KAP STUDY

Attitudes and knowledge of paediatric dentists' on digital radiography and cone beam computed tomography

Figen Eren Giray,[1] Sertac Peker,[2] Sebnem Ercalik Yalcinkaya,[3] Betul Kargul,[4] Johan Aps[5]

Abstract

Objective: To determine the frequency and reasons of digital radiography and cone-beam computed tomography usage among paediatric dental practitioners, and to assess their knowledge and need for specific education.

Methods: The cross-sectional study was conducted from January to July 2017 and comprised paediatric dentists present at the European Academy of Paediatric Dentistry Interim Seminar in Turin, Italy, and members of the Turkish Society of Paediatric Dentistry who did not attend the event. Data about sociodemographics and their attitude towards, use of, and knowledge of digital radiography and cone beam computed tomography was collected by means of a 20-item questionnaire that was mailed to all the subjects. SPSS 22 was used to evaluate data.

Results: Of the 435 questionnaires distributed, 245(56%) were returned, while 194 (45%) were deemed usable. The mean age of the responding paediatric dentists was 35.84±9.10 (range: 24-67 years) and 126(64.9%) were female. Users of digital radiography identified its advantages, such as lower radiation dose 166(85.7%), ease of image storage 150(77.3%), and the possibility to change image settings and to carry out measurements 106(54.5%). Overall, 70(36%) paediatric dentists had no knowledge of cone beam computed tomography. Dental trauma was cited as the reason for using cone beam computed tomography by 70(61.3%) subjects, dental development issues by 138(71%) and pathology in the jaws by 147(75.8%).

Conclusion: Digital radiography and cone beam computed tomography users are increasing in the world.

Keywords: Paediatric dentistry, Digital radiography, Cone beam computed tomography, Use, Knowledge. (JPMA 69: 205; 2019)

Introduction

Dental radiographs are valuable aids in the oral healthcare of infants, children, adolescents and persons with special healthcare needs. They are used to diagnose and monitor oral diseases, maxillofacial development and the progress of therapy.[1] Major reasons for taking radiographs of teeth and supporting tissue in paediatric dentistry are detection of caries, dental injuries, disturbances in tooth development and examination of pathological conditions other than caries. However, the potential risks associated with radiography should not be neglected. Radiographic guidelines exist to avoid unnecessary exposure, as well as to identify individuals for whom radiographic examination will be beneficial.[1,2] Digital radiological imaging (DRI) has the potential to reduce the absorbed radiation dose as shorter exposure times are required to obtain diagnostic acceptable images. The possibility of proper storage of the image, making changes to density and contrast, and sending of images to other centres through a digital imaging network are the other advantages.[3] Imaging technologies like cone beam computed tomography (CBCT) have added three-dimensional (3D) capabilities that have many applications in dentistry.[1]

In view of the increasing availability of DRI and CBCT in dental practices, dentists' attitudes towards, and their knowledge about, these technologies are of great importance. Questionnaires are considered popular and

[1,2,4]Department of Pediatric Dentistry, [3]Department of Oral and Maxillofacial Radiology, Dental School, Marmara University, Istanbul, Turkey, [5]Department of Pediatric Dentistry, School of Dentistry, University of Washington, Seattle, USA.
Correspondence: Figen Eren Giray. e-mail: erenfigen@yahoo.com

fundamental tools for acquiring information on knowledge, behaviour and perception of people.[4] Previous studies have investigated the knowledge and attitudes of different digital radiography technologies in various specialties in dentistry using questionnaires. However, to our knowledge no study has investigated the use of CBCT specifically among paediatric dental practitioners. One study investigated the usage of digital radiography among the members of American Academy of Paediatric Dentistry (AAPD) more than 10 years ago.[5] The current study was planned to determine the frequency of DRI and CBCT usage among paediatric dental practitioners in daily practice and their accompanying reasons for using or not using DRI and CBCT. Besides, the study looked to assess their knowledge and need for education in that specific area.

Subjects and Methods

The cross-sectional 'knowledge, attitude, practice' (KAP) study was conducted from January to July 2017 and comprised paediatric dentists present at the European Academy of Paediatric Dentistry (EAPD) Interim Seminar in Turin, Italy, and members of the Turkish Society of Paediatric Dentistry (TSPD) who did not attend the event. Approval was obtained from the ethics committee of Marmara University, Istanbul, Turkey.

Selection of subjects was carried out through voluntary response sampling technique. Individuals who did not volunteer to participate, who were specialists in some other field and dental students were excluded.

For the estimation of the required sample size, we took account of the number of registered members of TSPD. A sample size of 88 was found to be representative of the total TSPD population.

A self-administered, close-ended questionnaire with 20 multiple-choice questions (MCQs) was distributed to all the subjects electronically.

The questionnaire was designed, modelled and modified on the basis of previous studies in order to suit paediatric dentistry.[6-9]

The cover letter outlining the aims of the project explained that participation was voluntary and informed respondents that their answers would be treated confidentially.

The questionnaire had 4 main sections. The first section comprised demographic data like age, gender, working situation, years of professional experience etc. The second section was related to usage and attitude of paediatric dentists towards DRI, with the first question being whether or not they used DRI. If the answer was 'no', they were asked to go to question 14 and 15 which covered the reasons why they choose not to use DRI and if there were any plans to use DRI in the future on a daily basis. The third section was about the attitude towards and knowledge of CBCT. If the answer was 'negative', they were asked to go to the end of the questionnaire. The last section comprised information sources to update DRI and CBCT knowledge of paediatric dentists.

Data was tabulated in Microsoft Office Excel 2013 spreadsheet. For statistical analysis, SPSS 22 was used. Chi-square test and continuity (Yates) correction were used to compare descriptive statistics (mean, standard deviation, frequency, percentage) and qualitative data. $P<0.05$ was considered statistically significant.

Results

A total of 435 questionnaires were distributed; 190(43.7%) to EAPD participants, and 245(56.3%) to TSPD members. In terms of response, 143(75%) questionnaires were returned by EAPD participants and 102(41.6%) from TSPD members. Total responses received were 245(56%), but only 194(79%) qualified to be the final sample. The overall mean age of the respondents was 35.84±9.10 years (range: 24-67 years). As for geographic location, subjects from Turkey were 89(46%), Europe 70(36%), America 16(8%), and Asia 19(10%). Overall, 154(79.4%) paediatric dentists reported using DRI. According to age, gender and years of professional experience, no statistically significant differences were found between DRI and non-DRI users ($p>0.05$ each), but statistically significant differences were found regarding type of practice and country ($p=0.005$). The number of DRI users who were working at some university was significantly higher than postgraduate students ($p=0.018$). The number of DRI users in Turkey was significantly higher than in other countries (Table-1).

Users of digital radiography identified its advantages, such as lower radiation dose 166(85.7%), ease of image storage 150(77.3%), and the possibility to change image settings and to carry out measurements 106(54.5%). From among the non-DRI group, which had 40(20.6%) subjects, 25(62%) cited high cost as the reason and 22(55%) did not have the essential equipment.

Among the DRI users, 126(81.8%) used it for panoramic

Table-1: Demographic data of the paediatric dentists and statistical evaluation of digital radiological imaging (DRI) users and non-users.

Variable		n (%)	DRI n (%)	Non DRI n (%)	*p*-value
Age	20-29	62 (32.0)	47 (75.8%)	15 (24.2%)	
	30-39	67 (34.5)	59 (88.1%)	8 (11.9%)	[1]0.091
	>40	65 (33.5)	48 (73.8%)	17 (26.2%)	
Gender	Male	68 (35,1)	53 (77.9%)	15 (22.1%)	[2]0.858
	Female	126 (64.9)	101 (80.2%)	25 (19.8%)	
Type of practice	Student	28 (14,4)	18 (64.3%)	10 (35.7%)	
	Private	73 (37.6)	55 (75.3%)	18 (24.7%)	[1]0.018*
	University	93 (47.9)	81 (87.1%)	12 (12.9%)	
Years of professional experience	1-9	85 (43.8)	70 (82.4%)	15 (17.6%)	
	10-19	54 (27.8)	44 (81.5%)	10 (18.5%)	[1]0.351
	>20	55 (28.4)	40 (72.7%)	15 (27.3%)	
Country	Turkey	89 (45.9)	79 (88.8%)	10 (11.2%)	[2]0.005*
	Other	105 (54.1)	75 (71.4%)	30 (28.6%)	

[1]Chi-square test, [2]Continuity (yates) correction, * p<0.05

Table-2: Distribution of digital radiologic imaging systems according to demographic data.

		Digital sensors			*p*-value
		CCD/CMOS n (%)	PSP n (%)	Both n (%)	
Age	20-29	14 (32.6%)	26 (60.5%)	3 (7.0%)	
	30-39	23 (45.1%)	24 (47.1%)	4 (7.8%)	0.583
	>40	18 (38.3%)	23 (48.9%)	6 (12.8%)	
Gender	Male	16 (35.6%)	25 (55.6%)	4 (8.9%)	0.822
	Female	39 (40.6%)	48 (50.0%)	9 (9.4%)	
Type of practice	Student	6 (35.3%)	11 (64.7%)	0 (0%)	
	Private	29 (58.0%)	18 (36.0%)	3 (6.0%)	0.005*
	University	20 (27.0%)	44 (59.5%)	10 (13.5%)	
Years of Professional experience	1-9	20 (32.8%)	38 (62.3%)	3 (4.9%)	
	10-19	17 (42.5%)	16 (40.0%)	7 (17.5%)	0.094
	>20	18 (45.0%)	19 (47.5%)	3 (7.5%)	
Country	Turkey	18 (25.4%)	45 (63.4%)	8 (11.3%)	0.004*
	Others	37 (52.9%)	28 (40.0%)	5 (7.1%)	

Chi-square test, * p<0.05, CCD: charged coupled devices, CMOS: complementary metal oxide semiconductors, PSP: photo stimulable storage phosphor plates

radiography, 124(80.5%) for periapical radiography, 33(21.3%) for bitewing and 3(1.9%) for cephalometric radiography. The frequency of DRI use was reported as 'very frequently' by 77(50.3%) and 'always' by 53(34.6%).

Of the DRI users, 96(62.3%) stated that DRI did not increase the number of radiographic exposures, 68(44.4%) reported having 'sometimes' difficulty in placing digital sensors into the patient's mouth, 117(76%) were using smaller sensors for paediatric patients, and 76(49.3%) reported using image detector holders. DRI was being used for more than 3 years by 118(76.5%) subjects, and 120(77.6%) had panoramic X-ray device in their clinics, and of them, 49(41.1%) were photostimulable storage phosphor (PSP), 44(36.6%) were charge-coupled device (CCD) or complementary metal oxide semi-conductor (CMOS) sensor systems, and 21(17.9%) were analogue film.

Of the DRI users, 127(82.8%) stated using zoom, 122(79.3%) altered the contrast and 56(36.6%) changed the brightness for evaluation of the digital images.

Of the DRI users, 80(51.8%) were PSP users, 60(39%) were CCD/CMOS users, and 14(9.2%) were using both the systems. A statistically significant difference was found between DRI systems according to the type of practice and country (p=0.005 and p=0.004). Use of PSP differed by work environment (Table-2).

Overall, 70(36%) paediatric dentists had no knowledge of CBCT. Dental trauma was cited as the reason for using CTBT by 70(61.3%) subjects, dental development issues by 138(71%) and pathology in the jaws by 147(75.8%). There was a significant difference between the type of practice and the knowledge of CBCT (p=0.003), between the years of being in the profession and the knowledge of CBCT (p=0.001) and between paediatric dentists from Turkey and other countries (p=0.001). Young paediatric dentists (years of experience 1-9) had significantly higher knowledge of CBCT than older professionals (10 years or more of experience) (p<0.05). More Turkish paediatric dentists reported to have knowledge of CBCT than paediatric dentists from other countries (p<0.05) (Table-3).

Table-3: Paediatric dentists' knowledge of CBCT according to demographic distribution.

		Had previous knowledge of CBCT		*p*-value
		Yes n (%)	No n (%)	
Age	20-29	46 (74.2%)	16 (25.8%)	
	30-39	40 (59.7%)	27 (40.3%)	0,123
	>40	38 (58.5%)	27 (41.5%)	
Gender	Male	45 (66.2%)	23 (33.8%)	0,630
	Female	79 (62.7%)	47 (37.3%)	
Type of practice	Student	15 (53.6%)	13 (46.4%)	
	Private practice	38 (52.1%)	35 (47.9%)	0,003*
	University	71 (76.3%)	22 (23.7%)	
Years of Professional experience	1-9	66 (77.6%)	19 (22.4%)	
	10-19	31 (57.4%)	23 (42.6%)	0,001*
	>20	27 (49.1%)	28 (50.9%)	
Country	Turkey	73 (82.0%)	16 (18.0%)	0,001*
	Others	51 (48.6%)	54 (51.4%)	

Chi-square test, * p<0.05, CBCT: Cone beam computed tomography.

Discussion

Radiographs are supposed to add critical information to the clinical examination, revealing developmental and eruption problems in paediatric dentistry.[2] To our knowledge there is limited data about use of digital radiography[5] but there is no published data on CBCT knowledge in paediatric dentistry. As such, the present study is unique in its approach as it involved different nationalities.

A questionnaire is a well-established tool within scientific research for acquiring information on participants' social characteristics, present and past behaviour, standards of behaviour or attitudes and their beliefs and reasons for action with respect to any topic under investigation.[4] The internet is likely to become popular for survey distribution, yet this study showed that paediatric dentists were reluctant to respond to the online questionnaire. The lower response rate in general have been discussed and challenged in previous studies.[5,8,10-12] Out of 435 digital radiography questionnaires, 245 (56%) were returned by the subjects. However, only 194 (79%) were filled up enough to be part of the sample. This low response rate was in accordance with previous digital dental radiology studies.[5,8,10-12] Nevertheless the response rate in this study was higher than in a study approved by the American Academy of Paediatric Dentistry (AAPD).[5]

Previously published studies were based on the evaluation of the knowledge and attitudes of general dentists and other than paediatric dentistry specialties about DRI and/or CBCT. The results of the latter varied substantially.[6-10,13-15] Two studies conducted in 2001 and 2005[10,13] showed that only 14% dental practitioners preferred DRI, while other studies reported higher frequencies.[6-9,16] Surveys conducted amongst Belgian general dental practitioners reported that the rates of DRI use were 34% and 38% while a study reported higher rate of 55.6% in 2011 and 85.4% in 2015 among Brazilian young dental practitioners.[6,9,17] A recent report noted that the rate of use of DRI as an aid has increased to 76.6% among Turkish endodontists.[8] A study determined the popularity of DRI among members of the AAPD and reported that 26% practitioners implemented digital radiography in their practices, whereas 71% considered future acquisition.[5] This study revealed that 79.4% of paediatric dentists used DRI, indicating its popularity in this specialty of dentistry.

Dental practitioners who have recently graduated should be expected to be more familiar with DRI. Indeed in this study, paediatric dentists with 1-9 years of professional experience reported a higher rate of use of DRI than their colleagues with more years of experience. However, the difference wasn't statistically significant. This result was in agreement with a study published in 2016.[9] However, literature is not conclusive on this subject, as another 2016 study observed that significantly more dentists with less than 10 years of professional practice used DRI in their practice.[8]

Statistical analysis of our results showed no significant association between age and gender and the use of DRI, which is in agreement with data reported in previous studies.[7,9,10,16] A significant difference in the frequency of DRI was found between type of practice in this study. Paediatric dentists employed at a university indicated the highest score of DRI with a rate of 87.1%. It seems that this higher rate of digital radiography utilisation among academicians may be due to the high rate of academicians participating in the questionnaire (47.9%) and the pioneering role of technological advances in universities. This result is in agreement with previous studies.[7,8]

It is interesting that earlier Turkish publications[7,8] reported higher frequency of DRI than other published manuscripts on this topic.[6,10,16,17] In our study, DRI appeared to be used more compared to other countries among paediatric dentists. This observation can be related with increased introduction and sales of digital systems in Turkey.

Studies stated 'no developing process' as the most important factor for choosing digital radiography.[7,8,18] In the current study, 'relatively lower radiation dose' (85.7%) was stated as the most important factor, followed by 'easy to store images' (77,3%) which is in accordance with a study.[19] It is possible that paediatric dentists are more aware of the radiation doses associated with analogue versus DRI, which can explain their answers in the questionnaire.

In accordance with trends reported previously,[7-9,16] 'high cost' and 'I do not have essential equipment' were stated as the most important reasons in this study for not choosing DRI.

The results of the current study show that panoramic (81.8%) and periapical radiography (80.5%) were the most common applications of DRI in paediatric dentistry. In contrast to previous reports,[7,8,20] 62.3% of the DRI users stated that DRI did not increase the number of radiographic

exposures. This can either be attributed to the fact that paediatric dentists are in agreement with compromises when it comes down to image quality or they are just more accurate in taking radiographs, or they select their patients better so the overall number of retakes remains small. The latter are all assumptions by the authors, which have not been investigated.

Achieving high-quality radiographs is a difficult task, especially in young and uncooperative children. Nevertheless, it is very important for correct diagnosis and treatment, and for minimising children's exposure to unnecessary radiation. Image detector holders can assist dentists in correctly placing the image detector and the X-ray beam to prevent the film or PSP storage plate from folding, and in helping to standardise radiographs for follow-up purposes.[21] The present study showed that 49.3% of the DRI users reported using image detector film holders. This rate was higher than in previous reports.[8,22]

Two major digital intraoral radiographic systems are used in dental practice: CCD/CMOS and PSP plate.[14] In a questionnaire study, paediatric dentists reported that CCD/CMOS was preferred because it produced faster images, but was less tolerable by young children due to their size and volume. PSP was considered more child-friendly and less expensive, but less durable.[5] In accordance with a study by Russo et al, the PSP use (51,8%) was higher than CCD/CMOS (39%) use among DRI users.[5] As it can be expected, PSP sensors were favoured by paediatric dentists since they are more flexible and thinner than rigid digital sensors and they have the dimensions of analogue film.

The use of CBCT was another parameter in this study. CBCT has advanced from exceptional use to a common imaging modality in dentistry due to depreciating cost, easy access to the technology, and reduced radiation exposure to the patient. CBCT devices allow two- and 3D gray-scale and colour reconstruction of the maxilla and mandible.[23] The image produced from the 3D radiographic scan allows the paediatric dentist (clinician) to study the area of interest from multiple vantage points.[24] This is a significant advancement for dentistry and for evaluation of the paediatric patients.[23] About 64% of the paediatric dentists in our study had knowledge regarding CBCT, and 87.1% of these referred their patients for specific 3D imaging. Similarly in another study, CBCT knowledge among endodontists was stated as 66.7% and in another study, general knowledge about CBCT among general dentists was reported to be 56%.[7,8] In one study, 18.8% of dental practitioners reported referring their patients for CBCT.[16] On the contrary, other reports reported 100% awareness of CBCT among dentists.[19,25] In the latter, the main reasons for CBCT referrals were reported to be for dental implant planning,[7,8,16,25,26] cyst-tumour diagnosis,[7,8] suspected surgical pathology and temporomandibular joint analysis.[26] A study evaluated orthodontists' attitudes towards CBCT and most obviously their indications for CBCT were reported as detection of oral and craniofacial anomalies such as impacted teeth (80,9%) and cleft lip and palate (57,4%).[15] In our study, paediatric dentists preferred to use CBCT for examination of pathological conditions other than caries like cyst and/or tumours (75.8%) and disturbances in tooth development like supernumerary teeth/mesiodens (71%). It is understandable that the outcomes of the latter studies and ours are slightly different as different dentist populations and specialties were studied. It is hard to compare a paediatric dentist with a periodontologist when one considers the indications for CBCT. It should also be emphasised that while CBCT enables imaging of tissues in three dimensions (axial, sagittal, and coronal planes) it also results in a higher radiation dose than other dental radiographic modalities. Thus, the indications for CBCT, especially in paediatric patients, should be carefully weighed against the potential risks of exposing patients to ionizing radiation.

In this study, there was a correlation between type of practice, years of experience, country and previous knowledge of CBCT and the results of our study are supported by the findings from previous studies.[7,8] No statistically significant difference was found between age/gender and awareness of CBCT, which is in accordance with literature.[16]

Congresses and exhibitions helped the paediatric dentists to update their knowledge regarding DRI and CBCT. Internet, scientific books and journals were also recorded as other sources used by practitioners to promote their knowledge. One of the limitations of this study was the low response rate. Since this questionnaire was distributed electronically, however, the subjects who responded may be more inclined to use modern technology compared to those who did not respond to the e-mail. The sample size may also be applied to approximate the required sample size. But the sample size was validated by simulating the characteristics of our subjects, thus was one of the limitations of the study. The biggest limitation of this study is that it did not gauge the respondents' actual in-depth

knowledge of DRI and CBCT. It merely gauged their habits and opinions, which nevertheless is useful information to be used in continued medical education (CME) courses and for academic curriculum teaching. The latter are both subject to constant change as also technology and software changes continuously.

Conclusion

Digital radiography and CBCT users are increasing in the world. Most paediatric dentists are using digital radiography and they are globally keeping up with the latest imaging systems. Young paediatric dentists have higher knowledge of digital radiography and CBCT.

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