

Dental students' knowledge and attitude towards cone-beam computed tomography: An Indian scenario

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ABSTRACT

Background: Cone-beam computed tomography (CBCT) is an upcoming imaging modality in field of dentistry with promising outcomes.

Aim of the Study: To assess the dental student's knowledge and attitude regarding CBCT in K. M. Shah Dental College and Hospital as they are future practitioners.

Methodology: An anonymous questionnaire consisting of 11 questions was distributed among 320 dental students which included final BDS students, interns, and postgraduate students. Descriptive statistics was used to analyze the responses of the participants, and Chi-square test was applied to statistically evaluate the differences in the responses according to the education level.

Results: Totally, 96.9% response rate was achieved. All the students had heard of CBCT used for dental practice. The majority of them gained knowledge about CBCT through faculty lessons. Lower radiation dose was given as the most important advantage of CBCT over medical computed tomography. Many of the students thought that CBCT should be taught during clinical phase of their education, and there is necessary for CBCT unit at dental faculties. More than half of the students believed that the use of CBCT would become more widespread in the near future, and they aspire to use CBCT technology in their future careers.

Conclusion: Seeing the positive attitude, it was concluded that the students' should be provided with thorough practical knowledge and efforts should be made to improve their concepts regarding CBCT.

Key words: Attitude, cone-beam computed tomography, dentistry, knowledge, radiology

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The introduction of cone-beam computed tomography (CBCT) for dentomaxillofacial region has provided a novel platform for diagnosis and treatment planning. In the past decade, it is probably the most revolutionary innovation in the field of dentistry that provides opportunities to the dentist to diagnose in three dimensions. It provides real-time multidimensional images that have expanded the role of imaging from diagnosis to image guidance of operative and surgical procedures as well as for postoperative assessment.^[1,2]

As CBCT is the future of dentistry for diagnosis, treatment planning, and posttreatment evaluation, there should be a thorough theoretical and practical knowledge of CBCT among dental students who are the future clinicians. Hence, the present study was undertaken to evaluate the dental (undergraduate and postgraduate) students' knowledge and attitude regarding CBCT and also to evaluate the need of efforts to be made to further improve the students' knowledge base regarding this promising new technology.

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METHODOLOGY

The study was conducted in K. M. Shah Dental College and Hospital, Sumandeep Vidyapeeth University, Vadodara, Gujarat, India. A validated questionnaire was adopted from the study conducted by Kamburoglu *et al.*^[3] The related approval was obtained from the corresponding author for adopting the questionnaire and from the Institutional Ethics Committee, Sumandeep Vidyapeeth University. The questionnaire consisted of eleven questions and was anonymous.

The knowledge and attitude of total 310 (193 females, 117 males) dental students was surveyed. The study groups were consisting of 97 (75 females, 22 males) IVth year BDS students, 96 (75 females, 21 males) interns, and 117 (43 females, 74 males) postgraduate students (PGs) from all nine specialties of dentistry.

The collected data were analyzed by a International Business Machine Corporation, Statistical Package for Social Sciences Version 19.0 (IBM SPSS v. 19.0). The data analysis was performed according to descriptive statistics which is presented as frequencies (*n*) and percentages (%). The significance of differences in the responses depending on the education level was determined by Chi-square test (the level of significance was set at $p < 0.05$).

RESULTS AND OBSERVATIONS

Response rate

Totally, 320 questionnaires were distributed to the students, out of which 310 students responded and returned the filled questionnaire (response rate: 96.7%). No significant difference was found according to the gender of the participants for any of the questions. However, there was a significant difference depending on the level of education for most of the questions ($p < 0.05$).

Awareness about cone-beam computed tomography

All the participants (100%, $n = 310$) were aware about the use of CBCT in dentistry irrespective of education level.

Source of knowledge

Majority (74.19%) of the students obtained the knowledge of CBCT in their classes. However, there was statistically significant difference ($p = 0.01$) between the answers of UGs (67.01%), interns (73.95%), and PGs (57.26%). Almost half of the PGs, but more than half of UGs and interns told that they have learned about CBCT by faculty lessons. In addition, 25.16% of participants learned about CBCT by seminars and 29.67% of them through the internet, with statistically significant differences ($p = 0.01$) in the responses of UGs, interns, and PGs. Other sources of information included textbooks, conferences, and through patient's reports (5.16%) [Table 1].

Advantages of cone-beam computed tomography

Lower radiation dose was cited as the most important advantage of CBCT over medical computed tomography (CT) (45.16%, $n = 140$) and less space occupied by it was the least important advantage (2.58%, $n = 08$), cited by the participants. Although 19.68% ($n = 61$) participants were not aware about the advantages of CBCT. Here also, there was a statistically significant ($p = 0.01$) difference between the responses according to education level. More than half of the PGs (56.41%, $n = 66$) were in favor of lower radiation dose being the most common advantage as compared with 42.7% ($n = 41$) and only 34.02% ($n = 33$) IVth year students [Table 2].

Extent of cone-beam computed tomography use in near future

Half of the participants (49.35%, $n = 165$), comprising 50.52% ($n = 49$) IVth year BDS students, 44.79% ($n = 43$) interns, and 52.14% ($n = 61$) PGs, believed that CBCT

Table 1: Source of knowledge

Education level	How did you obtain information regarding CBCT?			
	Faculty lessons (%)	Seminars (%)	Internet (%)	Others (%)
IV th year	65 (67.01)	21 (21.65)	27 (27.84)	5 (5.15)
Internship	71 (73.95)	13 (13.54)	23 (23.96)	0
Postgraduate	67 (57.26)	44 (37.61)	42 (35.89)	11 (9.40)
Total	203 (74.19)	78 (25.16)	92 (29.67)	16 (5.16)

CBCT=Cone-beam computed tomography

Table 2: Advantages of cone beam computed tomography

Please number the following advantages of CBCT over medical CT form the most important to least important	IV th year (%)	Internship (%)	Postgraduate (%)	Total (%)
Lower radiation dose	33 (34.02)	41 (42.7)	66 (56.41)	140 (45.16)
Shorter scanning time	2 (2.06)	6 (6.25)	7 (5.98)	15 (4.84)
Less expensive	21 (21.65)	11 (11.46)	6 (5.13)	38 (32.48)
Occupies less space	0	3 (3.13)	5 (4.27)	8 (2.58)
Easier to maintain	3 (3.09)	5 (5.21)	5 (4.27)	13 (11.11)
Image processing is easier	2 (2.06)	7 (7.29)	4 (3.42)	13 (11.11)
Data reconstruction can be performed on PC	8 (8.25)	8 (8.33)	5 (4.27)	21 (17.95)
No idea	28 (28.87)	15 (15.63)	18 (15.38)	61 (19.68)

CBCT=Cone-beam computed tomography, CT=Computed tomography, PC=Personal computer

would be commonly used in routine dental practice. 20.32% ($n = 63$) participants believed that it will not be commonly used and 19.35% ($n = 60$) participants suggested that CBCT will be used exclusively for selective dental applications. The selective applications suggested were disimpaction, implants, trauma cases, endodontic procedures, orthodontic procedures, and for the cases which are difficult to diagnose by routine radiographic techniques. The opinion regarding these selected dental applications differed significantly among the groups ($p = 0.028$). A few participants (10.97%, $n = 34$) did not have any idea regarding the extent of the use of CBCT [Table 3].

Education of cone-beam computed tomography

Majority (69.68%, $n = 216$) of the participants told that their faculty provides adequate education regarding CBCT. Yet, there was a significant difference ($p = 0.000$) between responses of the participants. Majority of IVth year BDS students (81.44%, $n = 79$) and PGs (73.5%, $n = 86$) but only half of the interns (53.12%, $n = 51$) believed that the faculty provides adequate education of CBCT. 20% ($n = 62$) participants thought that the knowledge provided is inadequate and the main reason for this was lack of practical exposure.

Incorporation of cone-beam computed tomography in dental curriculum

A majority of the participants (74.84%, $n = 232$) thought that the education of CBCT should be provided during their clinical phase of the study in contrast to only a few participants who felt that it should be taught during preclinical phase (8.06%, $n = 25$) and doctoral phase (15.48%, $n = 48$). 1.93% ($n = 6$) of participants did not think for the need of education related to CBCT. While 90.72% IVth year BDS students felt that CBCT should be taught in clinical phase, 22.22% PGs were in favor of CBCT education during doctoral phase ($P = 0.00$) [Table 4].

Need of cone-beam computed tomography

Almost all the participants (90.64%, $n = 281$) felt the need for a CBCT unit at their dental faculty including 89.6% ($n = 87$) IVth year BDS students, 89.58% ($n = 86$) interns, and 92.3% ($n = 108$) PGs.

Attitude toward cone-beam computed tomography

The majority of participants (73.87%, $n = 229$) desired to use CBCT in their future dental practice. Only a few (10.32%, $n = 32$) told that they did not look forward to using this modality in their future professional career while 15.8% ($n = 49$) had no idea about this. There was no statistically significant difference between the responses according to the education level ($p = 0.44$).

Indications of cone-beam computed tomography

The most common indication for the use of CBCT was given as cyst and tumor cases (27.09%) followed by implants (26.45%), disimpaction (11.94%), and orthodontic assessment (9.35%). The other uses suggested were endodontic procedures, periodontic procedures, temporomandibular joint (TMJ) disorders, and to detect root fractures. There was statistically significant difference between the responses of IVth year BDS students, interns, and PGs ($p = 0.005$) [Table 5].

DISCUSSION

Due to numerous advantages and brilliant outcomes, the utility of CBCT in dental practice is increasing worldwide. In countries in Europe^[4] and in America,^[5] specific guidelines are also issued by their dental councils. As CBCT is a recent and emerging modality with availability of only a small number of units in India, its use is not widely accepted by the dental practitioners till date.^[6]

When compared to conventional CT scanners, CBCT reduces the effective dose of radiation up to 98%.^[7] Instead of pixels, the image is displayed in isometric voxels which provides

Table 3: Extent of cone beam computed tomography use in near future

Education level	To what extent do you think CBCT will be used in routine dental practice in near future?			
	In all areas of dentistry (%)	For selected dental applications (%)	It will not commonly used (%)	No idea (%)
IV th year	49 (50.52)	12 (12.37)	19 (19.59)	17 (17.53)
Internship	43 (44.79)	19 (19.79)	22 (22.91)	12 (12.5)
Postgraduate	61 (52.14)	29 (24.79)	22 (18.8)	5 (4.27)
Total	153 (49.35)	60 (19.35)	63 (20.32)	34 (10.97)

CBCT=Cone-beam computed tomography

Table 4: Incorporation of cone-beam computed tomography in dental curriculum

Education level	Which year of dental education should include lectures on CBCT?			
	Preclinical phase (%)	Clinical phase (%)	Doctoral phase (%)	There is no need (%)
IV th year	5 (5.15)	88 (90.72)	4 (4.12)	0
Internship	14 (14.58)	63 (65.62)	18 (18.75)	1 (1.04)
Postgraduate	6 (5.13)	81 (69.23)	26 (22.22)	5 (4.27)
Total	25 (8.06)	232 (74.84)	48 (15.48)	6 (1.93)

CBCT=Cone-beam computed tomography

Table 5: Indications of cone beam computed tomography

For what cases you choose to use CBCT in your future clinical dental carrier?	IV th year (%)	Internship (%)	Postgraduate (%)	Total (%)
Implant dentistry	22 (22.68)	17 (17.70)	43 (36.75)	82 (26.45)
Extraction of impacted teeth	12 (12.37)	7 (7.29)	18 (15.38)	37 (11.94)
Evaluation of patients with cyst and tumors	31 (31.96)	22 (22.68)	31 (26.5)	84 (27.09)
Orthodontic assessment	8 (8.25)	7 (7.29)	14 (11.97)	29 (9.35)
All of the above	54 (55.67)	65 (67.71)	55 (47.01)	174 (56.12)
Other	0	1 (1.04)	8 (6.84)	9 (2.9)
No need	2 (2.06)	1 (1.04)	0	3 (0.97)

CBCT=Cone-beam computed tomography

high resolution, accuracy, and reproducibility to CBCT images.^[8] The other advantages include beam limitation, shorter scanning time, minimum patient discomfort, and reduced image artifact.^[1,2] The compact size, relatively lower cost when compared with medical CT and easy maintenance makes it suitable for dental clinics.^[8] However, drawbacks of CBCT include beam hardening, scatter from dental materials, and poor soft-tissue contrast.^[9]

CBCT is useful in almost all areas of dentistry. The indications of CBCT include implant dentistry, evaluation of jaws for cysts and tumors, orthodontics, TMJ examination, paranasal sinus examination, assessment of third molars, and its relation to mandibular canal before disimpaction, trauma cases, and endodontics.^[10,11] Seeing the high accuracy in diagnosis, usefulness in treatment planning and having a long list of advantages and indications in the field of dentistry, CBCT is the future of dentistry for diagnosis, treatment planning, and posttreatment evaluation.

In recent times, the knowledge- and attitude-based studies in the field of oral and maxillofacial radiology are mainly based on digital imaging^[12,13] and trends on radiographic prescriptions.^[6,14] There is only one study^[15] which surveys the awareness and attitude of dental practitioners regarding CBCT in India, which concluded that more knowledge is required for dental practitioners about CBCT. In India, although the numbers of CBCT units are increasing in private sectors, the appropriate use of CBCT is possible only if dentists and dental students have adequate knowledge about it.

All the dental colleges in India come under one statutory body, the Dental Council of India (DCI). As per this statutory body regulation,^[16] all the dental colleges should follow the DCI-specified curriculum, should have prescribed technical and clinical requirements and should follow the same examination pattern. As per DCI specifications,^[17] BDS curriculum includes only one theory hour to educate the students regarding the specialized radiographic technique, and CBCT is taught as a part of it. DCI has still not made the CBCT scanner as mandatory equipment in its technical and clinical requirements. Due to this reason and also due to the cost factor involved in the installation of CBCT scanner, many dental colleges in India are presently not

having a CBCT unit. Hence, in India, the postgraduate dental radiology courses and undergraduate dental radiography teaching are presently providing adequate training in two-dimensional intraoral radiography, panoramic imaging, and other skull imaging modalities. As a result, many of the dentists who are passing out may have limited knowledge about CBCT. Currently, many private imaging centers have installed CBCT scanner units. However, with limited theoretical and practical exposure to the dentists, the benefit from this new technology may not profit the patients. Hence, the present study was focused to gather the information regarding dental students' approach to this promising new imaging modality.

In the present study, the students were broadly categorized into three groups: (i) Final BDS students who are learning and developing their clinical skills, (ii) interns who are about to begin their professional careers, and (iii) postgraduates who are specializing their proficiencies. The different phases of learning were thought to affect their knowledge and attitude toward the upcoming trends in the field of dentistry. The positive aspect was that all the participants, irrespective of their level of study, had at least some idea regarding the use of CBCT for dentomaxillofacial region.

Statistically significant differences were noticed in responses to almost all the questions as per the level of education. To begin with, the source of information was limited to faculty lecture for most of the UGs whereas multiple sources were available for the PGs in addition to their classes. Horizons of knowledge were also becoming wider according to the education level when the knowledge regarding advantages and extent of use of CBCT was tested. As the PGs are more exposed to the recent advancements through seminars, workshops, and training programs, their knowledge was found to be sounder than that of the undergraduates.

There was adequate number of participants in each group who said that the knowledge provided to them was not adequate. When depth of their knowledge was analyzed, many answers were suggestive of quite superficial knowledge of the students. The lack of practical exposure was reflected as the main cause for limited knowledge of the students. As an answer to one question, all the students have unanimously showed their desire to have CBCT unit in their faculty, irrespective of their

education level. Furthermore, the time allotment for teaching this newer technique should be increased.

In our study, all the participants had heard about CBCT used in dental practice. The study conducted by Dölekoglu *et al.*^[18] showed that 56% of the general dentists had knowledge and 30% of them had referred their patients for CBCT. Another study conducted by Yalcinkaya *et al.*^[19] evaluating knowledge and attitude of endodontists demonstrated that 66.7% of the endodontists had knowledge about CBCT and 41.9% of them had referred their patients for CBCT. In both of these studies,^[18,19] lower radiation dose was given as the most important advantage of CBCT over CT. This result was similar to our study. The general dentists gave implant planning as a most common indication followed by the evaluation of cyst and tumors.^[18] While in our study, evaluation of cyst and tumors was given as most important indication followed by implant dentistry.

When the attitude of the students was evaluated, many positive and encouraging responses were obtained. Most of the students wanted to learn about CBCT as a part of their clinical practice, and many of them were looking forward to adopt this newer modality as a part of their future professional career.

CONCLUSION

CBCT is a potential imaging modality to bring a new era in the world of imaging science. It has many advantages over medical CT and it overcomes many limitations of the same. In the present study, we found that due to lack of practical exposure, the dental students are unaware of its potential benefits and usefulness. Even though all of the students had heard about CBCT in dental practice, when evaluated in depth, it was found that their knowledge regarding CBCT is very much of theoretical aspect and is superficial. A similar type of survey needs to be conducted among students of different colleges across the country to evaluate the knowledge regarding this new technology. The statutory body and the universities should make efforts to provide a CBCT unit in the radiology department. The curriculum should be revised and more theory time should be allotted to allow in-depth teaching of CBCT to the students.

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Conflicts of interest

There are no conflicts of interest.

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