Awareness and practice pertaining to the use of digital imaging for orthodontic purposes among undergraduate dental students

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Abstract

The current study aimed at evaluation of the awareness of undergraduate dental students regarding the use of digital imaging that are used for orthodontic diagnosis and treatment. An online survey using google forms was conducted among the undergraduate dental students as a part of this study setting. The sample size of participants was 109. The survey was composed of a set of 14 questions including demographics. Ethical clearance was obtained from the Institutionalized ethical committee. SPSS software was used for data analysis and descriptive statistics. Among the entire population, 46.2% participants said that they would be using digital dental imaging during their practices and in their career and the remaining 53.8% participants said that they would not be using digital imaging due to various reasons. This study found out that undergraduate dental students have an average level of awareness regarding the use of digital dental imaging that are used for orthodontic diagnosis and treatment.

Key words: Digital imaging, innovative technology, knowledge, orthodontic purposes, radiation

INTRODUCTION

Since the invention of X-rays, the field of imaging has progressed from 2D images to more comprehensive imaging, known as 3D imaging, that can significantly improve various treatment options.[1] These advanced imaging techniques have improved the diagnosis of many diseases as well as the quality of their treatment.[2] To avoid exposing the patient to the deleterious effects of ionizing radiation, it is very much crucial to choose an appropriate screening or testing approach at the diagnosis stage.[3] New studies are focused on improving image acquisition with importance on minimal adverse radiation effects.[4] In any new strategy, the benefit of the transformation to any fundamental shift in representation should not only be taken into account but also in terms of expense and risk.[5]

Computed tomography (CT), including its 3D and ortho CT variants, has recently been used to diagnose a number of dental problems.[6] Dental radiology is a clinical specialty that is rapidly developing. Dental X-ray radiation exposure is typically not noticeably more dangerous than other commonplace dangers, such as intraoral X-rays.[7] The extent of the effect following a diagnostic level of radiation

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Table 1: Table represents the questionnaire asked and the survey answers that were replied by the participants

Question	Options	UG (%)	Male (%)	Female (%)	P
Are you aware of the term "digital imaging" in orthodontics?	Yes	84.6	30.8	53.8	0.505
	No	15.4	7.7	7.7	
Do you think digital imaging should be provided at any dental institute?	Yes	61.5	15.4	46.2	0.779
	No	38.5	23.1	15.4	
Would you use digital imaging in your practices and in your future career?	Yes	46.2	23.1	23.1	0.687
	No	53.8	15.4	38.5	
Are you aware of common terminology used in CBCT such as FOV, SSV, MIP, multiplanar reconstruction, and DICOM images?	Aware	15.4	7.7	7.7	0.551
	Not aware	61.5	23.1	38.5	
	Partially aware	23.1	7.7	15.4	
Which tech do you prefer when you need 3D-dental imaging of the head and neck region?	CT	15.4	7.7	7.7	0.402
	CBCT	23.1	7.7	15.4	
	Both	61.5	23.1	38.5	
How does CBCT differ from CT?	Low radiation dose than CT	61.5	23.1	38.5	0.405
	Same radiation dose as of CT	38.5	15.4	23.1	
Have you ever learned about the basic functioning of CBCT?	Yes	84.6	30.8	53.8	0.790
	No	15.4	7.7	7.7	
Do you think CBCT is better suited for dental purposes when compared to CT?	Yes	69.2	23.1	46.2	0.008*
	No	30.8	15.4	15.4	
Periodontal status can be best seen by	CBCT	38.5	15.4	23.1	0.002*
	OPG	30.8	15.4	15.4	
	IOPA	30.8	7.7	23.1	
Does digital radiography require less exposure than conventional?	Yes	46.2	15.4	30.8	0.877
	No	53.8	23.1	30.8	
Root resorption is seen better in	IOPA	15.4	7.7	7.7	0.001*
	OPG	15.4	7.7	7.7	
	CBCT	15.4	7.7	7.7	
	All	53.8	15.4	38.5	
Airway space is better analyzed in	Lateral cephalogram	23.1	7.7	15.4	0.844
	CBCT	23.1	7.7	15.4	
	Both	53.8	23.1	30.8	
Can a 2D (lateral cephalogram) radiograph be obtained from a CBCT?	Yes	46.2	15.4	30.8	0.724
	No	38.5	15.4	23.1	
	Don't know	15.4	7.7	7.7	
If yes, do you think the 2D image obtained is accurate?	Yes	61.5	23.1	38.5	0.004*
	No	23.1	7.7	15.4	
	Not aware	15.4	7.7	7.7	

$P < 0.05$ - statistically significant*. P value > 0.05 - statistically insignificant. CT: Computed Tomography, CBCT: Cone-beam CT, OPG: Orthopantomography, IOPA: Intraoral periapical, MIP: Maximum intensity projection, 3D: Three-dimensional, 2D: Two-dimensional, FOV: Field-of-view, SSV: second scout view.

is unclear.[8] The field of CT was introduced in the late 1900s, but because of its high costs, radiation sensitivity, and limited usage, its application was limited to situations such as complicated anomalies.[9,10] Because of the relative availability of reduced cost and decreased exposure of cone-beam CT (CBCT), interest in the use of 3D imaging has developed drastically over the last two decades, especially in orthodontic treatment strategies.[11] A new forum for diagnosis and care preparation has been launched with the implementation of CBCT for the dentomaxillofacial zone.[12]

In the last decade, the dentist has created 3D-diagnostics possibilities for the most innovative breakthrough in dentistry.[13] It offers multi-dimensional images in real time, which have extended the function of imaging from diagnosis to image operations for postoperative evaluations.[1] In recent days, dentists have been prominent with CBCT in our country and have favored imaging.

Our research and knowledge have resulted in high-quality publications from our team.[14-28] Thus, the current study aimed to evaluating the awareness of undergraduate dental students regarding the use of digital dental imaging that is used for orthodontic diagnosis and treatment.
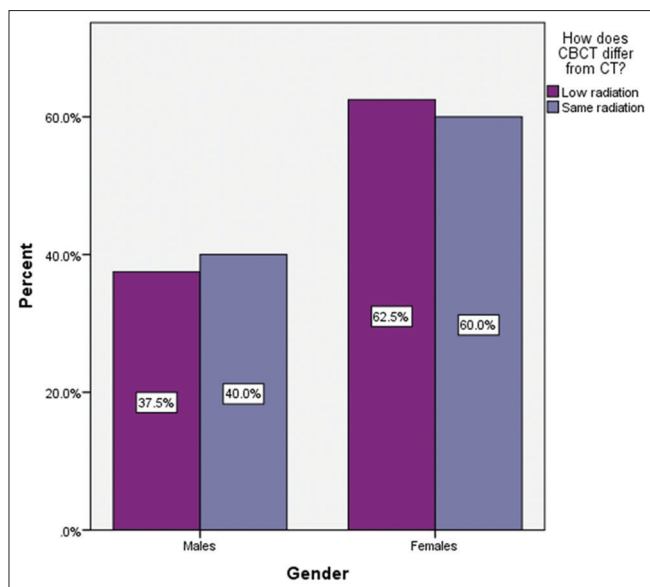
Figure 1: Bar chart representing the gender-based association between CBCT and CT in comparison of radiation. The X-axis depicts the gender distribution and Y-axis depicts the percentage of students. Out of 100% of the population who preferred CBCT emits low radiation than CT, 62.5 were females and 37.5 constituted males. Hence, more females preferred to use CBCT than CT as it emits very low radiation when compared to CT. CT: Computed tomography, CBCT: Cone-beam computed tomography
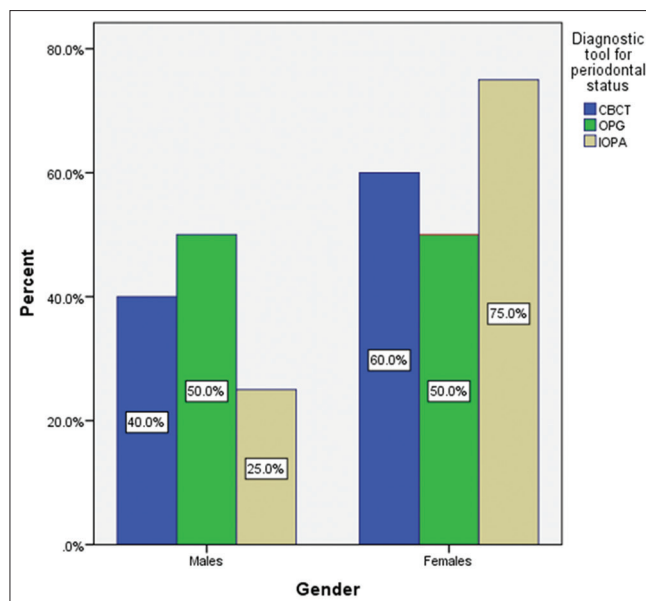

Figure 2: Bar chart representing the association of gender and the best technology that was preferred to view the periodontal status. X-axis depicts participant gender and Y-axis depicts the Percentage of students. Out of 100% of the population who preferred CBCT as the best technology to view the periodontal status, 50 constituted females and 50 constituted males. Hence, both females and males preferred CBCT as the best technology to view the periodontal status. CBCT: Cone-beam computed tomography
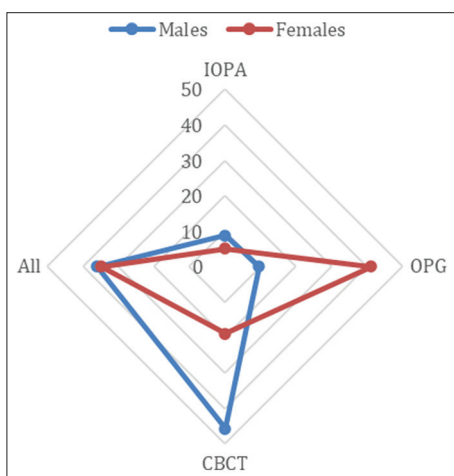

Figure 3: Bar chart represents the association of gender and the best technology that was preferred to view the root resorption. X-axis depicts participant gender and Y-axis depicts the Percentage of students. Out of 15.4% of the population who preferred CBCT as the best technology to view the root resorption, 7.7 constituted females and 7.7 constituted males. Hence, both males and females preferred CBCT as the best technology to view the root resorption. CBCT: Cone-beam computed tomography

MATERIALS AND METHODS

This cross-sectional study was conducted among dental students in a private institution in August 2021. An online questionnaire was distributed through Google Forms
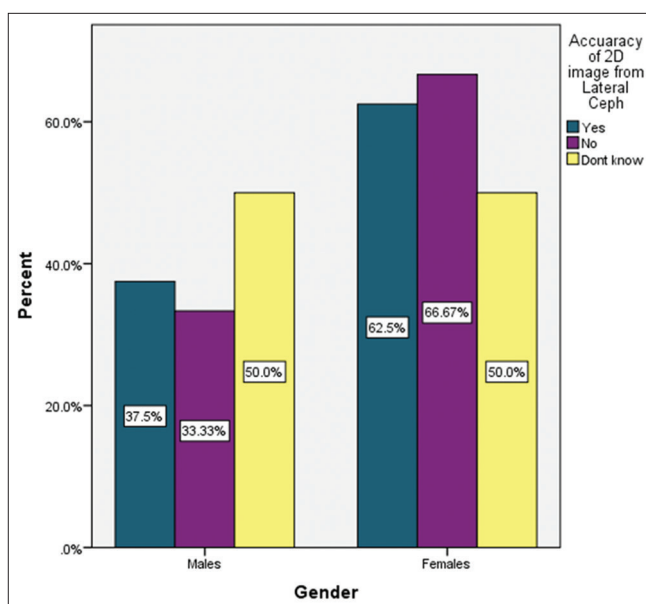

Figure 4: Bar chart representing the association of gender and accuracy of 2D image obtained from CBCT. The X-axis depicts the gender of the participant and Y-axis depicts the Percentage of students. Out of 100 of the population who said 2D image obtained from CBCT is accurate, 62.5 constituted females and 37.5 constituted males. Hence, more females prefer CBCT for obtaining an accurate 2D image. CBCT: Cone-beam computed tomography

among the undergraduate dental students till the final year. The sample size of participants was estimated to be

109 from the study done by Balabaskaran *et al.*[29] Ethical approval and informed consent from the participants were obtained. Stratified random sampling was used among first to final-year students. The measure taken to minimize the sampling bias was stratification and matching independent variables in a selected sample. The internal validity was the usage of a pretested questionnaire.

The questionnaire presented consisted of a set of 14 questions including demographic information. Data collection software was used. Data manipulation/cleanup in Excel spreadsheet. The list of output variables assessed was the knowledge, awareness, and practice among undergraduate dental students regarding the use of digital dental imaging that is used for orthodontic diagnosis and treatment. Each output variable was represented and framed in a table form. The statistical software used was SPSS 23.0, which was a statistical software developed by International Business Machines Corporation (IBM), Armonk, New York, United States of America. Descriptive and association tests were done to analyze the interrelationship between the variables. The institutional clearance certificate number is IHEC/SDC/ORTHO/21/051.

RESULTS

The results that were obtained from the survey have been arranged in tabular form as shown in Table 1 and were plotted graphically for a clear assessment as shown in [Figures 1-4].

DISCUSSION

The therapy of oral and maxillofacial pathologies with a lower radiation dosage of CBCT plays an important role in dentistry.[29] The majority of people believe that CBCT differs from CT in that it emits less radiation. The findings were comparable to those of Chau and Fung's experiment,[13,30] which found that CBCT gave lower doses whereas CT produced larger amounts. The majority of respondents agreed that they would utilize digital imaging in their clinical practices and future careers, while the remaining stated that they would not use digital imaging for a variety of reasons. The findings differed from those of Aditya *et al.*,[31] who discovered that digital imaging technology such as CBCT was less commonly employed in clinical practice due to a lack of understanding of its applicability in orthodontic procedures. Almost everyone reported that CBCT is better suited for dental purposes when compared to CT. The findings were in relation to previous study which[32] reported that dental practitioners prescribe CBCT imaging only with patient care in mind, enhanced patient safety measures, and improved clinical results. Majority of the population are not aware of the terminology used in CBCT such as field-of-view, second scout view second scout view SSV, and maximum intensity projection. This study is in accordance with the study by Yeh JK, Chen CH[33] on Turkish dental students which highlighted difficulties in acquiring knowledge of different systems without practical experience and may constitute a significant factor contributing to students' indifference to this technology.

CONCLUSION

Precise information on the use of digital imaging in dentistry is important considering the different applications and varied potential of various technologies such as CBCT and CT in dentistry. Digital imaging is necessary for diagnostic and therapeutic understanding in the field of dentistry. The present study observed, in comparison with other optical imaging systems, that many respondents did not know their radiation exposures. The present study shows that undergraduate dental students have an average level of awareness regarding the use of digital imaging that is used for orthodontic diagnosis and treatment.

Conflicts of interest
There are no conflicts of interest.

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