

Assessment of Dentists Knowledge towards Cone Beam Computed Tomography in Public and University Teaching Hospitals in Khartoum State

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Abstract

Purpose: Cone beam computed tomography (CBCT) is an excellent three-dimensional (3D) imaging technique. It was introduced in 1996. In developing countries including Sudan this technique has been recently introduced.

The aim of this study was to assess the current knowledge of dentists in University teaching hospitals and public hospitals in Khartoum State with regards to the usage and application of CBCT.

Material and method: After obtaining permission and ethical clearance from the responsible authorities, this study on CBCT was conducted among dentists in University and public hospitals by using a self-administered questionnaire to assess the knowledge on CBCT among dentists. The questionnaire was distributed among 250 dentists in Universities teaching hospitals and public hospitals in Khartoum state. It includes allocated information comprised demographic data (age, gender, years of employment, educational degree, duration of experience and working area) in addition to fifteen questions concerning) regarding the CBCT technology.

Result: 220 Dentist responded to the questionnaire. 2.7% have been found to have a high level of knowledge, 18.6% had an average level of knowledge, 54.1% low level and the remaining 20.9% had very low level of knowledge.

A significant difference was noted among the category of gender ($p=0.00$). Based on educational level, the highest score of knowledge was found among specialist ($p=0.004$).

Conclusion: This study concludes that the knowledge of the dentists either general practitioners or specialists about cone beam computed tomography as a new imaging modality is inadequate.

Keywords: Knowledge; Cone beam computed tomography; Dentists

Introduction

Cone beam computed tomography (CBCT), is a three-dimensional (3D) dental and maxillofacial imaging modality that has been developed in recent years [1].

Cone beam computed tomography is a medical imaging technique consisting of X-ray computed tomography where the X-rays are divergent, forming a cone with cone beam CT, an X-ray beam in the shape of a cone is moved around the patient to produce large number of images in the form of views or slices [2,3].

CBCT produces high quality images and it has the ability to give sub-millimeter resolution in terms of images with high diagnostic quality [4].

Cone beam technology was first presented in the European market in 1996 by QR S.R.L. (NewTom 9000) and into the US market in 2001. CT scanner has the ability to produce three-dimensional (3-D) images of dental structures, soft tissues, nerve paths and bone in the craniofacial region in a single scan. Therefore, images obtained with cone beam CT allow for more precise treatment planning [2,5].

The continuous technological advance of these devices and software, together with a reduction of cost for the clinician and the patient, has made CBCT progressively more reachable. Additionally, the many obvious advantages of CBCT over conventional Computed Tomography (CT) and conventional panoramic and intraoral imaging have resulted in substantial increase in the applications of CBCT in dentomaxillofacial imaging [6,7].

Whereas oral health professionals have long depended on 2-D imaging for diagnosis and treatment planning, this technology typically requires multiple exposures and with them, multiple doses of damaging radiation. Nowadays, with a properly prescribed 3-D scan, practitioners

have gained the ability to collect much more data-often with a single scan and potentially with a lower effective patient dose [8,9].

CBCT, as with any technology, has disadvantages. One major disadvantage is it can only demonstrate limited contrast resolution, mainly due to relatively high scatter radiation during image acquisition and inherent flat panel detector related artifacts. CBCT is not sufficient for soft tissue evaluation. The risk of adult patient fatal malignancy related to CBCT is between 1/100,000 and 1/350,000 and when using the technology for children, the risk could be twice as much [2].

The patient's history and clinical examination must justify the use of CBCT by demonstrating that the benefits to the patient outweigh the potential risks. CBCT should not be routinely used for detection of caries, periodontal bone loss and periapical pathosis or for routine orthodontic diagnosis [2].

Clinicians should use CBCT only when the need for imaging cannot be answered adequately by lower dose conventional dental radiography or alternate imaging modalities [3].

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Received October 18, 2017; **Accepted** November 17, 2017; **Published** November 22, 2017

Citation: Abdelmonaim Y, Fayez A, Abid R, Abdelraziq K, Mohammed R, et al. (2017) Assessment of Dentists Knowledge towards Cone Beam Computed Tomography in Public and University Teaching Hospitals in Khartoum State. OMICS J Radiol 6: 280. doi: [10.4172/2167-7964.1000280](https://doi.org/10.4172/2167-7964.1000280)

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The European Academy of Dental and Maxillofacial Radiology has issued guidelines for the use of this technology in European countries. Nevertheless, in many other countries including Sudan, such instruction is lacking (9).

In view of this and the importance of dentist's knowledge towards new technologies, this survey was designed with an aim to assess the current knowledge among dentists in Khartoum state towards the usage and application of CBCT.

Material and Methods

The present study was carried out among medicals, specialists and house officers working in University teaching hospitals and public hospitals in Khartoum state to assess their knowledge on CBCT.

The study protocol was approved by the Ethical Committee of faculty of Dentistry, University of Science and Technology, Omdurman.

A total of 250 dentists were invited to participate in this study, but only 220 dentists responded to the questionnaire which was comprised of demographic data (age, sex, years of employment, educational degree) and fifteen other questions regarding the technology of CBCT.

The questionnaire was designed to be informative with the provision of four options from which the study participants were asked to choose one answer.

Question 1 was about a single CBCT examination.

Questions 2, 4, 6, 9, 12 and 13 assessed the indication for the use of CBCT.

Questions 3 and 14 were about the advantages of CBCT over CT and intraoral radiograph.

Questions 5, 7 and 8 evaluated the use of CBCT. Question 19 assessed the application of CBCT in orthodontics.

Question 11 determined the uses of CBCT in implant.

Question 15 considered the prescription of CBCT.

The questionnaire was adopted from the study done among dentists in Iran [10]. (The questionnaire is available from the corresponding author).

Pretesting of questionnaire was done on 10 randomly selected dentists after whom it was finalized based on the result of pretest.

The questionnaire was personally handed over to 250 Participants who worked at public and University hospitals in Khartoum state.

A brief discussion and clarification about the questionnaire sections was done during the meeting and before attempting to answer the questions.

The distribution of the questionnaires among the hospitals lasted for a time period of two weeks and a reminder was given to the participants after a week for the completion of the questionnaire.

The study participants included medicals, specialists and house officers. There was no obligation for answering the questionnaire and dentists were warranted that the results of this study will be used only for educational purposes and will not be used for assessing the dentists. Prior consent was obtained from the participants and their confidentiality was maintained.

In the current survey, analysis of data was done by the SPSS software version 22. Comparison between two mean was undertaken

by using Mann-Whitney test while comparison between more than two groups was accomplished by using Kruskal-Wallis test. A P value less than 0.05 were considered as significant.

Results

Out of the 250 questionnaires that were distributed among dentists 220 were answered. Generally, a notable response rate was observed (88%). The participants comprised 104 house officers (47%), 78 medical officers (35%) and 38 specialists (17%), including 151 females (69%) and 69 males (31%) (Figures 1 and 2).

There were 69 men (31.4%) and 151 women (68.6%) accounting for a sex ratio of 2.2 and aged between 23 and 56 yrs old with an average of 39.5 ± 7.73 yrs old (Figure 3).

The grading scales for assessing the level of knowledge were as follows; 0-20 was considered as very low; 21-40 was considered as low; 41-60 was considered as average; 61-80 was considered as high and 81-100 was considered as very high. 20.9% had a very low average of knowledge, 54.1% had a low level of knowledge, 18.6% had an average level of knowledge and 2.7% had a high level of knowledge (Figure 4).

Dentists' relative frequency of distribution for the answers of the fifteen questions related to CBCT are illustrated in Table 1.

The statistical analysis did not show any significant correlation between the level of knowledge and age ($p=0.2$), years of employment ($p=0.1$) and working area in either University or public hospitals ($p=0.1$) (Tables 2-4)

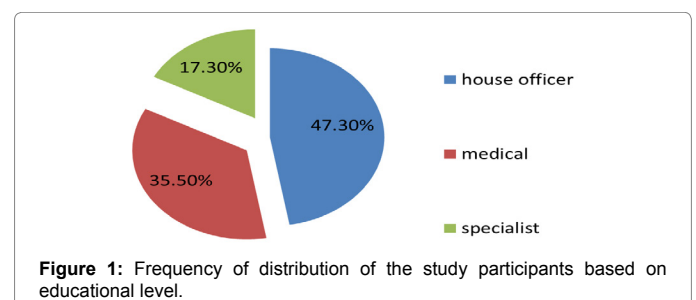


Figure 1: Frequency of distribution of the study participants based on educational level.

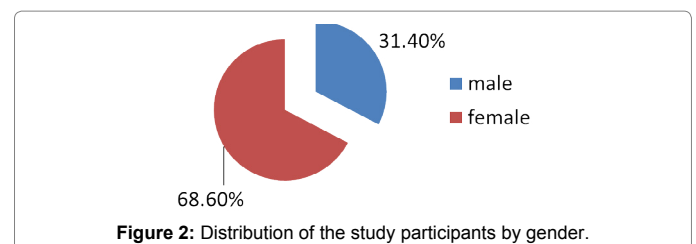


Figure 2: Distribution of the study participants by gender.

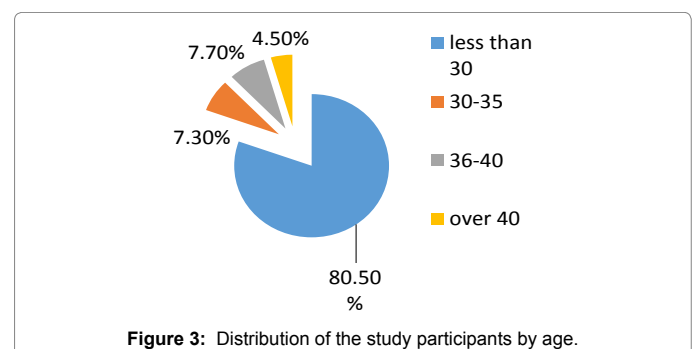


Figure 3: Distribution of the study participants by age.

However, upon comparison of the level of knowledge in with regards to gender, a significant difference was seen between males and females ($p=0.001$) (Table 5).

Additionally, a significant difference in knowledge was found among dentists based on their educational degree (house officers, medical officers and specialists) ($p=0.01$) (Table 6).

Discussion

The selection of a proper diagnostic technique plays a pivotal role in the treatment of disease. An appropriate diagnostic method can provide essential information, in addition to the minimizing of cost and harm to patients. In dental radiography, efforts have been made to reduce patient exposure to radiation. Cone-beam computed tomography (CBCT) and digital radiography were developed to attain this goal [11].

In Sudan, no published study was done considering the knowledge about CBCT imaging among dentists and this may be due to the ignorance of the new techniques existence and the few number of the CBCT machines. Therefore, it is necessary to shed light and to assess the knowledge in regards to CBCT to initiate continuing dental training on that subject.

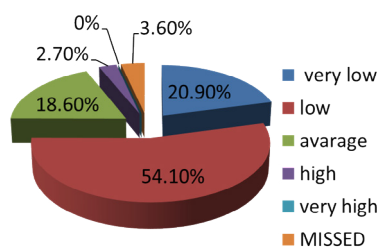


Figure 4: Frequency of distribution of the study participants according to level of knowledge.

The present study was conducted to evaluate Sudanese dentists' knowledge regarding CBCT.

Two hundred and twenty dentists including house officers, medical officers and specialists contributed in this cross-sectional study.

The present study found that the majority of respondents had a low level of knowledge about CBCT and only few respondents had a high level of knowledge regarding this topic. A possible clarification for this finding can be the unavailability of CBCT at the work place with a consequent difficulty in the acquirement of knowledge on a given system without practical experience. Therefore, the lack of CBCT units in the dental office setup may represent a significant factor contributing to dentists' unfamiliarity with this technology with CBCT education being chiefly limited to textbooks.

This is in line with the study carried out by Kamburoğlu et al., among Turkish dental students which underscored the problems with acquiring knowledge on a given system without practical experience [12].

In the current study no relationship has been found between age and knowledge about CBCT, a finding that could possibly be owing to its recent recognition as an imaging modality and the lack of CBCT units at their work areas also the lack of practical experience and unfamiliarity with image characteristics in image acquisition. In addition to the advanced level of software knowledge regarding understanding and interpreting of CBCT images [13].

The results of the present study reveal a significant difference between genders with regards to CBCT knowledge. Males had greater knowledge compared to females and this can be explained by the fact that most of the training courses in CBCT are held outside Sudan and the majority of females have certain obligations that prevent them from attending such courses to improve their level of knowledge.

Questions	Correct	Incorrect
Question 1: Prescribing CBCT	66 (30%)	143 (65%)
Question 2: Justifiability for indications of CBCT	27(12.3%)	182 (82.17%)
Question 3: Comparing CT and CBCT	65 (29.5%)	144(65.5%)
Question 4: Most common indications of CBCT .	111(50.5%)	97(41.1%)
Question 5: CBCT and TMJ	45 (20.5%)	158 (71.8%)
Question 6: Contraindication of CBCT	107 (48.6%)	99(45%)
Question 7: Indication of CBCT in root fractures	138 (62.7%)	67 (30.5%)
Question 8: CBCT and articular disc	68(30.9%)	135(61.4%)
Question 9: Indication of CBCT for implant surgery in edentulous patients	31 (14.1%)	170(77.3%)
Question 10: Contraindication of CBCT in orthodontics	51 (23.2%)	150 (68.2%)
Question 11: Contraindications of CBCT in implant surgery	58 (26.4%)	142 (64.5%)
Question 12: Contra indication of CBCT	40(18.2%)	162 (73.6%)
Question 13: Comparing CBCT with Orthopantomogram (OPG)	78 (35.5%)	121(55%)
Question 14: Comparing CBCT with intraoral radiographies	96 (43.6%)	108 (49.1%)
Question 15: Order for prescription	86 (39.1%)	115 (52.3%)

Table 1: Dentists' relative frequency of distribution for the answers of the fifteen questions related to CBCT

Age	Number of Dentists	Mean	Standard deviation
Less than 30	177	32.8	14.1
35-30	16	36.2	13.7
40-36	17	33.3	13.5
Over 40	10	42	13.3

p value = 0.2

Table 2: Comparisons of knowledge scores by age.

Years of employment	Number	Mean	Standard deviation
Less than 5years	163	32.3	14.2
5-10 Years	36	36.7	12.03
10-15 Years	11	36	13.7
Over 15 years	10	39.3	18.1

p value = 0.1

Table 3: Comparison of knowledge scores according to number of years for employment.

Working area	Number	Mean	Standard deviation
University teaching Hospital	143	34.6	14.2
Public hospital	65	30.4	13.7
Both	12	36.6	13.4

p value = 0.1

Table 4: Comparison of knowledge scores by working area.

Gender	Number	Mean	Standard deviation
Male	69	34.8	13.6
Female	151	32.9	14.3

p value = 0.0

Table 5: Comparison of knowledge scores by gender.

Educational degree	Number	Mean	Standard deviation
House officer	104	31.2	13.4
Medical	78	34.04	14.6
Specialist	38	39.07	13.6

P value = 0.1

Table 6: Comparison of knowledge scores by educational degree.

Concerning the number of years of employment, there was no significant difference in the knowledge of individuals with different numbers of years of employment. This can also be attributed to the absence of CBCT in their working areas together with the lack of a sufficient theoretical knowledge and practical experience through continuous education programs.

Moreover, specialists demonstrated a higher level of knowledge about CBCT than house officers and medical officers. This difference may be due to the characteristics of the specialist's job as it involves various modalities of three dimensional imaging compared with a general dentist. Given the fact that the advantages of CBCT are clear over other methods of imaging, it should not be limited to specialty branches and comprehensive training must return the real and logic role of this modality.

This is in accordance with the study done by Mahdizadeh et al. which revealed that specialists had greater knowledge about CBCT compared to other conventional intraoral radiographies [11].

Regarding the knowledge of dentists on the basis of the field of practice either private or public hospitals, there was no significant difference found. This finding reflects the generalizability in the lack of knowledge towards the CBCT technology and the need for improvement of the level of education regarding this new technology, additionally effort should be spent to increase the availability of CBCT machines in hospitals to encourage dentists to raise their knowledge in regards to it.

One of the limitations of the present study is the type of questionnaire used (self-reporting questionnaire) which could be a possible source of bias. Another limitation is the use of convenient sampling technique which could compromise the generalizability of the current results. However, the consensus achieved from this study on the general need of the dental practitioners to have a formal and structured training in CBCT cannot be overlooked.

Conclusion

The results of this study indicate that there is a gap in knowledge of CBCT applications among Sudanese dentists as it is a new innovation in the field of dental radiology, with a consequent restriction in the ability to explore this imaging modality to the fullest.

Introduction of training in CBCT at undergraduate as well as postgraduate level will assist dentists in using this technique in an efficient way to upgrade the accuracy and reliability of oral and maxillo-facial diagnosis, treatment planning and outcomes.

Acknowledgement

We wish to thank the dentists who participated in this study, without their participation this work would have been impossible. Special thanks to Dr. Sakina Abbasher and Azza Tajelsir for helping us in revising and editing the English language.

Competing Interests

The authors declare that they have no competing interests.

Ethics Approval and Consent to Participate

The study protocol was approved by the Ethical Committee of faculty of Dentistry, University of Science and Technology, Omdurman.

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