child against possible radiation while having a dental X-ray.	47	11.90%	105	26.58%	243	61.52%
<b>Knowledge</b>						
Diş röntgeni çocuğun genel sağlığına zarar verebilir.	120	30.38%	169	42.78%	106	26.84%
A dental X-ray causes permanent damage to the body.	161	40.76%	190	48.10%	44	11.14%
The number of dental X-rays taken increases the risk of damage caused by radiation.	37	9.37%	169	42.78%	189	47.85%
The benefits of dental x-rays outweigh the risks for the child.	60	15.19%	183	46.33%	152	38.48%
A dental X-ray helps the dentist better plan treatment for a child.	4	1.01%	79	20.00%	312	78.99%
Radiation from x-rays used for medical purposes is higher than radiation from dental x-rays.	30	7.59%	246	62.28%	119	30.13%
I know that there are ways to protect my child from radiation with a dental X-ray, such as wearing a lead apron.	9	2.28%	149	37.72%	237	60.00%
Exposure to a dental X-ray is too minor to cause significant harm to my child.	31	7.85%	203	51.39%	161	40.76%
Dental X-rays are more harmful to children than adults.	74	18.73%	214	54.18%	107	27.09%
Exposure to environmental radiation (eg, sun, telephone) is higher than radiation from dental x-rays.	41	10.38%	239	60.51%	115	29.11%

towards dental radiography (Table 5). When the correlation between knowledge and attitude scores is analyzed, it is observed that there is a statistically significant, weak and positive correlation between the two variables ( $r = 0.34$ ,  $P < 0.001$ ). As the level of accurate knowledge of the parents about dental radiography increases, their positive attitude tends to increase (Table 5).

### Knowledge

It is seen that the education level of the parents and the frequency of visits to the dentist have a significant effect on the knowledge level of the parents about dental radiography ( $P < 0.05$ ) (Table 6). Increase in parents' education level causes an increase in knowledge scores about dental radiographs ( $t = 3.038$ ,  $P = 0.003$ ) (Table 6). Likewise, the frequency of parents going to the dentist causes an increase in knowledge scores ( $t = 4.638$ ,  $P = 0.003$ ) (Table 6). There was no linear relationship between gender, frequency of dental visits and dental radiography experience of the child, preferred health institution for treatment, parent accompanying the child during the oral

examination or dental treatment, requesting an explanation from the physician about dental radiography and protective clothing, and parents' knowledge score ( $P > 0.05$ ) (Table 6). It is seen that the mean knowledge score (243.70) of parents with a graduate level education is higher than the mean knowledge score (143.12) of parents who are university graduates (193.61), high school graduates (184.33) and secondary school graduates ( $P < 0.05$ ) (Table 7). It was found that the mean knowledge score of parents who visit their dentists once in 6 months (245.03) is higher than the mean knowledge score of parents who visit their dentists once a year (204.02), and the mean knowledge score of parents who visit their dentist once every 2 years ( $P < 0.05$ ) (Table 8).

### Discussion

Pediatric dental radiographs have a wide application area in dentistry, from diagnosis to treatment planning.<sup>13</sup> Although radiation exposure in the dental setting is relatively low, it is one of the most frequently performed

**Table 3** Linear regression analysis for attitude scores.

Model	Coefficients				Linearity	Autocorrelation	Constant Variance	ANOVA	Corrected R <sup>2</sup>
	B	Std. error (HC4)	t	p	VIF	Durbin Watson	Breusch Pagan (P)	Model (P)	
Constant	<b>1.915</b>	<b>0.783</b>	<b>2.446</b>	<b>0.015*</b>		1.959	<b>0.000*</b>	<b>0.000*</b>	0.185
Gender	0.278	0.172	1.620	0.106	1.039				
Educational level	-0.134	0.080	-1.683	0.094	1.200				
Frequency of parent visiting the dentist	-0.033	0.152	-0.213	0.831	1.833				
Frequency of children visiting the dentist	-0.048	0.134	-0.357	0.721	1.657				
Children's dental radiography experience	<b>0.370</b>	<b>0.085</b>	<b>4.375</b>	<b>0.000*</b>	1.186				
State University Hospital	-0.044	0.314	0.141	0.888	2.238				
Private Clinic	0.054	0.233	0.230	0.819	2.750				
Oral and Dental Health Center	-0.547	0.288	-1.895	0.059	2.277				
Accompanying children to dental visits	0.015	0.443	0.034	0.973	1.070				
Request clarification from the dentist	-0.055	0.114	-0.487	0.627	1.106				
Requesting protective clothing	0.009	0.117	0.077	0.983	1.116				
Knowledge score	<b>0.179</b>	<b>0.032</b>	<b>5.510</b>	<b>0.000*</b>	1.159				

Robust Linear Regression

HC4: Heteroskedasticity Consistent Standard Errors

Dependent Variable: Attitude Score

\* Significant p value at 0.05 level

**Table 4** Comparison of the child's dental radiography experience with the attitude score averages.

Has your child had a dental radiography?	Attitude Score				Kruskal Wallis		Dunn's Post Hoc
	N	Mean	Row mean	SD	KW	P	
Yes <sup>(1)</sup>	231	3.11	224.77	1.198	40.110	<b>0.000*</b>	1-2
No <sup>(2)</sup>	155	2.23	162.59	1.594			1-3
I don't remember <sup>(3)</sup>	8	1.25	86.31	1.035			

Kruskal Wallis test; Dunn's post hoc test \* Significant P value at 0.05 level; KW: Kruskal Wallis value.

**Table 5** Correlation analysis of the linear relationship between knowledge and attitude scores.

		Knowledge score	
Spearman's rho	Attitude score	r	0.333
		P	<b>0.000*</b>

Spearman's rho correlation analysis \* Significant P value at 0.05 level.

radiographic procedures and is frequently repeated several times during childhood and adolescence.<sup>7</sup>

It is among the responsibilities of the dentist to inform the parents about the benefits and risks of dental radiographs by the dentists. Informed consent for dental radiography is an overlooked issue in medical law today. Although it is not known exactly whether parents are informed about radiation and radiation safety when they go to the dentist for their children, it is not clear whether it is

**Table 6** Linear regression analysis for knowledge scores.

Model	Coefficients				Collinearity	Autocorrelation	Constant Variance	ANOVA	Corrected R <sup>2</sup>
	B	Std. error	t	p	VIF	Durbin Watson	Breusch Pagan (p)	Model (P)	
Constant	0.214	1.374	0.156	0.876					0.105
Gender	0.354	0.319	1.111	0.267	1.035		2.036	0.131	<b>0.000*</b>
Educational level	<b>0.450</b>	<b>0.148</b>	<b>3.038</b>	<b>0.003*</b>	1.164				
Frequency of parent visiting the dentist	<b>1.152</b>	<b>0.248</b>	<b>4.638</b>	<b>0.000*</b>	1.709				
Frequency of children visiting the dentist	−0.166	0.232	−0.717	0.474	1.654				
Children's dental radiography experience	0.261	0.155	1.690	0.092	1.175				
State University Hospital	0.222	0.653	0.340	0.734	1.070				
Private Clinic	0.081	0.578	0.140	0.889	2.238				
Oral and Dental Health Center	−0.329	0.465	−0.708	0.480	2.745				
Accompanying children to dental visits	−0.182	0.527	−0.345	0.731	2.276				
Request clarification from the dentist	−0.030	0.205	−0.148	0.882	1.105				
Requesting protective clothing	−0.021	0.216	−0.098	0.922	1.116				

Robust linear regression; Dependent variable: Knowledge score \* Significant P value at 0.05 level.

**Table 7** Comparison of parents' education levels and mean knowledge scores.

Educational level	Knowledge score				Kruskal Wallis		Dunn's Post Hoc
	N	Mean	Row Mean	SD	KW	P	
Primary school <sup>(1)</sup>	21	4.19	195.93	2.358	21.143	<b>0.000*</b>	2–5
Middle school <sup>(2)</sup>	29	2.97	143.12	2.079			3–5
High school <sup>(3)</sup>	87	3.93	184.33	2.578			4–5
University <sup>(4)</sup>	179	4.13	193.61	2.545			
Postgraduate <sup>(5)</sup>	79	5.28	243.70	2.689			

Kruskal Wallis test; Dunn's post hoc test \* Significant P value at 0.05 level; KW: Kruskal Wallis value.

**Table 8** Comparison of parent's dentist visit frequency and mean knowledge scores.

Frequency of parent visiting the dentist	Knowledge Score				Kruskal Wallis		Dunn's Post Hoc
	N	Mean	Row Mean	SD	KW	P	
Every 2 years or more <sup>(1)</sup>	152	3.52	166.08	2.284	26.021	<b>0.000*</b>	1–2
1 per year <sup>(2)</sup>	164	4.37	204.02	2.617			1–3
1 in every 6 months <sup>(3)</sup>	78	5.35	245.03	2.748			2–3

Kruskal Wallis test; Dunn's post hoc test \* Significant P value at 0.05 level; KW: Kruskal Wallis value.

fully understood by the parents even if the information is provided. In this context, parents have every right to understand and question about the risks and benefits of dental radiography. The importance of patient information about the benefits and risks of radiological examinations is emphasized around the world.<sup>14,15</sup> In our study, 75.95% of the parents wanted the dentist to explain why dental radiography was needed.

Generally, the society is aware of environmental radiation such as the harmful effects of the sun and has insufficient knowledge about the effects of medical radiation.<sup>16</sup> Also, people are unaware that exposure to radiation from the environment (e.g. sun) is higher than radiation from dental radiographs.<sup>17</sup> In our study, 60.51% of parents were not aware that the environmental radiation was higher than the radiation from dental radiographs.

While parents are aware of the importance of dental radiographs that are told to them, few parents seem to be informed about the risks.<sup>7</sup> Arzani et al. also stated that parents' awareness of pediatric dental radiographs is insufficient and this may be due to the fact that dentists spend less time informing parents about radiographs.<sup>18</sup> In this study, it is seen that parents do not have enough information about dental radiographs. The reason why parents do not have sufficient level of knowledge is that dentists do not provide enough information. The main reason for this can be explained as the very limited examination and treatment times of Turkish dentists and, unfortunately, the inadequacies in the health system.

Concerns about the use of pediatric dental radiographs are observed among Turkish parents due to the lack of awareness about the risks and benefits of dental radiographs. This study is among the first studies to evaluate the knowledge, attitudes, behaviors and related factors towards pediatric dental radiographs during the dental treatment of children of Turkish parents.

Shah et al. reported that while more than half of the parents considered dental radiographs to be safe, few parents considered dental radiographs to be harmful.<sup>8</sup> In this study, most of the participants evaluated dental radiographs as safe, useful and necessary for dental treatment, and 80.25% of the participants stated that they would allow dental radiographs for their children. These results are similar to parental attitudes in the previous study.

Chiri et al. stated that although parents' dental radiography knowledge level was low, their attitudes towards dental radiography were positive, while Manju et al. emphasized that there is a positive relationship between parental education level and positive attitude towards dental radiographs.<sup>4,7</sup> Contrary to the study of Chiri et al., in this study, it is seen that there is a weak positive correlation between parents' knowledge levels and attitudes.<sup>7</sup> In addition, while it is seen that the increase in the education level is related to the knowledge level of the participants, there is no relationship between the attitude and the education level.

It has been reported that the attitudes developed towards dental radiographs can be shaped depending on experience, not primarily from the level of knowledge.<sup>4,7</sup> This study, similar to previous studies, showed that parents' experiences with dental radiographs for their children can positively shape parental attitudes. In other studies, it

is stated that parents who have a child previously had dental radiographs have a more positive attitude towards dental radiographs.<sup>4,7</sup>

Considering the limitations of our study, this study includes patients who applied to two pediatric dentistry clinics in Istanbul. Knowledge and attitude bias towards dental radiography may be due to clinics located in a particular region and certain socioeconomic levels of parents. For this reason, it is recommended that studies involving a larger population, including parents from different socioeconomic levels living in different regions, should be conducted in the future.

## Declaration of competing interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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