

Barriers Toward Better CBCT Knowledge, Attitude, and Practice

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Abstract

Objective: This study attempts to evaluate the knowledge, attitude, and clinical practice of Iraqi dentists toward CBCT use, referral patterns, observed challenges, and the impacts of previous training on its adoption. **Material and Methods:** A total of 202 Iraqi dentists participated in this study and self-administered questionnaires were distributed to them via Google Forms from 3/2/2025 to 1/4/2025. Participants included both general practitioners (GPs) and specialists regardless of their years of experience in different dental fields. **Results:** Dental specialists showed significantly higher referral frequency for CBCT compared with GPs ($P = 0.002$). However, there was no significant relationship between gender and referral frequency for CBCT ($P = 0.068$), also, there were no statistically significant differences were noticed in the specialists' responses in comparison to GPs about following guidelines for CBCT request ($P = 0.167$), having formal training on CBCT ($P = 0.255$), their adequacy of knowledge of CBCT ($P = 0.293$), and the need for CBCT training ($P = 0.058$). There was a significant difference in the specialist responses compared to GPs about the necessity of CBCT in daily practice ($P = 0.014$). While there were no significant differences between both genders and years of practice ($P = 0.138$, $P = 0.091$), respectively, regarding the necessity of CBCT. Also, no significant relationship was found between both specialties and age groups ($P = 0.14$, $P = 0.839$), respectively regarding the primary purpose of CBCT. A highly significant relationship has been found between being a specialist versus GP and CBCT radiation dose compared to CT ($P =$

0.001). While no significant relationship when CBCT dose compared to orthopantomography (OPG) ($P = 0.084$). **Conclusion:** The major barrier toward better CBCT KAP was the lack of undergraduate training to CBCT imaging. Initiating a new educational initiatives program and establishing clear referral guidelines are crucial to fostering the effectiveness and ensuring the appropriate use of CBCT in dental practice across Iraq.

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Introduction

Cone beam computed tomography (CBCT) in dental imaging has revolutionized the process of diagnosis, treatment, and follow-up in dentistry because it offers three-dimensional visualization of oral and maxillofacial structures with a reasonable dose of radiation when compared with traditional computed tomography (CT) imaging [1]. In many dental specialties like orthodontics, endodontics, maxillofacial surgery, and dental implants, CBCT become a crucial diagnostic tool. Many countries are implementing it now widely due to its ability to improve treatment planning and clinical outcomes.

However, depending on many considerations like cost, accessibility, education, and training, its integration into routine dentistry varies [2].

Despite of the benefits of CBCT, concerns still exist regarding overuse, training, and referral guidelines [3]. According to existing studies which show that many dentists lack sufficient education, proper training regarding its indications, radiation safety, and image interpretation which lead to inconsistent patterns of usage [4]. Although CBCT is a gold standard method for certain dental applications, its usage should only be justified

when clinically indicated to reduce radiation exposure to patients [5].

The availability and uses of CBCT technology are still limited in Iraq and there is a shortage of information regarding the knowledge, attitude, and practice of Iraqi dentists toward this imaging modality. According to previous studies conducted in Iraq, a large number of dentists know the diagnostic advantages of CBCT but they have little access to training and education in this field. This gap is further exacerbated by the absence of formal education during undergraduate study programs in the universities [4].

To the best of our knowledge, there are limited studies on CBCT surveys conducted among Iraqi dentists to evaluate the impact of CBCT training on the attitudes of specialists compared to GPs. The aim of this study was to evaluate the knowledge, attitude, and clinical practice of Iraqi dentists toward CBCT use, referral patterns, observed challenges, and the impacts of previous training on its adoption.

Material and Methods

After obtaining the ethical approval of the research committee at the College of Dentistry of Al-Iraqia University. A total of 202 Iraqi dentists participated in this study and self-administered questionnaires were distributed to them via Google Forms from 3/2/2025 to 1/4/2025. Participants included both general practitioners (GPs) and specialists regardless of their years of experience in different dental fields such as oral surgery, conservative dentistry, orthodontics, prosthodontics, and periodontics. The sample size was determined using data from a prior electronic questionnaire survey [4].

Responses were anonymized to preserve confidentiality, and participation was entirely voluntary. The questionnaire was developed after reviewing similar studies and validated survey tools [6,7] and reviewed by oral & maxillofacial radiologist and oral & maxillofacial surgeon who are experts in using CBCT. It was composed of four sections: The first section was the demographic information which includes age, gender, year of practice, specialty, and practice setting. The second section focused on the knowledge of CBCT use and radiation awareness. The third section was designed to address attitudes and referral practices. The fourth section investigated the suggestions of the participants to improve CBCT referral.

Descriptive statistics were presented in terms of frequencies and percentages. Chi-square tests using the statistical package for social sciences software (SPSS V25) were used for analyzing the data.

Results

The majority of participants were males and under the age of 30 years. Regarding professional experience, the highest percentage of participants had less than five years, and the lowest was between 11 to 20 years of experience. Looking at dental specialization, GPs made up the majority of the survey. A total of 202 participants completed self-administered questionnaires in this analysis, representing different dental professionals across Iraq. The sample includes diverse demographics in terms of age, gender, professional experience, and specialization.

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Table 1. Study demographic data.

Study variable	no.	%
age group		
<30	97	48
30-40	52	25.7
41-50	27	13.4
51-60	26	12.9
gender		
Male	126	62.4
Female	76	37.6
years of practice		
<5	88	43.6
5-10	44	21.7
11-20	27	13.4
>20	43	21.3
specialist vs GP		
General practitioner (GP)	109	54
Specialist	93	46
practice setting		
Private sector	55	27.2
Public sector	38	18.8
Academic institution	100	49.5
Other	9	4.5

There was a significant difference in the specialist responses compared to GPs about the necessity of CBCT in daily practice ($P = 0.014$). While there were no significant differences between both genders and years of practice ($P = 0.138$, $P = 0.091$), respectively, regarding the necessity of CBCT. Also, no significant relationship was found between both specialties and age groups ($P = 0.140$, $P = 0.839$), respectively regarding the primary purpose of CBCT. A highly significant relationship has been found between being a specialist versus GP and CBCT radiation dose compared to CT ($P = 0.001$). While no significant relationship when CBCT dose compared to orthopantomography (OPG) ($P = 0.084$).

The highest percentage of the responders thought that CBCT was occasionally needed in daily practice while the lowest percentage thought it was not necessary. Regarding the primary purpose of CBCT imaging, the majority of the participants identified diagnosis and treatment planning as the main indications. Most of the participants believed that CBCT radiation is only higher than conventional periapical (PA) radiography, and digital PA radiography.

It was interesting to note that 9.9% of participants believe that CBCT and digital PA imaging had the same radiation dose, and 8.9% of respondents thought CBCT emits a lower dose than traditional PA radiographs. The highest percentage of respondents believed that CBCT radiation is higher than OPG radiography and lower dose than traditional medical CT. The vast majority of the participants thought that CBCT was useful for dental implant planning and the lowest percentage thought it was useful for routine dental exams (Table 2).

Dental specialists showed significantly higher referral frequency for CBCT compared with GPs ($P = 0.002$). However, there was no significant relationship between gender and referral frequency for CBCT ($P = .068$), also, there were no statistically significant differences were noticed in the specialists' responses in comparison to GPs about following guidelines for CBCT request ($P = 0.167$), having formal training on CBCT ($P = 0.255$), their adequacy of knowledge of CBCT ($P = 0.293$), and the need for CBCT training ($P = 0.058$).

Most dentists reported that they rarely refer patients for CBCT imaging while the lowest percentage stated that they always made referrals. More than half of the participants followed clinical guidelines before making the referral decision but they didn't receive formal training on CBCT imaging and felt that the knowledge about CBCT imaging was insufficient. Half of the participants attended a workshop on CBCT imaging referrals but they didn't think CBCT imaging is over-utilized in their practice. The main challenge the participants faced in following guidelines for CBCT referral was lack of training while the main factor that influenced the decision for CBCT referral was the diagnostic necessity (Table 3).

When participants were asked about suggestions to improve CBCT referral, over half of the respondents (51%) identified the implementation of workshops or structured training programs on CBCT indications and referral protocols as the primary strategy.

Discussion

This questionnaire aims to assess awareness and knowledge of CBCT among Iraqi dentists

of different specialties and also to evaluate how their attitudes are affected by CBCT training and education. The fact that of a reasonable percentage of the respondents are academics reflects their particular interest in educational aspect related to the subject.

CBCT has an important role in diagnosis and treatment planning in dental practice [6-8]. It seems that the vast majority of respondents are aware of this fact. This is understood as CBCT is one of the radiographic assessment modalities. The primary aim of radiography in general is to complement the diagnosis process. Any treatment plan depends on accurate diagnostic information that will significantly enhance patient care, safety, and clinical outcomes [9].

Occasional use of CBCT as reported by the highest number of respondent might be related to the fact that CBCT modality is not required in all daily practices cases. CBCT is usually required in only certain situations in oral and maxillofacial surgery, endodontics, orthodontics, periodontics, and restorative dentistry [10]. Other radiographic modalities such as OPG can provide the necessary required information in most cases. High cost of CBCT and high radiation dose to the patients might be additional factors [11,12].

The study showed that knowledge defects in CBCT are more obvious in the technical aspect of CBCT machinery. Participants are not well informed about this technology compared to the more familiar conventional intraoral and extraoral radiographic modalities and this may explain the discrepancy between the participant responses regarding the CBCT dose compared to the literature. A high percentage of participants considered the radiation dose of CBCT was only higher compared to conventional PA and digital PA radiology respectively. Literature showed that CBCT had a much higher radiation dose [3]. Tamam et al study reported that CBCT has radiation dose is twice panoramic dental radiography [13]. It was, also, reported by this study that most of the respondents think that the radiation dose of CBCT was just lower compared to CT radiology, which contradict the literature. CBCT imaging for applications in dentistry produces much lower radiation doses than medical CT [1,14].

Specialist dentists, however, as the study confirmed are more knowledgeable than GPs on CBCT knowledge techniques and referral frequency for CBCT. this confirms the role of postgraduate education in different aspects of CBCT practice. A dentists with postgraduate qualification appear have more awareness of the role of CBCT and this could be attributed to the fact that postgraduate curricula focus more on advanced imaging

techniques compared to undergraduate curricula [15].

The fact that both gender and years of practice do not a noticeable influence the attitude toward CBCT further confirms that undergraduate studies focus more on conventional radiographic techniques [16]. Advanced radiographic techniques such as CBCT, CT scan and magnetic resonance imaging (MRI) lie out of the focus of undergraduate radiology subjects and this influences postgraduation practice [17].

As CBCT provides wide coverage of facial bones and teeth [18], CBCT is used as the standard imaging technique for several dental specialties, such as periodontology [19,20], orthodontics [21,22], oral medicine [23], oral and maxillofacial surgery [24,25], endodontics [26,27].

However, it was evident from the results of the current study that CBCT imaging most commonly was used for dental implant planning which might be related to the fact that most of the participants practice dental implants. CBCT is a common place practice in dental implantology [28]. The highest percentage of participants work in both public and private health sectors. Dental implant practice is commone in both the public and private sectors, which increases the possibility to perform dental implant treatment.

Furthermore, almost all dental implant courses dedicate part of their practical training sessions to CBCT interpretation used for dental treatment. This finding aligns with the previous research [12]. This might explains why majority of dentists agreed that CBCT devices should be present in all dental clinics and believed that it was a helpful diagnostic tool in dentistry [4].

What might expaine that CBCT is not over utilized in dental practice is the belief that CBCT is not required in all dental situations. It also explains why the highest percentage of respondents rarely referred patients for CBCT imaging. Hazard of unnecessary radiation exposure might be one the reasons [29]. Inadequate knowledge in CBCT interpretation might be another factor [30]. This fact is confirmed by the European Academy of Dental Maxillofacial Radiology [5]. It worth mentioning that over half of the respondents are GPs. The highest percentage of dentists who rarely refer patients to CBCT were GPS.

Furthermore most of the participants didn't receive formal training on CBCT imaging usage, a fact confirmed by other studies [4]. Participants felt that their knowledge about CBCT imaging was insufficient. They have little or no instruction in the use and interpretation of CBCT imaging. This result is in accordance with the previous study [30].

The findings show that dentists are not well-informed on CBCT and that their understanding of this exciting technology needs to be improved. Therefore, providing precise knowledge and training on CBCT to Iraqi dentists is crucial due to its widespread use and potential in several dental specialties. Patients today expect modern technologies and services from their doctors and dentists. The technology that CBCT gives the doctor not only has many benefits for treating patients, but it also has a notable factor because the 3-D images are displayed on a large screen for both the patient and the doctor to observe. The study's limitations included a self-reported questionnaire that may lead to bias.

Conclusion

The major barrier toward better CBCT KAP was the lack of undergraduate training to CBCT imaging. Initiating a new educational initiatives program and establishing clear referral guidelines are crucial to fostering the effectiveness and ensuring the appropriate use of CBCT in dental practice across Iraq.

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Table 2. Descriptive statistics for responses on CBCT knowledge.

Study variable	no.	%
To what extent do you think CBCT is necessary in your daily practice?		
Not necessary	6	3
Necessary to little extent	26	12.8
Occasionally needed	87	43.1
Highly necessary	61	30.2
Extremely necessary	22	10.9
What do you think is the primary purpose of CBCT imaging?		
Diagnosis	105	52
Treatment planning	89	44
Routine check-up	2	1
Other	6	3
What do you think about the radiation dose of CBCT compared to conventional PA radiography?		
Lower	18	8.9
About the same	15	7.4
Higher	103	51
Much higher	66	32.7
What do you think about the radiation dose of CBCT compared to digital PA radiography?		
Much lower	4	2

Lower	7	3.5
About the same	20	9.9
Higher	96	47.5
Much higher	75	37.1
What do you think about the radiation dose of CBCT compared to OPG radiography?		
Much lower	1	0.5
Lower	19	9.4
About the same	50	24.8
Higher	108	53.5
Much higher	24	11.8
What do you think about the radiation dose of CBCT compared to CT radiography?		
Much lower	44	21.8
Lower	67	33.2
About the same	57	28.2
Higher	26	12.8
Much higher	8	4

Table 3. Descriptive statistics on attitude and referral practice toward CBCT.

Study variable	no.	%
On average, how often do you refer patients for CBCT imaging?		
Never	27	13.4
Rarely (1-2 monthly)	86	42.5
Sometimes (3-5 monthly)	55	27.2
Often (weekly)	25	12.4
Always	9	4.5
Do you consult clinical guidelines before referring a patient for CBCT imaging?		
No	37	18.3
Sometimes	51	25.2
Yes	114	56.3
Have you received formal training on CBCT imaging indications and usage?		
No	114	56.4
Yes	88	43.6
Do you feel your knowledge about CBCT imaging is sufficient?		
No	138	68.3
Yes	64	31.7
Would you attend a workshop or training session on CBCT imaging referrals?		
No	45	22.3

Maybe	56	27.7
Yes	101	50
Do you think CBCT imaging is over-utilized in your practice or region?		
No	102	50.5
Not sure	56	27.7
Yes	44	21.8