DENTAL PROFESSION STUDENT KNOWLEDGE ON CBCT AT FACULTY OF DENTISTRY UNIVERSITAS SUMATERA UTARA

Cek Dara Manja, Syifa Nabila Ramadhani Siregar

Department of Dental Radiology, FKG Universitas Sumatera Utara
e-mail: cek@usu.ac.id

KEYWORDS	ABSTRACT
Cone-Beam computed tomography, dental profession student, three-dimensional radiography	Cone-beam computed tomography (CBCT) is a three-dimensional radiographic imaging method that offers accurate data on the structure of hard tissues. The aim of this study was to estimate the CBCT knowledge level held by dental profession student at the Faculty of Dentistry, Universitas Sumatera Utara. The design of this study was a cross-sectional descriptive-analytic study using a questionnaire for collecting the data. The study included 385 dental profession student from the class of 2017, 2018, 2019, 2020, and 2021. The results showed that the percentage of students correctly identifying CBCT as a form of ionizing radiation radiography and CBCT's advantages over conventional CT was 52.2% and 48.1%, respectively. The percentage of students correctly identifying CBCT hardware 45.2%, CBCT con angle 64.4%, patient preparation 38.4%, and patient position was 36.6%, while only 24.2% of students correctly answered CBCT acquisition time. The study's findings concluded that the knowledge of dental profession student in the Faculty of Dentistry, Universitas Sumatera Utara, could be categorized into three levels: good (11.2%; 43 students), sufficient (21.8%; 84 students), and poor (67.0%; 258 students).

INTRODUCTION

Radiographic imaging transitioned from two-dimensional to three-dimensional images following the discovery of X-rays in 1895. One dento-maxillofacial imaging technique that generates three-dimensional images is cone-beam computed tomography (CBCT). CBCT imaging improves the accuracy of disease diagnosis, the standard of healthcare services by a better treatment planning, and patient radiation exposure while requiring less time.[1]

Since it can produce three-dimensional images of the teeth and mouth, CBCT is a well-established dentistry technology. In the digital age of dentistry, advancements in scanning technology have made CBCT one of the essential diagnostic modalities for dentist training and researchers. CBCT is becoming increasingly accessible and has numerous dental applications.[2] In comparison to conventional CT scan, CBCT is cheaper, consumes less space, has a quicker scanning time, a narrower head-to-neck beam, a lower radiation dose, and a more significant number of imaging modes to present maxillofacial images and multiplanar reconstruction that is interactive.[3]

Assessment of the jawbone for dental implant placement, orthodontic treatment planning, and evaluation of the temporomandibular joint for poor bone changes are significant dental applications of CBCT. CBCT is also utilized to assess the proximity of the mandibular third molars to the mandibular canal prior to extraction and evaluate infection signs, cysts, tumors, dentoalveolar trauma, cleft lip and palate, and endodontic review.[4]

It appears that general dentists and dental students lack knowledge of the benefits of CBCT technology and its uses. The inclusion of CBCT in the dental radiology curriculum is a must for encouraging future dentists to use three-dimensional imaging for accurate diagnosis and treatment planning; therefore, it is crucial to conduct a study to assess dental students' knowledge and attitudes regarding CBCT.[4]

An online poll performed by Sivesh S et al. (2020) with dental students who were interns at two Dental Colleges in Chennai showed that 97.3% were aware of the use of CBCT for dento-maxillofacial imaging, whereas 2.7% were unaware. It was found that 95 (51.4%) respondents understood CBCT working procedures, whereas 90 (48.6%) others did not.[5] Research conducted by Ramhari S et al. (2020) in Nagpur to analyze the knowledge, awareness, and attitudes of dentistry students and general dentists regarding CBCT revealed the level of knowledge among graduate students (25.35%), interns (24.79%), undergraduate students (24.69%), and general dentists (21.46%). The CBCT knowledge was at 29.64% for postgraduate students, 26.4% for undergraduate students, 25.87% for internship students, and general dentists had the highest percentages with 18.07%.[1]

Mehtaab SB et al. (2021) in Nagpur surveyed 300 university students and general dentists using a questionnaire to evaluate their understanding of the application of CBCT. There were no significant differences between undergraduate students (24,3%), graduate students (24,2%), interns (25,3%), and general dentists (23,9%) in their knowledge of CBCT.[6] In the study conducted by Kamburog lu K et al. (2011) in Turkey, a questionnaire consisting of eleven items was distributed to 472 (272 females and 200 males) students in Faculty of Dentistry, Ankara University of Gaza. In addition to collecting demographic data, the questionnaire assessed respondents' general CBCT knowledge and attitudes. The survey revealed that 70.8% of undergraduate and 83.3% of graduate students felt the CBCT education provided was insufficient.[3]

Reham F (2017) reported a study on 108 dental students in Saudi Arabia (90 undergraduates in clinical years and 18 postgraduates). Most respondents (93.8%, n=76) had training on CBCT, whereas only 6.2% of respondents (n=5) had not received training on CBCT. There was no statistically significant difference between the responses of undergraduate students (92.9%) and graduate students (100%) on their awareness of CBCT. Graduate students at Gazi

University were more aware of CBCT than undergraduate students (P= 0.00). The majority of undergraduate and graduate students (88.5% and 90.9%) acquired information about CBCT from faculty studies alone, while the students who obtained information through seminars or lectures from faculty and the internet had the lowest percentage (1.2%, n=1).[4]

As dental profession student are approaching graduation, the researchers selected them as research participants to evoke their interest in the fact that the radiology department has a device that can display an attractive 3-dimensional image that is enjoyable to study and valuable in the future. This will increase awareness that the three-dimensional image created by CBCT can be beneficial for patient referral and diagnosis. There is a substantial disparity between different studies on CBCT knowledge, which captivates the curiosity of researchers regarding the level of CBCT knowledge among dental students at the Faculty of Dentistry, Universitas Sumatera Utara.

METHODS

This research was a descriptive-analytic study with a cross-sectional design. It was conducted in the Faculty of Dentistry, Universitas Sumatera Utara, Medan, from March to June 2022. The sample consisted of 385 students from the Faculty of Dentistry at the Universitas Sumatera Utara. The sampling technique was simple random sampling, after

informed consent was approves, the inclusion criteria was consented to participate as study subjects. Inactive or on-leave dental profession students were excluded. This study employed a questionnaire comprising 15 items. The Ethics Committee of the Faculty of Medicine at the Universitas Sumatera Utara has approved this research (No. 133/KEPK/USU/2022).

RESULTS

The frequency of participants based on the class year: 11 individuals from the class of 2017, 14 from the class of 2018, 151 from the class of 2019, 109 from the class of 2020, and 100 from the class of 2021 (Table 1). Frequency of knowledge regarding Cone-Beam Computed Tomography, correct and incorrect answers, and percentage of responses were acquired from 385 Dental Profession Students at the Faculty of Dentistry, Universitas Sumatera Utara (Table 2). At the Faculty of Dentistry, Universitas Sumatera Utara, 11.2% of dental profession students had a good level of knowledge regarding Cone-Beam Computed Tomography, while 21.8% had a sufficient level of knowledge and 67.0% had a poor level of knowledge (Table 3).

Table 1. Frequency of responses based on class year

Class Year	N	%
2017	11	2,9
2018	14	3,6
2019	151	39,2
2020	109	28,3
2021	100	26,0
TOTAL	385	100,0

Table 2. Knowledge of dental profession students at the Faculty of Dentistry, Universitas Sumatera Utara on Cone-Beam Computed Tomography (n = 385)

Knowledge regarding *Cone-Beam Computed Tomography*	Answers			
	Correct		Incorrect	
	n	%	n	%
CBCT is an ionising radiation type.	201	52,2	184	47,8
CBCT advantages over standard CT	185	48,1	200	51,9
The major difference between CBCT and regular CT radiation exposure	217	56,4	168	43,6
Equipment/hardware of CBCT	174	45,2	211	54,8
The degree of con angle CBCT rotates around the patient's head	248	64,4	137	35,6
Prior to CBCT irradiation, the patient must be prepared.	148	38,4	237	61,6
Patient's position during the CBCT test	141	36,6	244	63,4
CBCT acquisition time	93	24,4	292	75,6
CBCT image quality	164	42,6	221	57,4
Advantages of CBCT	152	39,5	233	60,5
Disadvantages of CBCT	102	26,5	283	73,5
FOV abbreviation	303	78,7	82	21.3
Areas that can be selected to apply FOV function on CBCT	271	70,4	114	29,6
CBCT indications	205	53,2	180	46,8
CBCT contraindications	136	35,3	249	64,7

Table 3. Frequency of individual dental profession students knowledge level regarding Cone-Beam Computed Tomography at the Faculty of Dentistry, Universitas Sumatera Utara

Category	n	%
Good	43	11,2
Sufficient	84	21,8
Poor	258	67,0
Total	385	100,0

DISCUSSION

CBCT is a dento-maxillofacial imaging technique that produces 3D images and has beneficial multiplanar reform processes, such as selecting the irradiation region size, image precision, and faster scanning time.[6] General dentists and dental students appear to lack knowledge regarding the benefits of CBCT technology and its applications. The introduction of CBCT into the dental radiology curriculum is essential for encouraging future dentists to adopt three-dimensional imaging for accurate diagnosis and treatment planning.[4] This study was conducted on dentistry students from the dental profession student of 2017, 2018, 2019, 2020, and 2021, Faculty of Dentistry, Universitas Sumatera Utara.

Based on the study finding (Table 1), 2.9% of the class of 2017 and 3.6% of the class of 2018 have responded. These two cohorts had the lowest percentages because most of them already held a dentistry degree when this study was conducted. There were 39.2% participants from the 2019 cohort, 28.3% from the 2020 cohort, and 26.0% from the 2021 cohort. The class of 2021 participants appeared to be lower than the other two because, at the time this study was conducted, the students were in the middle of post-test coursework and, therefore, unable to complete the questionnaire.

Only 52.2% answered the question correctly, classifying their understanding of CBCT radiography as poor (Table 2). The findings of

this study revealed that some respondents were still unaware of the radiation source used to create a radiographic image. Research conducted by de-Azevedo-Vaz SL et al. (2013) on dentistry students' understanding of dental radiography revealed that 62,3% provided accurate responses. Knowing the type of radiation used in dentistry is one of the basic principles of radiography. Radiography that uses ionizing radiation to make images is dentistry's most common form of radiography.[7]

The percentage of respondents who adequately identified the benefits of CBCT against standard CT was 48.1%, which was categorized as poor. The radiation exposure dose is significantly lower with CBCT than with traditional CT, which is an advantage. Pamadya S et al. observed that 46.4% could not state the difference between CBCT and conventional CT. CBCT can provide three-dimensional images, and the appearance of various parts is comparable to that of a head CT scan but with less radiation exposure. In the past twelve years, a significant number of research studies have evaluated the placement of dental implants using conventional radiography, such as periapical and panoramic radiographs.[8]

About 56.4% of dental profession students knew about the significant difference in radiation exposure dosages between CBCT and standard CT, which was deemed sufficient. CBCT's radiation exposure dose during craniofacial exposure was ten times less than that of standard CT (68 Sv compared to 600 Sv of conventional CT). There were 61,7% of respondents who were aware that CBCT had a lower radiation dose than traditional CT, reported by a similar study conducted by Kamburoglu K et al. (2011). Since the 1990s, dental practitioners have adopted CT technology. CT has begun to be replaced in dental practice with CBCT technology due to its association with relatively high radiation exposure.[3,9,10]

Only 45.2% knew about CBCT hardware and were categorized as poor. CBCT equipment includes X-Ray Tubes, Gantry, and Detectors.[14] Sixty-four percent of respondents answered correctly, meaning their understanding of the angle at which the CBCT cone rotates around the patient's head was sufficient. This survey revealed that most respondents understand how the cone on the CBCT functions. The CBCT system employs a flat-panel detector and a specialized scanner with a collimated X-ray source that generates conical or pyramidal x-rays in one or partial circular rotations (180o-360o) around the patient's head.[11,12]

About 38,4% of respondents knew about the preparations applied to patients before CBCT irradiation, which was rated as poor. A CBCT scan is performed using a tongue depressor or cotton roll. Patients should be instructed to remain motionless, breathe gently through the nose, and close their eyes before exposure to limit the likelihood of movement caused by following the detector as

it passes in front of the face.[13] Because only 36.6% of respondents correctly identified the patient's posture during CBCT examination, the knowledge of patient position was also categorized as poor. Depending on the type of CBCT scan unit, the patient may be positioned supine, seated, or standing.[14]

Additionaly, the knowledge on CBCT image quality were classified as poor since only 14 respondents knew the time of CBCT acquisition.

The time required by CBCT technology to acquire 3D images is typically between 5 and 40 seconds. According to research conducted by Lechuga L et al. (2016), the acquisition duration of CBCT for Standard Dose Head (SDH) and Standard Dose Head Full (SDHFS) is 20 seconds; however, it takes 25 seconds for High-Quality Head (HQH), High-Quality Head Full (HQHFS), and OBl1.3 Full Screen (OBl13FS).[15]

The knowledge of quality of CBCT images was categorized as poor as only 42.6% of respondents possess this information. The CBCT imaging modality can provide sub-millimeter resolution (2 line pairs/mm), improves diagnostic image quality, and faster scan times. Comparing the image quality and dose of radiation emitted by CBCT and CT scans, Lechuga L. et al. (2016) discovered that the spatial resolution of CBCT was superior than CT scan while on the other hand, CT produced superior soft tissue differentiation.[9,15]

The knowledge of respondents regarding advantages and disadvantages of CBCT was 39.5% and 26.5%, and classified as poor. Increasing the number of projections on CBCT has decreased the level of metal artifacts, particularly in secondary reconstructions designed to view the jaws and teeth; however, CBCT does not provide a good contrast for soft tissues. Two primary factors limiting CBCT's contrast resolution: (1) While radiation contributes to an increase in picture noise, it is also a key contributor to decreased contrast by introducing a background signal that is not representative of the anatomy, hence diminishing image quality. (2) Numerous panel detector-based artifacts exist as their inherent flatness influences the linearity or responsivity to x-rays. According to research by Sathawane R et al. (2020), only 34.35% and 20.17% of dental profession students were aware of the advantages and disadvantages of CBCT, respectively. [1,16,17]

The respondents' understanding of the FOV abbreviation was categorized as good with 78.7% answered correctly. The field of view is the area that is irradiated on the patient. In the study by Pamadya S et al. (2017) regarding understanding FOV in CBCT, 60.6% of respondents provided the correct answer. The function of the FOV is to reduce radiation dose by altering the required radiation exposure area. In addition, it can lower the radiation exposure time if the minimum FOV is selected. The centralization

of the FOV itself, i.e. the rotational center of the CBCT collimator, is a second factor that can lower radiation dose and exposure time. [18,8]

Seventy percent of respondents understand the area that can be selected for FOV; as a result, it was regarded as sufficient knowledge. The jaw arch, maxillofacial, craniofacial, dentoalveolar area, and interarch are some areas that can be chosen for irradiation with FOV. In the study by Sathawane R et al. (2020) evaluating dental profession students' comprehension of FOV, 25.35% provided accurate responses.[1,14] The percentages of respondents who were aware of the indications for CBCT and its contraindications were 53.2% and 35.3 %, respectively. According to Al Noaman RF et al. (2017), 95.7% and 54.3% of dental profession students correctly responded to questions about the indications and contraindications of CBCT.[4]

As shown in Table 3, 11.2% (n=43) respondents had good knowledge while 21.8% (84 respondents) and 67.0% (258 respondents) had sufficient and poor knowledge, respectively. The group with the poor knowledge has the highest percentage. This was because CBCT was not a required skill of dental profession students at the Faculty of Dentistry, and this research was conducted to identify their interest in the equipment that will be crucial when they graduate with a degree in dentistry or a dental specialty.

CONCLUSION

In summary, the study's findings indicated that the knowledge level of dental profession students in the Faculty of Dentistry, Universitas Sumatera Utara consisted of 11% of good knowledge students, while 21.8% and 67.0% had sufficient and poor knowledge of CBCT.

REFERENCES

1. Sathawane R, Bhakte K, Chandak R, Lanjekar A, Badge L. Awareness, knowledge and attitude of dental students and general dental practitioners of Nagpur towards CBCT: a questionnaire based analytical study. International Journal of Research and Review. 2020: 7(6): 398-403.
2. Bhoosreddy AR, Sakhavalkar PU. Image deteriorating factors in cone beam computed tomography, their classification, and measures to reduce them: A pictorial essay. J Indian Acad Oral Med Radiol 2014;26:293-7.
3. Kamburoglu K, Kursun S, Akarslan ZZ. Dental students' knowledge and attitudes towards cone beam computed tomography in Turkey. Dentomaxillofac Radiol. 2011 Oct;40(7):439-43.
4. Al Noaman, R. F., & M. El Khateeb, S. Knowledge and attitude of cone beam CT- A questionnaire based study among Saudi dental students. Journal of Advances in Medicine and Medical Research, 2016;19(4), 1-10.
5. Sangar S, Vadivel JK. Awareness of dental students towards CBCT: A cross sectional study. J Indian Acad Oral Med Radiol 2020;32:366-70.
6. Bahtia MS, Sharma P, Amalkhan S, Dhopte A, Badge H. A questionnaire-based analytical survey of dental students and general dental practitioners' awareness, knowledge, and sttitudes toward CBCT. Annals of the Romanian Society for Cell Biology 2021;25(6):1862-70.
7. de-Azevedo-Vaz SL, Vasconcelos KF, Rovaris K, Ferreire NP, Neto FH. A survey on dental undergraduates' of knowledge of oral radiology. Braz J Oral Sci 2013;12(2):109-13.
8. Pamadya S, Dhartono J. Pengetahuan dokter gigi di indonesia tentang Cone-Beam Computed Tomography. JITEKGI 2021;17(2):84-93.

9. Kumar M, Shanavas M, Sidappa A, Kiran M. Cone beam computed tomography – Know its secrets. J Int Oral Health 2015;7(2):64-8.

10. Widyanigrum R, Faisal A, Mitrayana M, Mudjosemedi M, Agustina D. Imejing diagnostic kanker oral: prinsip interpretasi pada radiografi dental, CT, CBCT, MRI dan USG. Majalah Kedokteran Gigi Indonesia 2018;4(1).

11. Akarslan Z, Peker I. Advances in radiographic techniques used in dentistry. emerging trends in oral health sciences and dentistry 2015;35:764.

12. Suomalainen A. Pakbaznejad E, Elmira R, Soraya. Dentomaxillofacial imaging with panoramic views and cone beam CT. Insights into Imaging 2015;6(1), 1–16.

13. White SC, Pharoah MJ. Oral radiology principle and interpretation. 7th ed. Canada: Elsevier Mosby, 2014:192. The

14. Kumar P, Sajatha S, Yashodha Devi B. K, Rakesh N, Shwetha V. Basics of CBCT imaging. JDOR; 1(13):49-55.

15. Lechuga L, Weidlich GA. Cone Beam CT vs fan beam CT: A comparison of image quality and dose delivered between two differing CT imaging modalities. Cureus 2016;8(9):1-13.

16. Adibi S, Zhang W, Servos T, O'Neill PN. Cone beam computed tomography in dentistry. What dental educators and learnes should know. Journal of Dental Education. 2012;76(11):1437-42.

17. Venkatesh E, Elluru SV. Cone beam computed tomography: basics and applications in dentistry. J Istanb Univ Fac Dent 2017;51(3 Suppl 1):S102-S21.

18. Gonzalez SM. Prinsip dasar interpretasi cone beam computed tomography. Penerbit Buku Kedokteran EGC. 2016:2.