

Original Research Article

Evaluation of Pediatric Dentists' Dental Radiography Knowledge and Attitudes in Türkiye

Türkiye'deki Çocuk Diş Hekimlerinin Dental Radyografi Bilgi ve Tutumlarının Değerlendirilmesi

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ABSTRACT

Aim: The aim of this study is to evaluate the knowledge levels and attitudes of pediatric dentists regarding the use of dental radiography through an online survey.

Materials and Method: A data collection form consisting of a total of 17 questions and 2 basic parts, which was prepared in accordance with the current guidelines of the European Academy of Pediatric Dentistry regarding the use of radiography in 2020, was used. The first part of the form was prepared to evaluate the sociodemographic characteristics of the participants and the second part of the form was for the evaluation of the participants' level of knowledge about the use of radiography in pediatric dentistry. In the analysis of the data, descriptive statistics, mean values, frequencies and proportions were calculated. The chi-square test was used to determine the association between categorical variables.

Results: 131 pediatric dentists participated in the study. In accordance with the Guideline recommendation, 40.5% of dentists stated that they preferred bite-wing radiographs as the first choice for the detection and diagnosis of dental caries and 77% stated that they preferred periapical radiographs as the first choice for dental trauma.

Conclusion: Even though pediatric dentists in Türkiye usually choose the most appropriate radiographic technique for most clinical situations; knowledge levels need to be increased for more precise diagnosis and treatment planning and radiation protection.

Keywords: Cone-beam computed tomography; Dental radiography; Knowledge; Panoramic radiography; Pediatric dentistry

ÖZET

Amaç: Bu çalışmanın amacı, çevrimiçi uygulanan bir anket aracılığıyla çocuk diş hekimlerinin dental radyografi kullanımına ilişkin bilgi düzeylerini ve davranışlarını değerlendirmektir.

Gereç ve Yöntem: Çalışmada Avrupa Çocuk Diş Hekimliği Akademisi'nin 2020 yılında radyografi kullanımı ile alakalı yayınlamış olduğu güncel yönergelerine göre hazırlanmış olan, toplam 17 sorudan ve 2 temel bölümden oluşan bir veri toplama formu kullanılmıştır. Formun ilk bölümü (beş soru) katılımcıların sosyodemografik özelliklerini değerlendirmeye yönelik hazırlanmış olup, formun 2. bölümü ise (on iki soru) katılımcıların çocuk diş hekimliğinde radyografi kullanımı ile alakalı bilgi seviyelerinin ve davranışlarının değerlendirilmesine yöneliktir. Verilerin analizinde tanımlayıcı istatistikler, ortalama değerler, frekanslar ve oranlar hesaplanmıştır. Kategorik değişkenler arasındaki ilişkiyi belirlemek için ise ki-kare testi kullanılmıştır.

Bulgular: Çalışmaya katılan 131 çocuk diş hekiminden (ortalama yaş 32.2) %71.8'i üniversite hastanesinde, %25.2'si özel klinikte ve %3'ü kamu hastanesinde çalışmakta idi. Yönerge önerisine uygun olarak, diş hekimlerinin %40.5'i diş çürüğü tespiti ve teşhisi için ilk tercih olarak bite-wing radyografi, %77'si ise dental travma için ilk tercih olarak periapikal radyografi tercih ettiklerini belirtti.

Sonuç: Türkiye'deki çocuk diş hekimleri çoğu klinik durum için genellikle en uygun radyografik tekniği seçse de; daha kesin tanı ve tedavi planlaması ve radyasyondan korunma için bilgi düzeylerinin artırılması gerekmektedir.

Anahtar Kelimeler: Bilgi; Çocuk diş hekimliği; Dental radyografi; Dijital radyografi; Panoramik radyografi

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INTRODUCTION

Dental radiography is considered as the greatest and also most useful diagnostic aid for a careful examination of a child's oral cavity. It is regarded as the most valuable diagnostic tool, particularly for infants, children, adolescent patients and patients with special health-care needs.¹ Two-dimensional radiographs such as panoramic, periapical and bite-wing are used in the evaluation of caries, tooth development, dental trauma, dental infections, dental anomalies and periodontal diseases.^{2,3} Although two-dimensional imaging is the gold standard, additional three-dimensional imaging such as cone-beam computed tomography (CBCT) can be used in cases where 2-dimensional imaging is not sufficient, such as severe trauma or the presence of a cyst/tumour.²

Radiation protection in the pediatric patients group is a more sensitive issue compared to adult patients. Three basic principles are considered in radiation protection in children and adolescents. These are justification, optimization, and limitation.^{3,4} Even though radiation exposure from dental radiographs is low, it is the dentist's responsibility to follow the as low as reasonably achievable (ALARA) principle to minimize the patient's exposure once the decision to obtain radiographs is made. The concept of radiation protection (ALARA), which is the basic principle, has been changed to "As Low as Diagnostic Acceptable" (ALADA).⁵ As a result of this change, the relationship between radiation dose and image quality has become important. The need for optimization is emphasized, aiming to use the lowest radiation dose to ensure optimal image quality. Today, the principle of ALADAIP (As Low As Diagnostically Achievable Being Indication-Oriented and Patient-specific) has been accepted as a result of the individualization of the current dental radiograph needs to be taken from the patient.⁴ Consequently, nowadays, it is the dentists' decision to choose the most diagnostic dental radiography with the least radiation exposure for the patients. Therefore, in the light of current guidelines,^{3,4,6} it is important for pediatric dentists to make the right decision when choosing a radiographic method.

The main purpose of this study is to evaluate the knowledge and attitudes of pediatric dentists in Türkiye regarding the use of dental radiography and to contribute to radiation protection strategies.

MATERIALS AND METHOD

Ethics committee approval required for the study was obtained from Ankara Yıldırım Beyazıt University Ethics Committee (Decision no: 06, Date: 07.04.2022). The survey was conducted between May 2022 and August 2022. The study was carried out through an online survey form prepared with Google forms. The link of the questionnaire form were sent to the participants via e-mail by the Turkish Association of Paediatric Dentistry. A cover letter was added summarizing the aims of the study and participants were informed that participation is voluntary and their answers will be kept confidential.

The questionnaire consisted of two parts. The first part consisted of five questions including sociodemographic characteristics such as age, gender, institution of employment, number of years in the profession and academic title. The second part included twelve questions that aimed to evaluate the knowledge and attitudes of the participants on radiography and the source from which they obtained this information (Figure 1). The questions have been prepared with reference to the guideline updated by the European Academy of Pediatric Dentistry (EAPD) in 2020.³

The data of the study were analyzed with IBM SPSS program (version 26). Arithmetic mean, standard deviation, median, minimum and maximum values were used in summarizing numerical data, frequency distributions and percentages were used in summarizing categorical data. The chi-square test was used to assess the relationships between categorical variables. Significance level was accepted as $p < 0.05$.

RESULTS

Sociodemographic characteristics of the participants

In total, 131 pediatric dentists from across Türkiye participated in the study. The overall mean age of the respondents was 32.12 ± 6.8 years (range: 23-57 years) (Q1). 87.8% of the participants were female and 12.2% were male (Q2). Most of the participants were employed in university hospitals (71.8%), followed by private practices (25.2%) and community oral and dental health centres (3%) (Q3). When

the pediatric dentists participating in the study are evaluated according to their academic titles; it was determined that 3% were professors, 6.1% associate professors, 23.7% assistant professors, 25.2%

specialists and 42% research assistants (Q4) (Table 1). The experience of the participants in the field of pediatric dentistry ranged from the first year of the postgraduate pediatric dentistry program to 35 years (median: 7.00 years) (Q5).

- | | |
|--|---|
| <p>1) Age:</p> <p>2) Gender: Female <input type="checkbox"/> Male <input type="checkbox"/></p> <p>3) Institution:
 <input type="checkbox"/> Private Practice
 <input type="checkbox"/> Community oral and dental health center
 <input type="checkbox"/> University Hospital</p> <p>4) Title:
 <input type="checkbox"/> Post-graduate student on a pedodontics program
 <input type="checkbox"/> PhD or specialist
 <input type="checkbox"/> Assistant professor
 <input type="checkbox"/> Associate professor
 <input type="checkbox"/> Professor</p> <p>5) How many years have you been working as a pediatric dentist?.....</p> <p>6) Which radiograph is your first choice for caries detection and diagnosis?
 <input type="checkbox"/> Periapical radiographs
 <input type="checkbox"/> Bite-wing radiograph
 <input type="checkbox"/> Panoramic X-rays
 <input type="checkbox"/> CBCT</p> <p>7) Which radiograph is your second choice for caries detection and diagnosis?
 <input type="checkbox"/> Periapical radiographs
 <input type="checkbox"/> Bite-wing radiograph
 <input type="checkbox"/> Panoramic X-rays
 <input type="checkbox"/> CBCT</p> <p>8) Which radiograph do you prefer in the presence of acute dental infection? (You can choose more than one)
 <input type="checkbox"/> Periapical radiographs
 <input type="checkbox"/> Bite-wing radiograph
 <input type="checkbox"/> Panoramic X-rays
 <input type="checkbox"/> CBCT</p> <p>9) Which radiograph is your first choice for dental trauma (Tooth fractures or luxation injuries)?
 <input type="checkbox"/> Periapical radiographs
 <input type="checkbox"/> Bite-wing radiograph
 <input type="checkbox"/> Panoramic X-rays
 <input type="checkbox"/> CBCT</p> <p>10) Which radiograph is your first choice for tooth resorption?
 <input type="checkbox"/> Periapical radiographs
 <input type="checkbox"/> Bite-wing radiograph
 <input type="checkbox"/> Panoramic X-rays
 <input type="checkbox"/> CBCT</p> <p>11) Which radiograph is your first choice for localised dental anomalies?
 <input type="checkbox"/> Periapical radiographs
 <input type="checkbox"/> Bite-wing radiograph
 <input type="checkbox"/> Panoramic X-rays
 <input type="checkbox"/> CBCT</p> | <p>12) Which radiograph is your first choice for generalised dental anomalies?
 <input type="checkbox"/> Periapical radiographs
 <input type="checkbox"/> Bite-wing radiograph
 <input type="checkbox"/> Panoramic X-rays
 <input type="checkbox"/> CBCT</p> <p>13) Which radiograph is your first choice for developmental disorders such as Molar-incisor Hypomineralisation/Amelogenesis Imperfecta?
 <input type="checkbox"/> Periapical radiographs
 <input type="checkbox"/> Bite-wing radiograph
 <input type="checkbox"/> Panoramic X-rays
 <input type="checkbox"/> CBCT</p> <p>14) Which radiograph is your first choice for localised periodontal disease?
 <input type="checkbox"/> Periapical radiographs
 <input type="checkbox"/> Bite-wing radiograph
 <input type="checkbox"/> Panoramic X-rays
 <input type="checkbox"/> CBCT</p> <p>15) Which radiograph is your first choice for temporomandibular dysfunction?
 <input type="checkbox"/> Periapical radiographs
 <input type="checkbox"/> Bite-wing radiograph
 <input type="checkbox"/> Panoramic X-rays
 <input type="checkbox"/> CBCT</p> <p>16) Do you think the use of CBCT is necessary in the field of pedodontics?
 <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>17) If you do, in what situations do you prefer to use CBCT in children?
 <input type="checkbox"/> Caries detection
 <input type="checkbox"/> Acute dental infection
 <input type="checkbox"/> Severe dental trauma
 <input type="checkbox"/> Root resorption
 <input type="checkbox"/> Amelo/Dentinogenesis imperfecta
 <input type="checkbox"/> Molar-incisor hypomineralisation
 <input type="checkbox"/> Periodontal disease
 <input type="checkbox"/> Temporomandibular dysfunction
 <input type="checkbox"/> Cysts and tumours
 <input type="checkbox"/> Invasive cervical resorption
 <input type="checkbox"/> Tooth impaction</p> <p>18) From what source did you learn what you know about the use of radiography in pediatric dentistry?
 <input type="checkbox"/> Undergraduate education
 <input type="checkbox"/> Post-graduate education
 <input type="checkbox"/> Congress/conferences
 <input type="checkbox"/> Literatures/guidelines</p> |
|--|---|

Figure 1. The questionnaire used in the survey

Table 1. Demographic distribution of the pediatric dentists

		n	%
Gender	Female	115	87.8
	Male	16	12.2
Institution	University hospital	94	71.8
	Private practice	33	25.3
	Community oral and dental health centres	4	3
Title	Research assistant	55	42
	Specialist	33	25.2
	Assistant professor	31	23.7
	Associate professor	8	6.1
	Professor	4	3

The knowledge and attitudes of the participants on radiography

A total of 53 dentists (40.5%) stated that they preferred bite-wing radiographs as the first choice for caries detection and diagnosis, 46 (35.1%) dentists panoramic and 32 dentists (24.4%) preferred periapical radiographs (Q6). To the second preferred type of radiography in the detection and diagnosis of caries, 68 (51.9%) dentists chose periapical, 45 (34.4%)

dentists chose bite-wing and 18 (13.7%) dentists chose panoramic radiographs (Q7) (Table 2).

The majority of the participants stated that periapical radiography was their first choice in the presence of acute dental infection (Q8) (91.6%) and in the presence of dental trauma (Q9) (77%). In the presence of tooth resorption, many pediatric dentists (90.8%) have stated that periapical radiography is their first choice (Q10). In the presence of localized dental anomalies, periapical radiography is preferred as the first choice by the majority of the participants (80.1%); in the presence of generalized dental anomaly, 93.1% of the participants stated that they preferred panoramic radiography (Q11/12) (Table 2).

When asked which radiograph they would prefer first for developmental disorders, 90.9% of participants received panoramic radiographs (Q13); about localized periodontal disease, they stated that they would prefer periapical radiographs with a proportion of 59.5% (Q14) and panoramic radiographs with a proportion of 71.8% for temporomandibular dysfunction (TMD) (Q15) (Table 2).

Table 2. Distribution of the participants' responses to Q6-Q15

Questions	Periapical radiographs		Bite-wing radiographs		Panoramic radiographs		CBCT		Total	
	n	%	n	%	n	%	n	%	n	%
Q6	32	24.4	53	40.5	46	35.1	-	-	131	100
Q7	68	51.9	45	34.4	18	13.7	-	-	131	100
Q8	120	91.6	5	3.8	79	60.3	2	1.5	206	100
Q9	101	77.1	-	-	28	21.4	2	1.5	131	100
Q10	119	90.8	-	-	2	1.5	10	7.7	131	100
Q11	105	80.1	1	0.8	23	17.6	2	1.5	131	100
Q12	-	-	1	0.8	122	93.1	8	6.1	131	100
Q13	10	7.6	2	1.5	119	90.9	-	-	131	100
Q14	78	59.5	9	6.9	43	32.8	1	0.8	131	100
Q15	-	-	-	-	94	71.8	37	28.2	131	100

87.8% of the participants stated that they benefited from CBCT most frequently in the presence of cysts/tumours (89.3%), followed by tooth impaction (81.7%) and temporomandibular disorders (55.7%) (Q16) (Table 3).

79.4% of the dentists stated that they obtained this information during their undergraduate education, 72.5% post-graduate education, 59.5% from the literatures/guidelines, and 37.4% from the congress/conferences (Q17).

Variable dependence was evaluated using the chi-square test among all questions. The only significant relationship detected was "Which radiography is your first choice for dental trauma? (Tooth fractures or luxation injuries) (Q9)?" and the institutions of the participants ($p=0.014$). Periapical radiographs were preferred by dentists working at universities (70.3%), in private practice (25.7%) and in community oral and dental health centers (4%), respectively (Table 4).

Table 3. Distribution of the participants' responses to Q16

CBCT Indications	n	%
Caries detection	3	2.3
Acute dental infection	5	3.8
Severe dental trauma	63	48.1
Root resorption	38	29
Amelo/Dentinogenesis imperfecta	3	2.3
Molar-incisor hypomineralisation	2	1.5
Periodontal disease	73	55.7
Temporomandibular dysfunction	4	3.1
Cysts and tumours	117	89.3
Invasive cervical resorption	42	32.1
Tooth impaction	107	81.7

Table 4. Chi-square test

Question	Answers	Institutions			P value
		Private	Community oral and dental health centre	University	
Which radiography is your first choice for dental trauma? (Tooth fractures or luxation injuries) (Q9)?"	Periapical radiographs	25.7%	4%	70.3%	0.0014*
	Panoramic radiographs	25%	-	75%	
	Bite-wing radiographs	-	-	-	
	CBCT	-	-	100%	

* p<0.05

DISCUSSION

In the practice of pediatric dentistry, intraoral and extraoral radiography techniques are frequently used in order to make the correct diagnosis and treatment planning. When deciding to take radiography in children; it should be requested when it is thought to be superior to clinical or non-radiographic diagnostic methods or if treatment planning will be affected (justification principle). The type of radiography desired should be indication-oriented and specific to the problem (optimization principle) and the radiation dose should be minimized with rectangular collimation, to use fast films such as F speed or to use digital receptor technology in pediatric patients (limitation principle).³ It is important for pediatric dentists to request radiography from patients within the framework of these principles. The EAPD has updated the relevant clinical practice guidelines in 2020 to help pediatric dentists to decide when and how to prescribe dental radiographs in children and adolescents, providing clear coverage of which radiograph is most appropriate in which clinical

situation.³ Although there are few survey studies on the subject, none of these studies drew attention to the use of radiography in the right indications by reference to the guideline.^{7,8} As a result, in this study, we aim to explore this issue in depth.

Although it was previously claimed that the best diagnosis of caries made by combining clinical examination with panoramic and bite-wing radiographs in primary and mixed dentitions, especially in cases of proximal dental caries;⁹ it has also been suggested that radiography is not superior to intraoral examination.¹⁰ But, current clinical guidelines have recommended bite-wing radiographs as the best way to detect dental caries in pediatric patients.^{3,11-14} While 40.5% of dentists participating in the study said that they would prefer bite-wing as their first choice for caries detection and diagnosis, 35% preferred panoramic films (Q6). The results of our study are similar to the study of Mandinic *et al.*, who stated that bite-wing radiography was preferred at a proportion of 43.3% in caries diagnosis. Besides, as a result of current study the majority of dentists (51.9%)

stated that their second choice for caries detection and diagnosis is periapical radiography.⁸ While only bite-wing radiography is recommended for caries diagnosis and monitoring; in the presence of additional pathology, periapical radiographs and in cases where the patient can not tolerate intraoral radiographs panoramic radiographs are recommended.³ Due to the high proportion of dentists who choose panoramic radiography as their first option, it can be concluded that there is a lack of knowledge about the radiographic technique preferred by pediatric dentists in the detection and diagnosis of caries.

In the presence of acute dental infection, intraoral radiographs (periapical and panoramic) are recommended to be preferred.^{2,3} According to the results of this study, 91.6% of the dentists preferred periapical radiographs and 60.3% preferred panoramic radiographs (Q8). It can be said that pediatric dentists' knowledge and decisions on these issues are more comprehensive than the use of radiography in the diagnosis of caries.

Dental radiography is an essential part of the diagnostic process in dental trauma.¹⁵ According to previously published recommendations of the International Association of Dental Traumatology, at least one periapical radiograph is required for diagnosis, treatment (to detect potential root fractures and to evaluate the dental developmental stage that may be relevant during treatment) and monitoring of traumatized teeth.¹⁶ Also, EAPD recommendations stated that periapical radiography should be preferred as the first choice in the presence of dental trauma and tooth resorption.³ As a result of current study, pediatric dentists answered Q9 and Q10 in high proportions (77.1% to Q9 and 90.8% to Q10) as periapical radiographs. On the other hand, it has been determined that the response rates of dentists working in public hospitals to Q9 in line with the guideline recommendations are lower than those working in universities. This result may be due to the fact that current guidelines are followed more frequently as part of the continuing education process at universities. In addition, Van Gorp *et al.* were stated that the number of missed results by pediatric dentists was significant in the presence of trauma. This indicates that dentists need more and better training in radiological interpretation, including 2D imaging in the presence of trauma.¹⁷

Periapical radiography is recommended in the presence of localized dental anomalies and panoramic radiography is recommended in the presence of generalized dental anomalies.³ In the presence of localized dental anomalies, 80.1% of the pediatric dentists preferred periapical radiography in parallel with the guideline (Q11). In the presence of generalized dental anomalies, 93.1% panoramic radiography and 6.1% CBCT were preferred (Q12). Although CBCT has been proposed as an effective diagnostic device to identify dental anomalies;¹⁸ The EAPD guideline and The European DIMITRA (dentomaxillofacial paediatric imaging: an investigation towards low-dose radiation induced risks) project recommend that CBCT is indicated in the presence of dental anomalies when two-dimensional intraoral and extraoral examinations do not answer the diagnostic questions.^{3,4} Pediatric patients with genetically related developmental disorders such as amelogenesis/dentinogenesis/osteogenesis imperfecta require a complete radiographic assessment of dental condition. The panoramic radiograph is still the gold standard for detecting and diagnosing of them.^{3,19} In this study, dentists stated that they preferred panoramic radiographs at a high proportion (90.9%) in the presence of developmental disorders parallel with the EAPD guideline (Q13).

Radiographs are very important in determining the prognosis, developing a treatment plan and the outcome of treatments in periodontal diseases.²⁰ EAPD is recommended to use periapical radiography in localized periodontal disease and panoramic radiography in generalized periodontal disease as a first choice.³ Although the answer to the Q14 (which radiograph is your first choice for localized periodontal disease?) was periapical radiographs with a high proportion (59.5%); 32% of pediatric dentists also preferred panoramic radiography. In addition, since bite-wing radiographs allow monitoring of bone changes, it is recommended to be used in cases where periodontal disease is not very extensive, but as a result of the current study, it was preferred by only 6.9% of pediatric dentists.^{21,22} As a result of the study, it was determined that there is a lack of knowledge of pediatric dentists about the choice of radiographic technique in periodontal diseases.

In the presence of TMD, imaging with panoramic radiographs is recommended.³ Pediatric dentists sta-

ted that they prefer panoramic radiographs (%78) and CBCT (28.2%) in the presence of TMD (Q15). Although CBCT is said to be superior to conventional radiographic examinations in evaluating the morphology of the mineralized components of the TMJ, imaging with CBCT is not routinely recommended in the presence of TMD in a pediatric patient.^{3,23,24} Accordingly, it can be concluded that the lack of knowledge of pediatric dentists about radiographic imaging of TMD may lead to an increase in radiation exposure of patients. CBCT was reported to be most commonly used in cases with cysts/tumors, tooth impaction and severe dental trauma respectively. Besides, it was preferred at least in the presence of MIH and caries detection (Q16). These findings are consistent with the results of previous studies.^{7,15,24-26} It is concluded that pediatric dentists generally use CBCTs for the correct indications, in accordance with the guideline recommendations.

Despite the fact that the majority of the dentists who participated in the survey work in an university hospital, they stated that they learned about dental radiography during their undergraduate education. Knowledge of current guidelines delivers the necessary diagnostic quality of the image without repeating the radiographs, which reduces exposure to ionizing radiation for both the patient and dental team. Considering that the wrong radiographic technique choices are made in some clinical situations as a result of the study, it is expected that the proportion of pediatric dentists following and adhering to current literature and guidelines should increase.

Within the limitation of current study, the majority of pediatric dentists participating in this study work in university hospitals. Since the radiographic equipment of different hospitals may affect the radiographic technique preferences of dentists, it would be beneficial to conduct studies with the participation of more pediatric dentists in the future.

CONCLUSION

This survey showed that, although Turkish pediatric dentists choose the most appropriate radiographic technique for most clinical situations, there is a lack of knowledge about caries, periodontal diseases and TMD. Choosing a radiographic technique that is not suitable for the clinical situation will result in low di-

agnostic yield and an increase in radiation exposure with the need for re-radiography. Therefore, it will be beneficial to increase the level of knowledge by following the current guidelines and literatures.

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