

Cone-beam Computed Tomography in Dentistry Students' and Interns' Perspective in Abha, Saudi Arabia

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Abstract

Objective: The objective of the study was to assess the perspective of dental students and interns towards various aspects of cone-beam computed tomography (CBCT).

Materials and Methods: A cross-sectional study was conducted among the 5th year students, final year students, and interns of College of Dentistry, King Khalid University, Abha. A convenient sample of 380 students was taken for the study. A valid, reliable slightly modified questionnaire having 11-items was used. The two sections of the questionnaire consisted of questions related to demographic data such as gender and academic level in the first and questions related to CBCT in the second section. Students who were aware of CTBT use in dentistry were included in the study whereas those unaware of its use were excluded from the study.

Results: When subjects were asked whether they were aware of CBCT use specifically for dentistry; 68% were aware while 32% did not know about it. The findings of our study showed that 49.48%, 58.7%, and 80% of the 5th year, final year students, and interns, respectively, believed that lower radiation dose was the most important advantage of using CBCT over medical CT. Majority of the study subjects would choose CBCT in procedures such as implants, extraction of impacted teeth, evaluation of patient's cysts/tumors, and orthodontic assessment. On comparing the responses of the three groups, a statistically significant difference was found.

Conclusions: Although a majority of students and interns were aware of the use of CBCT in dentistry, still 32% were unaware about it. CBCT is a potential imaging modality to bring a new era in the world of imaging science. It has many advantages over medical CT as it overcomes many limitations of the same.

Key words: Advantage, Cone-beam computed tomography, Dental students, Imaging

INTRODUCTION

In dentistry, radiographs have been availed of as an important diagnostic tool to detect various oral diseases.^[1] Although intraoral periapical radiographs detect the pathologies of hard and soft oral tissues, the gross deficiency remains with these radiographs in the sense that

they do not differentiate between cysts, tumors, abscesses, etc., which has been made possible by the application of computed tomography (CT).^[2] It (CT) has been developed long back in 1967 by Sir Godfrey Hounsfield, and since then, it has undergone significant advances.^[3] Cone-beam CT (CBCT) is relatively new technology of digital dentistry that gives three-dimensional images of teeth and jaws. The method of gathering data in CBCT makes it quite different from CT, wherein rows of detectors are used, whereas in case of CBCT the whole section of patient is exposed over one detector from which the data then generates the individual slice images. The data of area of interest are obtained through a single rotation of the conical X-ray beam and reciprocal image receptor, by back-projection reconstructed tomography of CBCT scanners.^[4]

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There is a considerable increase in practical use of CBCT in various fields of dentistry due to its spectrum of varied functions: It is used for diagnosis and treatment plan of nerve tracing in cases of third molar extraction and is a highly useful tool in (a) implant placement, (b) maxillofacial surgeries, (c) pathologies of sinus, (d) endodontics for locating additional roots and accessory canals, (e) detecting vertical root fractures, (f) orthodontic cases, (g) orthognathic surgeries, (h) evaluating cysts, tumors, and temporomandibular joint (TMJ) disorders, and (i) forensic dentistry as well.^[5-7]

The advantages of CBCT include less radiation dose, smaller space to accommodate the apparatus, rapid scan time, and multi-planner visualization of dentist's area of concern.^[8,9]

However, the use of CBCT is beneficial in real sense and optimal degree only if the interpretation of its scans is done aptly and efficiently, otherwise, if wrongly interpreted by untrained professionals, it plunges us to arriving at false diagnosis or missed lesions.^[10]

Since its applicability in dental clinics is increasing manifold day by day, the precisely meticulous theoretical as well as practical knowledge and wholesome awareness toward various aspects of CBCT are indispensably important to be ideally achieved by dental students; of course, it would be beneficial in turn for them throughout their professional career ahead.

With this aim in mind, a study was conducted at King Khalid University Abha, Saudi Arabia, to assess perspective of dental students and interns towards various aspects of CBCT.

MATERIALS AND METHODS

A cross-sectional study was conducted among the 5th year students, final year students, and interns of College of Dentistry, King Khalid University, Abha. Before the conduct of the study, Ethical Approval was taken from Scientific Research Committee, King Khalid University. All students of the 5th year, final year, and interns of bachelor dental surgery program who were willing to participate were included in the study. A convenient sample of 380 students was taken for the study. A valid, reliable, slightly modified questionnaire (Appendix 1) having 11 items was taken from the previous study conducted by Kamburoglu *et al.*^[11] after taking researcher's permission. The two sections of the questionnaire consisted of questions related to demographic data such as gender and academic level in the first and questions related to CBCT in the second section. Students who were aware of CBCT use in dentistry were included in the study, whereas those unaware of its use were excluded from the study.

The confidentiality of the responses was assured to the participants. The duly filled questionnaires were collected on the same day so that students do not take the help from experts in the field of radiology, which would otherwise influence their responses resulting in bias.

The data, thus obtained were put to statistical analysis using SPSS version 19. Descriptive statistics for frequency and percentages were done. The comparison of responses between dental students and interns was done using Chi-square test; $P \leq 0.05$.

RESULTS

Out of the total 380 study participants; 149 were studying in the 5th year, 157 students belonged to final year, and 74 were doing internship [Figure 1]. 251 were male students and 129 were female subjects. When subjects were asked whether they have heard about CBCT used specifically for dentistry; 68% had heard about it while 32% did not know about it [Figure 2]. The results of the present study showed that majority of the 5th year (around 50%) and final year (86.95%) dental students obtained the information regarding CBCT from the didactic lectures while the majority of interns (74.29%) gained information regarding CBCT from seminars. The responses of students (5th and final year) and interns for Q2 and Q4 are shown in Table 1.

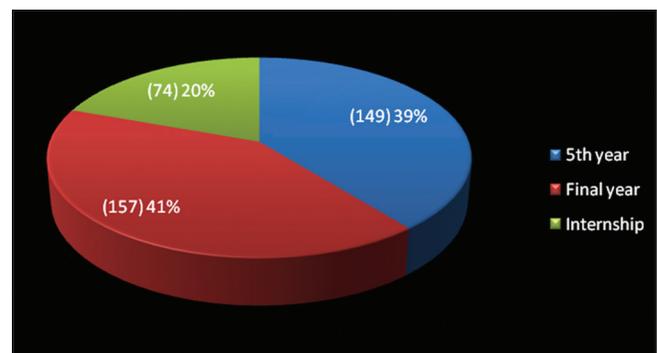


Figure 1: Frequency distribution of study subjects as per the academic year of bachelor of dental surgery program

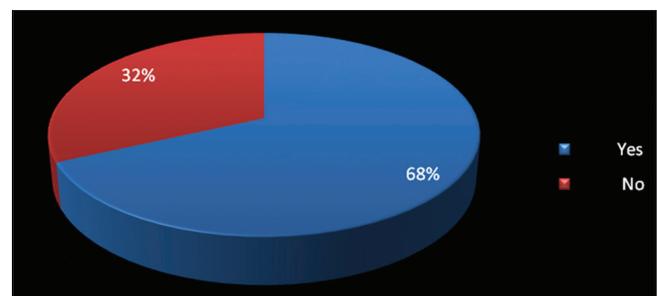


Figure 2: Frequency distribution of subjects when asked whether they have heard of cone beam computed tomography used specifically for dentistry

49.48%, 58.7%, and 80% of the 5th year, final year students, and interns, respectively, believed that lower radiation dose was the most important advantage of using CBCT over medical CT [Table 2]. The frequency distribution of students and interns as per their responses to Q5, Q6, and Q7 is given in Table 3. Majority of the study subjects would choose CBCT in various procedures such as implants, extraction of impacted teeth, evaluation of patient's cysts/ tumors, and orthodontic assessment [Table 4].

DISCUSSION

In the process of conducting the present study, the subjects were inquired as to whether they had heard of CBCT used specifically for dental procedures: Around 68% of them responded positively while 32% said of never having heard about it; whereas in case of the previous study

conducted by Kamburoglu *et al.*,^[11] it is stated to be found that <50% of the students had heard about CBCT. The students nowadays are becoming more inquisitive about new technologies, have well-equipped clinics and hospitals and possess internet facilities to gain more updated information; these are evidently the primary reasons for majority of the students reported in the present study as being aware about CBCT.

The results of the present study show that majority of the 5th year (around 50%) and final year (86.95%) dental students obtained their information regarding CBCT from didactic lectures while the majority of interns (74.29%) reported that they gained information regarding CBCT from seminars. These findings are similar to the previous study wherein majority of students gained their knowledge about CBCT during their classes;^[12] the obvious reason is that dental students are taught by the faculty in their classes

Table 1: Frequency distribution of subjects as per responses to Q2 and Q4

| | Q2. How did you obtain information regarding CBCT? | | | Q4. To what extent do you think CBCT will be used in routine dental practice in the near future? | | | |
|----------------------|--|-------------------|-------------------|--|---|--|------------------|
| | Didactic lectures n (%) | Seminars n (%) | Internet n (%) | In all areas of dentistry n (%) | For selected dental applications n (%) | Not commonly used in routine practice n (%) | No idea n (%) |
| 5 th year | 78 (49.48) | 4 (4.12) | 52 (53.60) | 16 (16.49) | 11 (11.34) | 18 (18.55) | 97 (100.0) |
| Final year | 80 (86.95) | 10 (12.5) | 50 (54.34) | 21 (22.82) | 6 (6.52) | 15 (16.34) | 92 (100.0) |
| Interns | 3 (4.29) | 52 (74.29) | 57 (81.43) | 10 (14.28) | 2 (2.86) | 1 (1.43) | 70 (100.0) |
| | Chi-square statistic is 155.6585. $P \leq 0.00001$ | | | Chi-square statistic is 22.4105. $P = 0.00102$ | | | |

CBCT: Cone beam computed tomography

Table 2: Frequency distribution of subjects as per their responses to Q3

| Q3. According to you, which is the most important advantage of CBCT over medical CT? | n (%) | | |
|--|----------------------|------------|------------|
| | 5 th year | Final year | Interns |
| Lower radiation dose | 48 (49.48) | 54 (58.70) | 56 (80.00) |
| Shorter scanning time | 8 (8.25) | 13 (14.13) | 6 (8.57) |
| Less expensive | 6 (6.19) | 8 (8.70) | 1 (1.43) |
| Occupies less space | 14 (14.43) | 10 (10.87) | 2 (2.86) |
| Easier to maintain | 8 (8.25) | 3 (3.26) | 3 (4.29) |
| Image processing is easier due to the limited beam | 7 (7.22) | 2 (2.17) | 1 (1.43) |
| Data reconstruction can be performed on a personal computer | 6 (6.19) | 2 (2.17) | 1 (1.43) |
| Total | 97 (100.0) | 92 (100.0) | 70 (100.0) |

Chi-square statistic is 33.0. $P \leq 0.001$. CBCT: Cone beam computed tomography, CT: Computed tomography

Table 3: Frequency distribution of subjects as per their responses to Q5, Q6, and Q7

| Q6. Which year of dental education should include lectures on CBCT? | Q5. Does your faculty provide adequate education regarding CBCT? | | Q7. Do you think it is necessary for a dental CBCT unit to be available at your faculty? | | |
|---|--|----------------|--|---------------------------------|------------|
| | Preclinical phase | Clinical phase | Internship | Yes | No |
| Students | 71 (37.57) | 97 (51.32) | 21 (11.11) | 104 (55.03) | 85 (44.97) |
| Interns | 4 (5.71) | 47 (67.14) | 19 (27.14) | 48 (49.48) | 22 (22.68) |
| | Chi-square is 28.6967. $P \leq 0.00001$ | | | Chi-square is 3.86. $P = 0.049$ | |
| | | | | Chi-square is 5.72. $P = 0.016$ | |

CBCT: Cone beam computed tomography

Table 4: Frequency distribution of subjects as per their responses to Q9

| Q9. For what cases would you choose to use CBCT in your future clinical dental career? | n (%) | | |
|--|----------------------|------------|------------|
| | 5 th year | Final year | Interns |
| Implant dentistry | 14 (14.43) | 12 (13.04) | 1 (1.43) |
| Extraction of impacted teeth | 18 (18.56) | 2 (2.17) | 1 (1.43) |
| Evaluation of patients with tumors or cysts | 20 (20.62) | 25 (27.17) | 5 (7.14) |
| Orthodontic assessment | 7 (7.22) | 2 (2.17) | 10 (14.29) |
| All of the above | 35 (36.08) | 51 (55.43) | 53 (75.71) |
| No need | 3 (3.09) | 0 (0.00) | 0 (0.00) |
| Total | 97 (100.0) | 92 (100.0) | 70 (100.0) |

Chi-square statistic is 61.8. $P \leq 0.00001$. CBCT: Cone beam computed tomography

so as to become aware of it. During internship, interns get the opportunity to read detailed information about the given topic(s) for seminar presentation, and thereby they get more acquainted to the recent advances in dental technology.

The findings of our study showed that 49.48%, 58.7%, and 80% of the 5th year, final year students, and the interns, respectively, believed that lower radiation dose was the most important advantage of using CBCT over medical CT. These results corroborated with the findings of previous research results wherein majority of students and interns offered same response insofar radiation dose is concerned.^[13] It is mentioned in other previous research that CBCT is a scanning system with low dose for generating the three-dimensional images of maxilla-facial structures;^[14,15] whereas CT captures large sections within no time but with high radiation dose.^[4] Reports from published literature reveal that the effective dose of radiation (average range 36.9–50.3 microsievert [μSv])^[16] is significantly reduced to as much low as 98% in comparison to that in case of “conventional” fan-beam CT systems (average range for mandible 1320–3324 μSv ; average range for maxilla 1031–1420 μSv).^[17] It has been well documented in previous studies that the lower radiation dose of X-rays, different image generation and reconstruction of sagittal and coronal views make it convenient to use CBCT in various dental procedures.^[18,19] Moreover, in the present study, shorter scan time was considered as to be the second most important advantage of using CBCT. Shorter scan time, patient compatibility, diminished image artifact,^[20,21] less expensive, and easy maintenance^[22] have all been recognized as certain advantages of CBCT in previous studies, notwithstanding the fact that it bears the disadvantages of beam hardening, poor soft tissue contrast, and scatter from dental materials as well.^[23]

The results of the present study depict that around 47% of the 5th year dental students, 43.48% of final year, and 31.48% of interns believed that their faculty did not provide adequate education to them about CBCT. Most

probably, the reason might be unavailability of the CBCT unit in the college, where the study was undertaken; and so imparting due to knowledge gets limited to theory only. Obviously, installation of CBCT units would make it possible for the faculty to provide better knowledge practically, in addition to its theoretical part. This finding calls for a considerate attention and action; so that students get satisfactory and useful knowledge regarding the same.

Majority of students (51.32%) and interns (67.14%) thought that the lectures on CBCT should be included in dental curriculum at the beginning of clinical phase. The findings match with those of the previous study done among dental students by Kamburoglu *et al.*^[11]

Moreover, 70.10% of the 5th year students, 76.02% of final year students, and 87.14% of interns believed the CBCT units are to be necessarily made available at their faculty. Unavailability of CBCT units in the dental college makes process of understanding the functions quite difficult for the students who thus genuinely wish to have CBCT units so that the faculty can impart better teaching, and thus they (students and interns) are well acquainted with its practical know-how which could be harnessed by them appropriately in their professional carriers ahead.

The findings of the current study show that around 53.6% of the 5th year dental students would choose CBCT in their clinical practice in future while 46.39% of them would not use it in future. Such results are indicative of the dilemma about convenience and efficacy of using CBCT by students since they lack the perfect knowledge about the same. On the other hand, the majority (68.57%) of interns was of the opinion of using CBCT in their professional career which might be due to more awareness and confidence among them regarding the same.

75.71% of interns, 55.43% of final year students, and 36.08% of the 5th year students thought that CBCT could be used in all procedures such as implant dentistry, extraction of impacted teeth, and evaluation of patients with tumors or cysts and orthodontic assessment. In the previous study, most of the students believed that CBCT is intended for implant dentistry.^[11] The vast scope for the use of CBCT includes surgical assessment of pathology of jaw, diagnosis of TMJ disorders,^[24] evaluation of growth and development,^[25] pre- and post-operative assessment of facial structures,^[26] and implant planning.^[27]

Recommendations

1. This high-quality imaging technology should indispensably be adopted by dentists during their procedures.

- Dental students should be provided with appropriate CBCT education supported by practical experience at the very formative stages of their education/training.
- CBCT units need necessarily to be made available at all the oral radiology departments.
- Explicit, detailed, and most updated information regarding CBCT should be included in the dental radiology curriculum.
- This study concludes with due thrust laid on the need that Continuing Dental Education programs and workshops are imperative to be organized on a routine basis to update knowledge of the faculty members.

CONCLUSIONS

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 were not fully aware of its potential benefits and usefulness. Overall, 68% of students had heard about CBCT in dental practice; when evaluated in depth, it was found that their knowledge regarding CBCT is mostly of theoretical aspect.

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APPENDIX 1

1. Questionnaire

Gender

1. Male (...)
2. Female (...)

Education level:

1. 5th year (...)
2. Final year (...)
3. Internship (...).

Q1. Have you heard of cone beam computed tomography (CBCT) used specifically for dentistry?

1. Yes (...)
2. No (...).

(The remaining questions were asked only of the subjects who responded “Yes” to Q1).

Q2. How did you obtain information regarding CBCT?

1. Didactic lectures (...)
2. Seminars (...)
3. Internet (...).

Q3. According to you which is the most important advantages of CBCT over medical CT?

1. Lower radiation dose (...)
2. Shorter scanning time (...)
3. Less expensive (...)
4. Occupies less space (...)
5. Easier to maintain (...)
6. Image processing is easier due to the limited beam (...)
7. Data reconstruction can be performed on a personal computer (...).

Q4. To what extent do you think CBCT will be used in routine dental practice in the near future?

1. In all areas of dentistry (...)
2. For selected dental applications (...)

3. It will not be commonly used in routine practice (...)
4. No idea.

Q5. Does your faculty provide adequate education regarding CBCT?

1. Yes (...)
2. No (...).

Q6. Which year of dental education should include lectures on CBCT?

1. Preclinical phase (...)
2. Clinical phase (...)
3. Internship (...).

Q7. Do you think it is necessary for a dental CBCT unit to be available at your faculty?

1. Yes (...)
2. No (...).

Q8. Would you choose to use CBCT in your future professional career?

1. Yes (...)
2. No (...).

Q9. For what cases would you choose to use CBCT in your future clinical dental career?

1. Implant Dentistry (...)
2. Extraction of impacted teeth (...)
3. Evaluation of patients with tumors or cysts (...)
4. Orthodontic assessment (...)
5. All of the above
6. No need.