

AWARENESS AND KNOWLEDGE OF CBCT AMONG A GROUP OF EGYPTIAN PEDIATRIC DENTISTS: A QUESTIONNAIRE STUDY

Sarah M. S. Khalil* , Shimaa Abu El Sadat** 
and Reham Khaled Elghazawy*** 

ABSTRACT

Aim: To assess the knowledge and awareness of CBCT among a group of pediatric dentists

Materials and methods: An online open-ended questionnaire with 21 items were delivered to around 300 applicants, who practice pediatric dentistry in Egypt. The questionnaire was conveyed by Facebook and distributed among different groups, via Whats app groups and messages, through emails and LinkedIn platform. Demographic, knowledge and awareness data regarding CBCT were collected. Categorical data were analyzed using chi square test followed by pairwise comparisons utilizing multiple z-tests with Bonferroni correction. The significance level was set at $p \leq 0.05$.

Results: Two-hundred twenty-nine participants responded to the survey during a 2-month interval. Almost half of the respondents showed poor knowledge of CBCT, 65.2% believes that adequate teaching is not given to dental students, regarding CBCT in their universities, and 95.2% assumes that continuous education courses is required for pediatric dentists.

Conclusions: There is explicit gap in knowledge and awareness of CBCT in pediatric dental practitioners, necessitating additional CBCT education and training courses for both undergraduate and postgraduate students.

Clinical relevance: The increase of knowledge and awareness among Egyptian pediatric dentists is required, more training and tuition should be integrated in the students' curricula in their undergraduate and post graduate stages.

KEYWORDS: CBCT, Pediatric dentists, questionnaire, children

* Lecturer, Pediatric Dentistry and Dental Public Health, Faculty of Dentistry, Beni-Suef University, Beni-Suef, Egypt

** Associate Professor, Oral and Maxillofacial Radiology, Faculty of Dentistry, Ain-shams University, Cairo, Egypt

*** Associate Professor, Pediatric Dentistry and Dental Public Health Department, Faculty of Dentistry Ain Shams University, Cairo, Egypt

INTRODUCTION

Imaging in pediatric dentistry is counted as a crucial diagnostic tool. Two-dimensional (2D) imaging modalities: periapical, bitewing, occlusal, lateral cephalometric and panoramic radiographs are commonly used as conventional means. However, in some clinical situations, a 3D measure is required when the 2D tools fail to fulfill the diagnostic task or attain the necessary diagnosis mandatory for the treatment plan.^[1-3]

According to the American Academy of Pediatric Dentistry, Cone Beam Computed Tomography (CBCT) provides high quality 3D images for the maxillofacial region.^[4] It is extensively used in the dental field and is considered as the standard of care in implant placement. It is also utilized in the assessment of impacted teeth, supernumerary teeth, dentoalveolar traumas, endodontic treatment and root resorption beside numerous other applications that have been significantly studied. It is clear that this type of imaging modality can result in exquisite images and can provide considerable beneficial diagnostic information for young children. It could be used in cases of malocclusion and dentofacial anomalies, localization of impacted teeth, cysts and other intrabony lesions, cleft lip and palate, localization of foreign bodies, TMJ problems and airway analysis, and sutural maturation.^[5]

Ominously, CBCT can frequently deliver a radiation dose far in excess of conventional dental imaging.^[2] The use of CBCT in children is debatable firstly; because of the radiation dose and secondly because of the vulnerability of children to ionizing radiation more than adults due to the higher mitotic activity, the presence of more undifferentiated mesenchymal cells. Besides, in young patients the first few years are considered as a period of organ development. In addition to that, the cumulative effect of radiation increases the risk of being carried out later in life.^[7] Alongside, movement of children within the CBCT scans may induce patient

movement artefact that affects the quality of the image. Thus, rigorous justification is mandatory before prescribing CBCT for a pediatric patient.^[8]

In 2018, the dentomaxillofacial pediatric imaging: an investigation towards low-dose radiation inducted risks (DIMITRA)^[11] position statement was the only guideline that explicitly discourse the use of CBCT in pediatric dentistry and discussed in detail the different indications in the field.^[9] The European Academy of Pediatric Dentistry also released a 'best clinical practice guide' in 2019 concerning the prescription of dental radiographs in children. It discussed the guidelines radiation protection (justification and optimization) regarding the use of CBCT, it also adhered to the *As Low As Diagnostically Acceptable being Indication-oriented and Patient-specific* (ALADAIP) principles.^[1,10] Because of the ionizing radiation hazards, it's quite controversial for pediatric dentists to use CBCT with children and young adults. Hence, the present conducted questionnaire aimed to evaluate the awareness and knowledge of CBCT among the Egyptian pediatric dentists and its prescription among young pediatric patients.

MATERIAL AND METHODS

This observational cross-sectional study was conducted in Egypt starting from August to September 2021. The required sample size calculation was performed using Epi info for windows version 7.2.^[11] A power analysis was designed to have adequate power to apply a statistical test of the research question regarding knowledge and awareness of CBCT among a group of Egyptian pediatric dentists. By adopting a confidence interval of (95%), a margin of error of (6%) with finite population correction and a frequency of (76.7%) based on the results of a previous study^[12]; the predicted sample size (n) was found to be (191) cases.

Ethical approval was obtained from the institutional research ethical committee, Faculty of

Dentistry, Ain Shams University (FDASU-Rec E92107). A self-administered questionnaire was designed based on previous studies with some modifications, assessing the knowledge, awareness, practice, education, and applications of CBCT among a convenient sample of pediatric dentists from private, governmental, and academic fields throughout Egypt.^[12-14] The survey participants were chosen based on their experience in the practice of pediatric dentistry in Egypt. The participating pediatric dentists were ensured that the results of the study were confidential and were used only for scientific purposes.

The targeted pediatric dentists received a link to the online questionnaire on social media (Facebook, what's app, linked in and emails). The survey questions were divided into two main sections; the 1st section incorporated the demographic details of the participants, which entailed 7 closed ended questions and their responses, Table (1). The 2nd section dealt with the degree of CBCT knowledge, awareness, interest, and practice of CBCT and their responses, Table (2). The whole survey entailed 21 qualitative close-ended questions and was administered to our participants. The participants were divided into groups according to the level of education, specialty, place of work and years of experience. Comparison between the responses of different groups was statistically analyzed for significant difference.

Categorical data were presented as frequencies and percentages and were analyzed using chi square test followed by pairwise comparisons utilizing multiple z-tests with Bonferroni correction. The significance level was set at $p \leq 0.05$. Statistical analysis was performed with R statistical analysis software version 4.1.3 for Windows¹.

1 R Core Team (2022). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL <https://www.R-project.org/>.

RESULTS

Descriptive statistics

Two-hundred twenty-nine participants responded to the survey during a 2-month interval. All data received was first analyzed using descriptive statistics. All the demographic data are displayed in Table (1).

Most of the age ranged from 20 to 39 years of age. Approximately 85% of the respondents were females and approximately 15% were males. Twenty-seven of the respondents had a doctorate degree and the greater number held a bachelor's degree, with 91 respondents detained a master's degree, board and fellowship represented only 4.9% (12 respondents). Again, the majority of the participants obtained their highest degree from the public universities with a value of 80.3%. The largest number (39.8%) practice pediatric dentistry privately, 31.1% work in the ministry of health, 29.1% work as academic staff members in both private and public institutes.

TABLE (1) Frequency and percentage (%) for answers for demographics

Parameter	Value	n	%
1-Age (n=229)	20-29 years	108	47.2%
	30-39 years	100	43.7%
	40-49 years	17	7.4%
	50-60 years	2	0.9%
	Above 60	2	0.9%
2-Gender (n=229)	Female	33	14.4%
	Male	196	85.6%
3-Which university are you graduated from? (n=229)	Public	154	67.2%
	Private	75	32.8%
4-Highest degree attained (n=244)	BDS	114	46.7%
	MSc	91	37.3%
	PhD	27	11.1%
	Board/fellowship	12	4.9%

Parameter	Value	n	%
5-Which university you got your highest degree from (n=229)	Public	184	80.3%
	Private	45	19.7%
6-Job description (n=354)	Ministry of Health	110	31.1%
	Private practice	141	39.8%
	Governmental academic	56	15.8%
	Private academic	47	13.3%
7-Years of experience (n=229)	1- 5 years	101	44.1%
	6-10 years	62	27.1%
	More than 10 years	66	28.8%

Nearly half of the respondents (44.1%) had 1 to 5 years of experience, 27.1% had 6 to 10 years' experience and the remainder showed an experience more than 10 years. The full questionnaire of the knowledge and the applications of digital imaging & CBCT in pediatric dental practice with the responses was demonstrated in Table (2). There was no significant association between knowledge and level of experience ($p=0.272$) in Table (3). Also, no significant association was found between the pediatric dentists who were graduated from public universities from those graduated from private universities, Table (4). No significant difference was found between the knowledge of CBCT, neither the highest degree attained nor the job description, Table (5,6).

Table (2) Frequency and percentage (%) for answers for knowledge and practice of digital technology and CBCT

Parameter	Value	n	%
8-Do you use digital imaging? (n=229)	Yes	173	75.5%
	No	56	24.5%
9-Did you come across the term CBCT? (n=229)	Yes	202	88.2%
	No	16	7.0%
	May be	11	4.8%

Parameter	Value	n	%
10-How do you rate your knowledge about CBCT? (n=229)	Good	116	50.7%
	Poor	113	49.3%
11-From where did you get your information about CBCT? (n=476)	Internet	83	17.4%
	Conferences	60	12.6%
	Trainings	49	10.3%
	Continuous education	92	19.3%
	Undergraduate courses	84	17.6%
	MSc	84	17.6%
	PhD	16	3.4%
12- Do you know how to interpret CBCT? (n=229)	Yes	38	16.6%
	No	57	24.9%
	Yes but not all the cases	134	58.5%
	Other	3	0.6%
13-What do you think are the reasons for not requesting a CBCT in pediatric dentistry? (n=384)	Fear of the radiation dose	106	27.6%
	Cost	128	33.3%
	Inability and difficulty to interpret	63	16.4%
	Other	87	22.7%
14- a. Have you ever faced the parent's refusal of the idea of CBCT for their children? (n=229)	Yes	66	28.8%
	No	110	48.0%
	Maybe	53	23.1%
14- b. What were their concerns? (n=314)	Fear from the radiation dose	77	24.5%
	The cost	111	35.4%
	Uncooperative child	48	15.3%
	No concerns	78	24.8%
15-How often do you request a CBCT? (n=229)	Always	1	0.4%
	Occasionally	159	69.4%
	Never	69	30.1%

Parameter	Value	n	%
16- Which of the following do you think might be an indication for requesting CBCT in pediatric dentistry? (n=765)	Ectopic permanent canines	141	18.4%
	Supernumerary teeth	114	14.9%
	Pathological lesions	185	24.2%
	Endodontic treatment	37	4.8%
	Cleft palate assessment	137	17.9%
	Dental traumas	132	17.3%
	Others	19	2.5%
17- Which of the following terminologies are you aware of? (n=307)	FOV	57	18.6%
	DICOM	39	12.7%
	Voxel size	121	39.4%
	None of these terminologies	90	29.3%
18- Have you got an idea about the guidelines of radiation protection? (n=229)	Yes	145	63.3%
	No	32	14.0%
	Maybe	52	22.7%
19- Do you think adequate teaching is given to the dental students regarding CBCT in their universities? (n=229)	Yes	29	12.7%
	No	149	65.1%
	Maybe	51	22.3%
20- Have you attended courses related to CBCT? (n=229)	Yes	64	27.9%
	No	165	72.1%
21- Do you feel the need for continuous education workshops for Pedodontists? (n=229)	Yes	218	95.2%
	No	11	4.8%

TABLE (3) Association between knowledge and level of experience

Level of experience	Knowledge		χ^2	p-value
	Good	Poor		
1-5 years	n	54	2.61	0.272
	%	46.6%		
6-10 years	n	26		
	%	22.4%		
More than 10 years	n	36		
	%	31.0%		

TABLE (4) Association between knowledge and university

University	Knowledge		χ^2	p-value
	Good	Poor		
Public	n	88	2.45	0.118
	%	75.9%		
Private	n	28		
	%	24.1%		

TABLE (5) Association between knowledge and highest degree attained

Highest degree attained	Knowledge		χ^2	p-value
	Good	Poor		
BDS	n	56	7.17	0.066
	%	45.5%		
MSc	n	41		
	%	33.3%		
PhD	n	20		
	%	16.3%		
Board/fellowship	n	6		
	%	4.9%		

TABLE (6) Association between knowledge and job description

Job description	Knowledge		χ^2	p-value
	Good	Poor		
Ministry of Health	n	50	3.80	0.284
	%	26.9%		
Private practice	n	81		
	%	43.5%		
Governmental academic	n	31		
	%	16.7%		
Private academic	n	24		
	%	12.9%		

DISCUSSION

Although CBCT is considered one of the most widespread imaging modalities with numerous applications in dentistry, yet, its use in pediatric dentistry is restrained. This could be ascribed to the higher radiation dose and longer scanning time compared to other conventional modalities. Consequently, CBCT studies in pediatric patients have been limited to review articles or case reports/series.^[16] Enhanced diagnostic accuracy of CBCT does not usually surpass the risk of ionizing radiation exposure in pediatric patients. Thus, proper clinical assessment is essential to ascertain the indications of CBCT and to determine the awareness of its use among pediatric dentists in clinical practice.^[12]

Most of the pediatric dentists who participated in the questionnaire were found to use digital imaging (75.5%) and even a higher percentage came across the word CBCT. Elucidating the term is quite valuable, as undoubtedly, they become acquainted with its applications in the pediatric dental practice. This percentage was slightly lower than the results obtained by Korean dentists in 2018 (87%) and Australian dentists in 2019 (82.5%).^[17] The increased use of digital imaging instead of conventional modalities is brought about by the ease of acquisitions, retrieval, archiving, electronic transfer of images, and the elimination of hazardous wastes resulting from chemical processing.^[8] On top, digital imaging is anticipated because of the low radiation dose during exposure, which is a fundamental prerequisite in young children.^[17] Although digital receptors are widely used in pediatric dental practice, the use of CBCT is still quite limited in our results (69.4 % occasionally requested CBCT in their practice). This may be attributed to the lack of knowledge of CBCT for the participants, in which nearly 50% reported poor expertise. Similarly, a scoping review was conducted in Australia examining dental practitioners' knowledge, confidence, competence and attitudes towards CBCT in the dental practice. They came up with the conclusion that there was deficient knowledge despite a widespread recognition of the significance in its use.^[18]

In the current questionnaire, it was found that the most common reasons for CBCT referral in children and adolescents among the Egyptian pediatric dentists were the pathological lesions which represented a 24% of the total indications followed by ectopic permanent canines, cleft palate, dental traumas and supernumerary teeth with a very small percentage seeking CBCT examination for endodontic treatment. It's rational that children with pathological lesions are sent for CBCT examination. However, it's remarkably that other indications also showed high percentages as such; dental traumas where in several cases, 2D images do not disclose all the information required to commence treatment plan. In addition, CBCT can deliver diagnostic precision in root fractures.^[5] Moreover, 18.4 % of the respondents believe that ectopic canines should be CBCT scanned. This may be due to the value of finding the effect of impacted teeth on the adjacent structures, and the direction of eruption which unquestionably influence the diagnosis of pediatric dentists working with their orthodontic colleagues. Finding about 15 % requesting CBCT for supernumerary teeth is quite interesting, as usually in clinical practice 2D image is assumed adequate by practitioners for diagnosis. Several articles have studied the reasons for referrals of CBCT in children, in **2016 Jakob et al.** found that the most common referrals in children was developing dentition, followed by the dento-alveolar traumas representing about 18 %.^[1,3,5,19] About 1/3 of the participants in our study never referred a patient for a CBCT which is a high percentage, and this entails that increasing awareness and knowledge among pediatric dentists is compulsory.

In this study, 121 participants were aware of the term voxel which is a representation of the image definition. Being exposed to such terms, signs the understanding of the use of small and large voxel sizes and their application in dental practice. As, some specific diagnostic tasks may require greater image resolution. For example, imaging of root canals or fracture lines in teeth need a higher level of image definition than the dose needed for detection of the presence or absence of a tooth. Also, fine

details may be required in cases of trauma and endodontic treatment. ^[8,20]

Only 16.6% of the contributors knew how to interpret CBCT cases but a significant number (58.5 %) could not interpret all the referred cases. Around one third of the participants think that not requesting CBCT in children were due to the high cost of scan and more than 25 % of the participants think that it may be due to the increased risk of ionizing radiation dose. A considerable number of the participants faced parenteral refusal for the idea of imaging their children using CBCT. Those who refused, their main concerns were the cost of the scan and the radiation dose.

The International Commission on Radiological Protection (ICRP) states that the use of dental CBCT for pediatric patients is a concern due to the children's higher radiosensitivity and smaller size. It also states that due to the larger relative coverage of the child's head, effective doses are higher compared with adults if exposure factors are not adjusted. ^[2] This is why the ALADAIP acronym has been introduced more recently. ^[9,19] It is worth noting that there are no dose limits for patients for the sake of reaching proper diagnosis, even in young children. It's been concluded that the three basic principles of radiation protection, "justification, limitation and optimization". ^[6] Recent innovative technologies in CBCT have shown several programs that provide low dose protocol specifically for children by changing the parameters settings; kVp, mA, scanning and exposure time and the FOV being examined. ^[8,20] Most of the pediatric dentists who participated in the study knew the radiation protection guidelines which indicates that those guidelines are clarified accurately in either the undergraduate or postgraduate stages in universities.

Approximately 50% of the participants rated their knowledge to be good regarding CBCT. The greatest amount of information and knowledge was acquired from continuous education, undergraduate courses, the master's degree followed by the internet with the following percentages (19.3%, 17.6%, 17.6% and 17.4% respectively). Hence, it explicates

in a way or another the presence of no significant difference between the years of experience, the graduate university, the highest degree attained, and the job description with the knowledge of the CBCT. Even though, 72.1 % of the participants attended courses related to CBCT, still 50 % of the them showed poor knowledge which mandates the increased demand for CBCT tutoring.

In the current questionnaire, 65% of the pediatric dentists believe that they didn't receive adequate training and education regarding CBCT in their undergraduate stage. Thus, most of the dentists might have received their training in the postgraduate stage from either the internet, continuous education or the post graduate programs. Ninety-five percent of the participants believe that more continuous education courses are to be given.

The vast majority of the pediatric dentists in this study observed that adequate knowledge related to CBCT usage was not being sufficiently provided in the educational institutions. In order to fill the gap, they suggested that continuous education programs on the basic aspects of CBCT should be conducted. The attitude of dentists and dental students towards CBCT may serve as a valuable indicator for the future direction of CBCT use, education and training. In this questionnaire, the requirement for improvements to standardization of CBCT training programs for pediatric dentists is highly recommended.

CONCLUSIONS

The study results indicated that there is a definite gap in knowledge and awareness of CBCT amongst pediatric dental specialists in Egypt.

Recommendations:

1. Further studies are needed to include more participants in different Egyptian universities.
2. Based on the results of the current study results additional CBCT education supported by practical experience is incorporated into the curriculum.

Limitations of the current study

1. The questionnaire used had many questions especially to assess the knowledge about CBCT use, which didn't encourage some pediatric dentists to participate.
2. Not all dental schools in Egypt were included in the study.

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