Assessment of Level of Knowledge regarding Cone Beam Computed Tomography amongst Dental Interns of Nepal

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ABSTRACT

Introduction: Cone Beam Computed Tomography (CBCT) is a crucial three-dimensional imaging technique in dentistry, enabling detailed visualization of the dentomaxillofacial region. It has wide applications in various dental procedures and has many advantages over Conventional Tomography (CT) as well. Since the present dental interns are future practitioners, their proficiency with CBCT becomes essential for maximizing its clinical benefits.

Objective: To assess the level of knowledge about CBCT among the dental interns of Nepal.

Materials and Method: A cross sectional study was conducted among convenient sample of 163 dental interns for a period of three months in six different colleges affiliated to Kathmandu University. Data was collected using a self-administered questionnaire. Data was entered in Microsoft Excel and analyzed using Statistical Package for Social Sciences (SPSS) version 20. One way Analysis of Variance (ANOVA) was used to find the difference in mean knowledge among dental interns of different colleges. Level of significance was set at p-value<0.05.

Result: The study included 163 participants, with 31 (21.5%) males and 128 (78.5%) females, from six different colleges of Nepal. The mean age was 24.65±2.06 years. The question concerning the usefulness of CBCT in assessing bone density for implant procedures yielded the highest correct response rate of 97.5%. Majority of the participants 88(54.0%) had average level of knowledge. Knowledge level varied according to gender and colleges, with statistically significant differences in mean knowledge scores among different colleges (p-value = 0.03*).

Conclusion: The dental interns of Nepal have an average CBCT knowledge level, with variation across different colleges. Emphasis should be placed on targeted educational interventions, including workshops, continuing education, and practical exposures, to improve understanding and uniformly address knowledge gaps.

Keywords: Cone beam computed tomography; dental interns; knowledge

INTRODUCTION

Cone Beam Computed Tomography (CBCT) has emerged as a crucial three-dimensional imaging technique in dentistry, enabling detailed visualization of the dento-maxillofacial region.[1] Initially introduced in the late 1990s, particularly by Arai et al. in Japan and Mozzo *et al.* in Italy, its adoption in developing countries like Nepal has been relatively recent.[2,3] CBCT imaging uses a cone-shaped X-ray beam rotated around the patient to produce a large number of slice images, facilitating detailed three-dimensional visualization.[4] CBCT offers high-resolution images in all three planes, aiding precise diagnosis and treatment planning with minimal radiation exposure, lower costs, less space and higher scanning speed compared to conventional CT scans. However, CBCT has limitations, including lower soft tissue resolution and the need for experienced interpretation.[5]

CBCT is widely used in dental procedures including implant placement, orthodontics, endodontic, and maxillofacial surgeries, especially prevalent in Nepal for implant imaging.[6] Establishment of CBCT imaging centers is also gradually increasing in Nepal lately, indicating an increasing trend toward its utilization. However, the deficit in knowledge regarding CBCT principles and applications presents challenges for the optimal utilization of CBCT technology.[4]

There is a paucity of published literature regarding the knowledge of CBCT among dental interns in Nepal. Since the present dental interns are future practitioners, their proficiency with CBCT becomes crucial for maximizing its clinical benefits. Considering the increasing use of CBCT in dentistry, it is crucial to assess the knowledge level of dental interns regarding this technology in order

to bridge the existing knowledge gap and ensure proficient integration of CBCT in dental clinical practice. Hence, this study aims to assess the level of knowledge regarding CBCT amongst dental interns of Nepal.

MATERIALS AND METHOD

A questionnaire based cross-sectional study was conducted for the period of three months with the help of self-administered, pre-tested questionnaire. Sample size was calculated by the following formula, $n = Z^2pq / d^2 + (Z^2pq/N) = 118$ [where, p = 18% 7 N = Total number of dental interns in Kathmandu University dental colleges (obtained from administrative authority of the concerned colleges)]. Further, taking response rate as 90%, final sample size was calculated to be 131.[1] (approximately 135). The minimum desired sample size was estimated to be 135 for the study. Using convenience sampling method, 163 dental interns were selected as study participants from six different colleges of Nepal affiliated to Kathmandu University (KU). Kathmandu University School of Medical Sciences (KUSMS), Nepal Medical College (NMC), Kathmandu Medical College (KMC), Kantipur Dental College (KDC), College of Medical Science (COMS) and Nobel Medical College Teaching Hospital (NMCTH) were the colleges included. This study was conducted after the ethical approval from Institutional Review Committee of Nepal Medical College (Reference no: 031-077/078). Verbal consent was obtained from head of institutions as well as informed consent from each student. Those dental interns who responded with incompletely filled questionnaire and those who were not willing to participate in the study were excluded.

Data was collected by the help of a questionnaire adopted from various studies.[5,8,9,10-12] The questionnaire was sent to the participants in the form of Google Forms (Alphabet Inc., USA) through email and Viber. Follow-up reminder was send at the end of every month to the non-respondents during data collection period. The questionnaire comprised of the questions regarding demographic details and 15 close-ended questions regarding mechanism, indications, contraindications, advantages and disadvantages of CBCT. Each question had either dichotomous option (Yes/No) or multiple choice options, the correct response scored as 1 and incorrect as 0. The total scores obtained from the responses of each participant was expressed in percentage and the values was interpreted as good (71-100%), average (51-70%) and poor (0-50%).

Data was entered in Microsoft Excel and exported to SPSS version 20 for analysis. Descriptive statistics were presented in the form of frequency, percentage, mean and standard deviation. One way ANOVA was used to find the difference in mean knowledge between dental interns of different colleges. Level of significance was set at p-value<0.05.

RESULT

Out of the total 163 participants involved in the study, majority 128 (78.5%) were female. Mean age of the study participants was 24.65±2.06 years. Most of the participants 31 (19.0%) were from KUSMS (Table 1).

Table 1: Distribution of the study participants by gender and colleges

Variables		n (%)
Gender	**Male**	**31 (21.5)**
	Female	128 (78.5)
College	KUSMS	31 (19.0)
	NMC	29 (17.8)
	KMC	26 (16.0)
	KDC	26 (16.0)
	COMS	27 (16.5)
	NMCTH	24 (14.7)
Total		163 (100.0)

Table 2 presents the responses of the study participants regarding questions related to CBCT. Majority 159 (97.5%) gave the correct response on question concerning the usefulness of CBCT in assessing bone density for implant procedures. Question about the justifiability of using intraoral radiographies compared to CBCT for detecting interproximal caries had the lowest correct response rate 34 (20.9%).

Table 2: Distribution of the study participants according to the responses

SN	Questions	Responses	n (%)
1.	The radiation used in CBCT is	Ionizing †	132 (81.0)
		Non-ionizing	31 (19.0)
2.	Mechanism of action of a CBCT machine	Virtual slices of the scanned region	46 (28.2)
		Divergent X-rays forming a cone which is reconstructed digitally †	104 (63.8)
		X-rays directed perpendicular to the long axis of the objects to be scanned	13 (8.0)
3.	The accurate order of the amount of radiation exposure to the patient is	CBCT> head CT> panoramic	30 (18.4)
		Head CT > panoramic > CBCT	27 (16.5)
		Head CT > CBCT > panoramic †	80 (49.1)
		Panoramic > head CT > CBCT	26 (16.0)
4.	CBCT is comparatively expensive than CT	Yes	82 (50.3)
		No †	81 (49.7)
5.	CBCT offers good soft tissue image resolution.	Yes	68 (41.7)
		No †	95 (58.3)
6.	Artifacts arising from metal restorations are more in CBCT than CT.	Yes	74 (45.4)
		No †	89 (54.6)
7.	Which of the following techniques provides higher clarity in the evaluation of periapical and periodontal lesions and root fractures?	CT	13 (8.0)
		CBCT †	150 (92)
8.	CBCT is not indicated for	Assessment of apical cyst	11 (6.8)
		Soft tissue evaluation †	118 (72.4)
		Sinus evaluation	17 (10.4)
		Detection of fractures in the posterior part of mandible	17 (10.4)
9.	CBCT cannot be used for which of the following diagnostic imaging task?	Position of temporomandibular disc†	77 (47.2)
		Position of condyle in glenoid fossa	37 (22.7)
		Condyle fracture	9 (5.5)
		Ankylosis	40 (24.5)
10.	Orthodontics application of CBCT cannot be for	Lip cleft †	68 (41.7)
		Palatal cleft	3 (1.8)
		Impacted canine	10 (6.2)
		Assessment of airways	82 (50.3)
11.	Intra oral radiographies compare to CBCT are justifiable for	Interproximal caries †	34 (20.9)
		Measuring the ridge height	5 (3.1)
		Extension of pathological lesions	27 (16.5)
		a and b	97 (59.5)
12.	Which of the following statements regarding CBCT is correct?	It can show only vertical root fractures	3 (1.8)
		It can show only horizontal root fractures	3 (1.8)
		All kinds of root fractures can be detected by CBCT †	142 (87.1)
		CBCT cannot detect root fractures	15 (9.3)
13.	CBCT is useful to evaluate bone density for implant procedure.	Yes †	159 (97.5)
		No	4 (2.5)
14.	In Nepal's scenario, the most common indication of CBCT is for the assessment of	Inferior alveolar nerve block for removing wisdom teeth	42 (25.8)
		Implant sites †	62 (38.0)
		Pathological lesions	42 (25.8)
		Bone density	17 (10.4)
15.	Have you heard about the guidelines for when or when not to take CBCT scan?	Yes †	66 (40.5)
		No	97 (59.5)

† Correct responses

Majority of the study participants 88 (54.0%) were in the average knowledge category, with 21 (60%) of males and 67 (52.3%) females. A higher proportion of females (27.3%) demonstrated poorer knowledge compared to males (14.3%). KDCshowed the highest proportion of participants 9 (34.6%) with good knowledge (Table 3).

Table 3:Distribution of the study participants according to the level of knowledge

Variables		Good	Average	Poor
		n (%)	n (%)	n (%)
Gender	Male	9 (25.7)	21 (60.0)	5 (14.3)
	Female	26 (20.3)	67 (52.3)	35 (27.3)
Colleges	KUSMS	9 (29.0)	15 (48.4)	7 (22.6)
	NMC	7 (24.1)	14 (48.3)	8 (27.6)
	KMC	6 (23.1)	15 (57.7)	5 (19.2)
	KDC	9 (34.6)	15 (57.7)	2 (7.7)
	COMS	3 (11.1)	17 (63.0)	7 (25.9)
	NMCTH	1 (4.2)	12 (50.0)	11 (45.8)
Total		35 (21.5)	88 (54.0)	40 (24.5)

There was a statistically significant difference (p-value 0.03) in knowledge scores among the interns of different colleges (Table 4). Post hoc Tukey test revealed a significant difference in mean knowledge scores between KDCand NMCTH(p-value = 0.04), with KDCexhibiting a higher mean knowledge score than the other college.

Table 4: Comparisons between knowledge scores and colleges

Variables		Mean±SD	p-value
College	KUSMS	9.39±2.35	
	NMC	8.66±2.32	
	KMC	9.38±1.84	
	KDC	9.58±1.75	0.003*
	COMS	8.59±1.69	
	NMCTH	7.92±1.86	
Total		8.94±2.05	

DISCUSSION

CBCT holds significant value in multiple aspects of maxillofacial diagnosis and treatment planning, yet there is limited understanding among undergraduate students and interns regarding its principles, mechanism, applications, and importance in this field.[4] Various literature shows limited in-depth knowledge about CBCT in practicing dentists and certain dental specialists as well.[5,12] This study has been conducted in order to assess the level of knowledge of CBCT amongst the dental interns of Nepal. The predominance of female participants (78.5%) in our study reflects the overall unequal gender distribution within the dental intern population in Nepal. Similar findings were found in many other studies.[5,13] This may suggest differences in interest or accessibility for participation in the study or career choice as dentists between males and females.

The responses from dental interns reflect varying levels of understanding regarding CBCT. Majority of the participants accurately identified fundamental aspects such as the ionizing nature of CBCT radiation and its utility in assessing periapical and periodontal lesions, detecting root fractures and evaluating bone density for implants. These results suggest that participants were well-informed about the clinical benefits of CBCT in these specific areas. However, many struggled with identifying the correct order of radiation exposure and specific indications for CBCT use. These findings are in accordance with the studies conducted among dentists and dental interns.[5,9,10] Less than half the participants had knowledge about the advantages of CBCT over CT, a finding consistent with the study among dental interns10but in contrary to a study conducted among postgraduate students in Navi Mumbai.[14]

Only few of the participants understood the justification for the use of intraoral radiographs for assessing interproximal caries, indicating a potential gap in knowledge regarding the comparative advantages of various imaging modalities in specific clinical scenarios. This finding is in contrast with a study[5] in which majority gave correct response.

Current study showed that most of the dental interns

of Nepal had average knowledge about CBCT. When superficial and basic questions were asked majority responded but when asked in depth, the only few responded. Similar pattern was also seen in dental interns of Mangalore, general dental practitioners of India and Iran.[10,14] Howevera higher level of knowledge about CBCT was demonstrated byspecialists in a study in Iran. This difference may be attributed to the characteristics of the specialist's job or more exposure to CBCT Unit and more exposure to the recent advancements through seminars, workshops, and training programs. Present study exhibits slightly predominance of male in average knowledge category and predominance of female in poor knowledge category. This suggests that, on average, males may have a slightly better understanding of the subject matter than females in the study population. This trend may be influenced by various factors, including societal norms, educational opportunities, and individual learning styles. On contrary, not much knowledge difference was noted between males and females in various studies.[1,5]

The findings of this study showed a difference in knowledge levels between dental interns of different colleges. This suggests that educational institutions may play a role in shaping the level of understanding of CBCT among dental interns. Colleges with higher mean knowledge scores may have CBCT set up with more exposure and effective educational programs.

The precise knowledge about CBCT in practicing dentistry is of paramount importance due to its wide application in future as well.[8] Any published literature assessing the level of knowledge regarding CBCT among dental interns in Nepal could not be traced. This study fills this gap by offering valuable insights into the knowledge levels of CBCT among dental interns in Nepal. Nevertheless, it is recommended to conduct further studies on a larger sample size, encompassing dental interns from other university-affiliated colleges as well.

CONCLUSION

The present study showed that dental interns in Nepal had an average level of knowledge regarding CBCT. The study also sheds light on the variations in CBCT knowledge levels among dental interns across different colleges of Nepal. Hence, it highlights the need of enhancing knowledge and understanding of CBCT with targeted educational interventions and implementing strategies such as continuing education programs, workshops, practical exposures and interactive training sessions.

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