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Assessment of knowledge, attitude and awareness regarding cone beam computed tomography among dental graduates in Pune city, India

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Abstract

Introduction: Cone beam computed tomography (CBCT) is an advanced imaging modality which has abundant clinical applications in the field of dentistry. As diagnostic imaging equipment, it is changing ways for dental practitioners in terms of diagnosis and hence, planning a more accurate treatment plan.

Materials and methods: A study was conducted among the dental graduates of Pune City. The structured, self-administered, close-ended questionnaire was designed to collect the data which consisted of two sections and comprised of 20 questions for assessing the knowledge, attitude and awareness among these students towards CBCT and to determine if an awareness lecture on the same could improve their knowledge and attitude on this topic. The reliability statistics were calculated and the Cronbach alpha was 0.751. Statistical analysis was done using descriptive statistics.

Results: In this study, there were a total of 75 participants between 23-27 years of age. Before conducting the seminar, around 49.2% of the participants were well acquainted with the basics of CBCT and after the seminar, 79.9% of the participants became aware of the same. About 90% of the interns felt that conducting seminars and workshops can be helpful in enhancing their knowledge on CBCT.

Conclusion: The participants had a positive attitude towards CBCT but lacked basic knowledge on, thus necessitating the need for more conducting CBCT workshops and awareness lectures.

Keywords: Cone Beam Computed Tomography (CBCT), Digital Imaging and Communication in Medicine (DICOM), Computed Tomography (CT), Imaging, Dental graduates

1. Introduction

Radiographic imaging is an important diagnostic alternative to the clinical evaluation. It helps in the diagnosis and treatment planning of various dental pathologies. In 1996, Cone Beam Computed Tomography (CBCT) was introduced as an advancement in technology resulting from the demand for 3-Dimensional information obtained by conventional Computed Tomography (CT) scans^[1]. CBCT is an imaging modality that has recently become useful for dentomaxillofacial imaging. When compared with conventional CT scanners, CBCT units cost less, requires less space, have faster scan time, limit the beam to the head and neck with reduction in the radiation doses and have interactive display modes that offer maxillofacial imaging making them well suitable for use in dental practices^[2].

CBCT systems function by concentrating a cone-shaped X-ray beam on a two dimensional (2D) detector that rotates 360° or less around the patient's head to produce a series of 2D images. A cone beam algorithm is then applied to this data set, allowing the operator to extract planar and curved reconstructions of varying thicknesses in any orientation and to generate accurate three-dimensional (3D) images of bone and soft-tissue surfaces, making them more useful in dental practices^[3]. Due to the complex anatomy of dentomaxillo facial region, it is difficult to make multiple projections at different angles to certain predefined planes. But with the introduction of CBCT, greater predictability in diagnosis and assessment of complex structure for treatment planning can be achieved^[4]. CBCT has many applications in dentistry such as implant planning, orthodontic treatment planning, endodontics, and evaluation of mandibular third molar root proximity to the inferior alveolar canal and in the diagnosis of

other oral and maxillofacial pathologies^[5]. In addition, CBCT can be also be used for evaluation of- impacted supernumerary teeth,^[6] root fractures,^[7] accessory canals,^[8] etc. This study was attempted to assess the knowledge, attitude and awareness regarding CBCT among the dental graduates.

Materials and Methods

A questionnaire study was conducted among dental graduates in Pune city to determine the knowledge, attitude and awareness of the graduates, regarding CBCT, pre and post awareness lecture. The objective of this study was to estimate the knowledge and importance of the CBCT among the graduates, and to create awareness about it. The study duration was about three months. The participants were selected based on the following criteria: (i) Dental graduates, (ii) Participants who were willing to participate in the study. Undergraduate students, Post-graduate students and staff members were excluded from the study. The input parameters for the sample size calculation used were as follows: 80% power of the study, alpha error 0.05, effect size 0.7, and degree of freedom as 5. The calculated sample size was 64 using G*power software version 3.1.9.2(Heinrich Heine university, Dusseldorf), the final considered sample size for the study was around 75. The convenient sampling technique was used in this study. A structured, self-administered, close-ended questionnaire was designed to collect the data which consisted of two parts and comprised of 20 questions related to knowledge, attitude, and awareness of CBCT amongst dental graduates. The first part consisted of demographic data such as age and gender and the second part consisted of questions based on Knowledge, Attitude and Awareness of CBCT. The reliability statistics was calculated using Cronbach alpha was 0.751. The questionnaire was prepared using Google forms (Google LLC, Mountain View, California, United States) and the link was distributed to the selected participants via email, WhatsApp number and other social media platforms (Instagram, telegram etc.). A brief introduction about the study was given and informed the consent was taken from all the participants. Data collected were entered in a spreadsheet (Microsoft excel 2016). Statistical analysis was done using descriptive statistics. SPSS (Statistical package for the social science) 23.0 version software (IBM Chicago, Illinois, united states). The p value was set at 0.05.

Results

Table 1 gives the demographic details of the 75 participants pre and post awareness lecture. Among the 75 participants, 80% were female while 20% were male. The age of majority of the participants (84%) lies in the range of 23-24 years. Table 2 assessed the knowledge of the participants regarding CBCT. Out of the 75 participants, 94.7% (n=71) had heard of CBCT before. 49.3% came across this term through books and journals while the remaining through internet, seminars and lessons by faculty. As for the different views of CBCT used in implant planning, the knowledge among the participants was 45.3% (n=34). However, after a thorough explanation about the views of CBCT through the lecture, 80% (n=60) were able to attempt the question correctly. Table 3 discussed the attitude and awareness of the participants regarding CBCT. 81.4% (n=61) of the participants agreed that ALARA principles must be kept in mind before choosing an imaging modality. The awareness for the same was incremented to 94.7% (n=71), subsequent to the awareness

lecture. About 90% of the dental graduates felt that conducting awareness lectures and workshops can be helpful in enhancing their knowledge on CBCT.

Discussion

Cone Beam Computed Tomography has proven to be the third eye for dentists, allowing them to derive an accurate diagnosis in cases where conventional dental imaging techniques cannot provide satisfactory information to reach to a final diagnosis^[1]. Hence, having basic knowledge and skills in interpreting CBCT images for the dental graduates (interns) before starting with their dental practice is of utmost importance. Contrary to this statement is the fact that, not many dental graduates have sufficient knowledge and skills in making the accurate interpretation from CBCT images. Hence, this study aims at examining the level of knowledge that the dental graduates possess regarding CBCT and their attitude towards the use of this imaging modality. CBCT has now slowly started to become an integral part of dentistry, in every aspect, thus necessitating the need to conduct more lectures and educate the dental interns on basic interpretation skills, as a part of the BDS course. Various modes of learning such as seminars, lectures, workshops, journals, internet etc. have helped in gaining knowledge on CBCT. Hence, an awareness lecture was also conducted as a part of this study to affirm the importance of CBCT in dental practice, impart basic knowledge required in regards to CBCT, and to bring about positive changes in their attitude towards it^[1]. In light of this, various studies have been conducted to assess dental students or practitioners' knowledge and attitude towards CBCT.

According to the study, majority (94.7%) of the participants were able to distinguish the panoramic reconstruction of a CBCT scan from a traditional panoramic radiograph, which is in line with the study conducted by Hui Ling Cheah and *et al.*^[9] approximately 50% of the participants came across the term CBCT via books and journals. On the contrary, according to K Kamburoglu *et al.*^[10], majority of the undergraduates acquired much of their knowledge about CBCT from their courses at the dental faculty. About 72% of the participants were not aware of the basic terminologies used in CBCT, owing to the fact that not sufficient knowledge is attained during the BDS course. Similar to this proportion are the conclusions drawn by Lavanya R *et al.*^[11], in a cross sectional study, where only 68.2% had partially awareness of the same. However, after conducting the seminar in this survey, there was an increase of knowledge by about 45%.

On questioning the attitude of the participants towards CBCT, in different scenarios, similar results were obtained before and after the seminar. Despite inadequate basic and practical knowledge, the interns were well aware of its implications and agreed that it will be used further in routine dental practice as well. This is in accordance with a study conducted by Misra *et al.*^[12] where maximum interns admitted that they would use CBCT in their professional dental career. Similar results were concluded by Patel *et al.*^[1] in a study, conducted among dental fraternities. Qirresh E *et al.*^[13], in his study, also mentioned that Continuing Dental Education (CDE) workshop should be conducted at regular intervals to provide information regarding CBCT. The limitation of this study was the small size population considered. Hence, the study can be done using a large population with different variables of topic in various locations of India.

Recommendations

1. More courses and seminars should be conducted for the dental

interns to update their theoretical and practical knowledge regarding newer imaging technologies Every dental student

must have a sound knowledge about CBCT and should be well aware about its practical implications and usage.

Table 1: Demographic details of study participants (N=75).

Sr. No.	Particulars	Responses	Pre-lecture		Post-lecture		Total N (%)
			N	%	N	%	
1	Age (years)	23	42	56	42	56	75 (100%)
		24	21	28	21	28	
		25	6	8	6	8	
		26	3	4	3	4	
		27	3	4	3	4	
2	Gender	Male	60	80	60	80	75 (100%)
		Female	15	20	15	20	

Note: % - percentage, N – number.

Table 2: Knowledge related questions' responses of study participants (n=75).

Sr. no.	Questions	Response	Number (N)		Percentage (%)		Total N (%)	
			Before	After	Before	After	Before	After
1.	Have you ever heard of Cone Beam Computed Tomography (CBCT)?	Yes	71	71	94.7	94.7	75 (100)	75 (100)
		No	4	4	5.3	5.3		
2.	How did you come across term CBCT?	Seminars/ Workshops	5	20	6.7	26.7	75 (100)	75 (100)
		Books and Journals	37	22	49.3	29.3		
		Lessons by faculty	27	30	36	40		
		Internet	6	3	8	4		
3.	Which of the images do you think is a CBCT image?	Figure 1A	48	55	64	73.3	75 (100)	75 (100)
		Figure 1B	4	12	5.3	16		
		Both 1A and 1B	10	6	13.3	8		
		Don't know	10	2	13.3	2.7		
4.	The effective dose is measured in which unit of measurement?	Sieverts (Sv)	30	61	40	81	75 (100)	75 (100)
		Grays (Gy)	12	5	16	6.7		
		Roentgens Equivalent Man (REM)	21	5	28	6.7		
		Roentgens (R)	12	4	16	5.3		
5.	What is the smallest 3-Dimensional element in a CBCT image, corresponding to a pixel, for a given slice thickness called as ?	Bit Depth	4	4	5.3	5.3	75 (100)	75 (100)
		Voxel	14	64	18.7	85.3		
		Vertex	9	0	12	0		
		Don't know	48	7	64	9.3		
6.	What is Digital Imaging & Communications In Medicine (DICOM) ?	A brand of CBCT scanner	6	2	8	2.7	75 (100)	75 (100)
		A protocol for management and transmission of medical images and data	21	52	28	69.3		
		A technique to translate virtual surgical plans (virtual stimulations) to surgical environment	19	7	25.3	9.3		
		Don't know	29	14	38.7	18.7		
7.	CBCT operates with the help of a software.	Yes	72	73	96	97.3	75 (100)	75 (100)
		No	3	2	4	2.7		
8.	Which of the following is a CBCT software?	Opental	2	1	2.7	1.3	75 (100)	75 (100)
		Dentrix	14	12	18.7	16		
		Carestream Dental	15	49	20	65.3		
		Don't know	44	13	58.7	17.3		
9.	What would be the best usage of CBCT in Endodontics?	Detecting the number of canals	3	2	4	2.7	75 (100)	75 (100)
		Detecting canal morphology	7	1	9.3	1.3		
		Detecting Vertical root fractures	3	2	4	2.7		
		All of the above	62	70	82.7	93.3		
10.	What would be the best usage of CBCT in Oral Surgery?	Better visualisation of relation of third molar/impacted teeth with respect to Inferior Alveolar Canal	6	4	8	4	75 (100)	75 (100)
		Implant site assessment	5	2	6.7	2.7		
		Investigation of mid-face fractures	1	0	1.3	0		
		All of the above	63	70	84	93.3		
11.	Is CBCT useful in Temporomandibular Joint Imaging?	Yes	68	34	90.7	45.3	75 (100)	75 (100)
		No	7	41	9.3	54.7		
12.	Which of the following views is	Coronal	12	4	16	5.3	75 (100)	75 (100)

	most useful in implant planning?	Saggital	13	10	17.3	13.3		
		Axial	16	1	21.3	1.3		
		All of the above	34	60	45.3	80		
13.	Which of the following views is most useful in viewing paranasal sinuses & nasal cavity?	Coronal	10	46	13.3	61.3	75 (100)	75 (100)
		Saggital	23	4	30.7	5.3		
		Axial	9	11	12	14.7		
		All of the above	33	14	44	18.7		

Table 3: Attitude and awareness related questions’ responses of study participants (N=75).

Sr. No.	Questions	Responses	Number (N)		Percentage (%)		Total	
			Before	After	Before	After	Before	After
1	CBCT will be used more often in routine dental practice in future:	Strongly Agree	20	30	26.7	40	75 (100)	75 (100)
		Agree	39	37	52	49.4		
		Neutral	11	7	14.7	9.3		
		Disagree	3	1	4	1.3		
		Strongly Disagree	2	0	2.7	0		
2	Reports and opinions by a radiologist are necessary along with a CBCT :	Strongly Agree	26	36	34.7	48	75 (100)	75 (100)
		Agree	37	31	49.3	41.3		
		Neutral	8	6	10.7	8		
		Disagree	1	0	1.3	0		
		Strongly Disagree	3	2	4	2.7		
3	CBCT is a domain that should be present in Oral Medicine and Radiology speciality only:	Strongly Agree	13	15	17.3	20	75 (100)	75 (100)
		Agree	27	28	36	37.3		
		Neutral	18	12	24	16		
		Disagree	11	17	14.7	22.7		
		Strongly Disagree	6	3	8	4		
4	Keeping the ALARA (As Low As Reasonably Achievable) principles in mind before choosing an imaging modality is of utmost importance:	Strongly Agree	35	39	46.7	52	75 (100)	75 (100)
		Agree	26	32	34.7	42.7		
		Neutral	10	4	13.3	5.3		
		Disagree	0	0	0	0		
		Strongly Disagree	4	0	5.3	0		
5	The patient should be made to wear a lead apron while taking CBCT ;	Strongly Agree	26	26	34.7	34.7	75 (100)	75 (100)
		Agree	33	40	44	53.3		
		Neutral	12	6	16	8		
		Disagree	1	0	1.3	0		
		Strongly Disagree	3	3	4	4		
6	CBCT imaging is needed in case of proximity of the third molar tooth to the inferior alveolar nerve:	Strongly Agree	21	40	28	53.3	75 (100)	75 (100)
		Agree	40	29	53.3	38.7		
		Neutral	11	4	14.7	5.3		
		Disagree	0	0	0	0		
		Strongly Disagree	3	2	4	2.7		
7	Seminars/Workshops can enhance our knowledge on CBCT:	Strongly Agree	32	42	42.7	56	75 (100)	75 (100)
		Agree	33	27	44	36		
		Neutral	8	6	10.7	8		
		Disagree	0	0	0	0		
		Strongly Disagree	2	0	2.7	0		

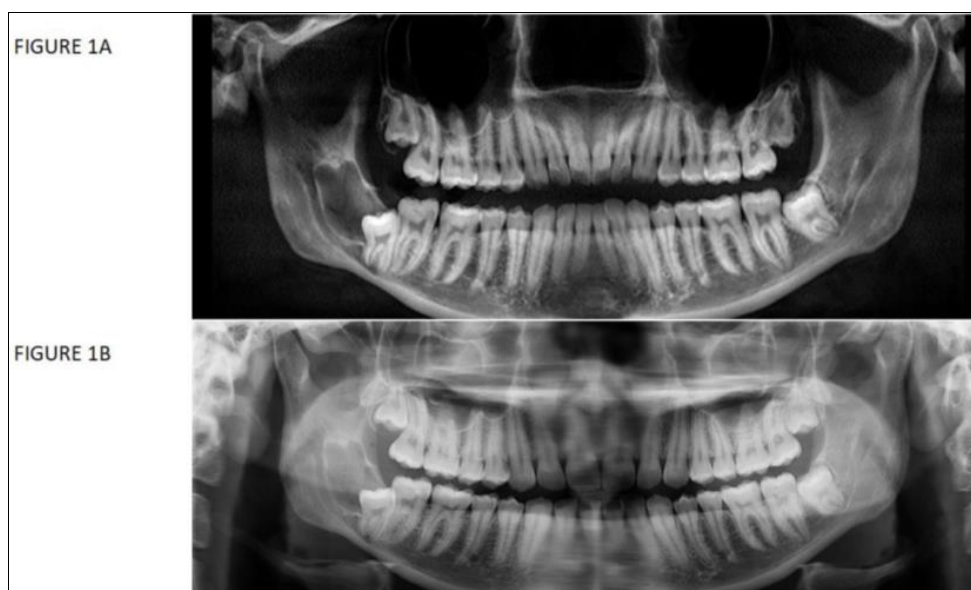


Fig 1: Cone Beam Computed Tomography (CBCT) and panoramic images used in Question No.3

Conclusion

In this study majority of the participants were well aware of the term CBCT and had positive attitude towards it. However, they did lack the basic knowledge regarding CBCT and when an awareness lecture was conducted for the same, it yielded positive results, indicating that more of educational courses and seminar should be conducted to update their theoretical and practical knowledge regarding CBCT and other imaging techniques.

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