

Awareness, Knowledge, Attitude and Practice of Radiation Hazards and Radiation Protection Among the Undergraduate Dental Students in C.S.M.S.S. Dental College & Hospital, Chh. Sambhajinagar: A Questionnaire Based Cross-Sectional Study

Kushal Shinde¹, Pallavi Divekar², Saaniya Shaikh³, Syeda Khuteja⁴,
Anju Sapkal⁵

^{1,2}BDS MDS, ^{3,4,5}BDS Intern. CSMSS Dental College And Hospital, Chh. Sambhajinagar.

Abstract:

Introduction: Radiation usage has been a common method of diagnosis and treatment planning in dentistry in recent years, evaluation of the awareness, knowledge, attitude and practice of radiation hazards and radiation protection among the undergraduate dental students as they represent future dental practitioners.

Aim: The aim of the study is to assess the awareness, knowledge, attitude and practice of radiation hazards and radiation protection among the undergraduate dental students.

Objective: To analyze the current status of awareness, knowledge, attitude and practice amongst the third year, final year dental students and dental interns participants towards radiation hazards and their protection.

Material and method: A cross-sectional questionnaire was administered to dental undergraduate students at Chhatrapati Shahu Maharaj Shikshan Sanstha (C.S.M.S.S) Dental College And Hospital, Chhatrapati Sambhajinagar, Maharashtra. The data was gathered on awareness, knowledge, attitude and practice of radiation hazards and radiation protection. The sample size of the study was 300 participants, each 100 from third year, final year and dental interns. A validated questionnaire with 20 multiple choice questions about radiation hazards and protection was used for the study. Descriptive statistics were calculated.

Result: The awareness, knowledge, attitude and practice about radiation hazards and radiation protection were highest in dental interns i.e. 66.15%, followed by third year dental students (56.6%) and then final year dental students (55.5%). Among the total participants, majority felt that lectures and tutorials or workshops should be conducted to acquire more knowledge on radiation hazards and protection.

Conclusion: The present study highlights the importance of lectures and training programs for improving the awareness, knowledge, attitude and practice of future dental practitioners. It is recommended that the curriculum of dental school for third and final year dental students should be expanded further to improve their knowledge of radiation hazards and protection. So as to protect the patients and themselves from harmful effects of radiation caused by unnecessary exposure and negligence by the dental practitioners.

Introduction:

X-rays are electromagnetic radiations that, when they travel through materials that could cause harm to healthy tissues by producing ions. It is believed that generation of free radicals or ions might cause alteration and mutations in human DNA. Stochastic and non-stochastic effects are the two categories of biological hazards linked to radiation exposure. While stochastic effects lack a threshold value and are therefore potentially more harmful and challenging to control, non-stochastic or deterministic impacts only become apparent when a specific radiation dosage through exposure is exceeded.¹

There is a documented statistical correlation between dental X-ray radiation and a higher risk of salivary gland cancers, thyroid cancer, and cerebral meningioma.²

However there is a controversy of statements over the precise amount of cancer risk linked to radiation exposures.³

It is vital to have in depth understanding of the radiation protection strategies and exposure parameters in order to prevent and mitigate such negative consequences. Radiograph in dentistry have stochastic effects or an all-or-none phenomenon, even though they are primarily utilized for diagnostic purposes where the least amount of radiation is required. Therefore, it is essential to lessen the negative effects of radiation exposure on patients and radiographers. Students pursuing undergraduate dental degrees must adhere to the ALARA principle because they will be exposed to the radiation during radiographic treatments. A good radiography technique includes using collimators and film holding devices, wearing a lead apron and thyroid collar, understanding exposure parameters and adhering to the position distance rule in a radiography room with lead partitions.⁴

Determining the variables that could affect the efficacy of radiation protection procedures is crucial to optimizing the use of radio-protective measures in dental practice. To do this, it is necessary to concurrently study in a single population, the relationships between several radiation protection-related concerns.⁵

Significant biological effects of radiation are contingent upon exposure length and dose in addition to individual characteristics including age, gender, and pre-morbid conditions.⁶

Guidelines for x-ray equipment specification, x-ray installation room layout, protective devices, and worker safety have been established by the Atomic Energy Regulatory Board (AERB), National Council on Radiation Protection (NCRP), International Commission on Radiological Protection (ICRP) and Measurements.⁷

As part of optimization process, patient dose levels for medical diagnostic exposure are known as Diagnostic Reference Levels, or DRLs.⁸

Radiology is now a significant area of study used in dentistry and medicine for diagnostic purpose. In dentistry, radiographs are essential for diagnostic purposes. The rapidly expanding spectrum of imaging modalities, such as ortho cubic super-high resolution CT (Ortho-CT) for researching various dental diseases and Cone Beam Computed Tomography (CBCT) for CT, has greatly expanded this discipline.⁹

Ionizing radiation is nearly often used in dentistry radiology tests, which are diagnostic in nature. Thus, it is important to execute oral and maxillofacial radiology with consideration and responsibility, limiting radiation exposure while optimizing diagnostic utility.¹⁰

Future dentists enrolled in undergraduate programs may be exposed too biological and radioactive risks at some point in their clinical practice. They must be informed about the various x-ray protection strategies. The daily dosage of radiation received and the various radiation protection techniques should be known to the dentist.¹¹

Thus, the study aimed to examine the awareness, knowledge, attitude and practice of radiation hazards and radiation protection among undergraduate dental students.

Material and method:

A cross sectional questionnaire based study was conducted on 300 undergraduate dental students whose curriculum included Dental Radiology and who had completed their posting in the Department of Oral Medicine and Radiology of C.S.M.S.S Dental College and Hospital.

This study was conducted over a period of 2 months from July to August 2024, after an approval from the Ethical Committee of the Institute was obtained (CSMSS.DCH/R/UG/SS/2024:12).

The questionnaire was tested for its content validity by the experts to ensure its comprehensive ability for the undergraduate dental students under the study and no modifications were suggested.

The reliability of the questionnaire was assessed and it was approved.

The questionnaire consisted of 20 multiple choice questions regarding radiation hazards and radiation protection. The questions were formulated such as to assess the awareness, knowledge, attitude and practice of the participants.

The study sample was taken from all dental students of 3rd year, final year, and interns each of which were 100 participants studying bachelor of dental surgery (BDS).

Participants who were satisfying the inclusion criteria of the study were selected. Participation in the study was voluntary. An informed consent was taken from the participants.

Students of all these academic years had completed the questionnaire in their respective classrooms. About 10 to 15 minutes were given to complete the entire questionnaire.

Data collected was then analyzed statistically for the results to be formulated.

Statistical analysis:

The data of the descriptive study was summarized as percentage. Following the data collection, descriptive statistics were applied to the data.

Results:

A total of 300 undergraduate dental students had participated in the study, which included 100 students from third year, 100 from final year and 100 dental interns (Figure1)(Table1).

Majority of the participants were female students i.e. 80.33% and male participants contributing to 19.66% (Figure2) (Table1).

Overall response from 300 participants showed 62.39% of the participants gave correct responses. Out of which, dental interns were accurate up to 66.15%, followed by third year dental students (56.6%) and then final year dental students (55.5%)(Table 2).

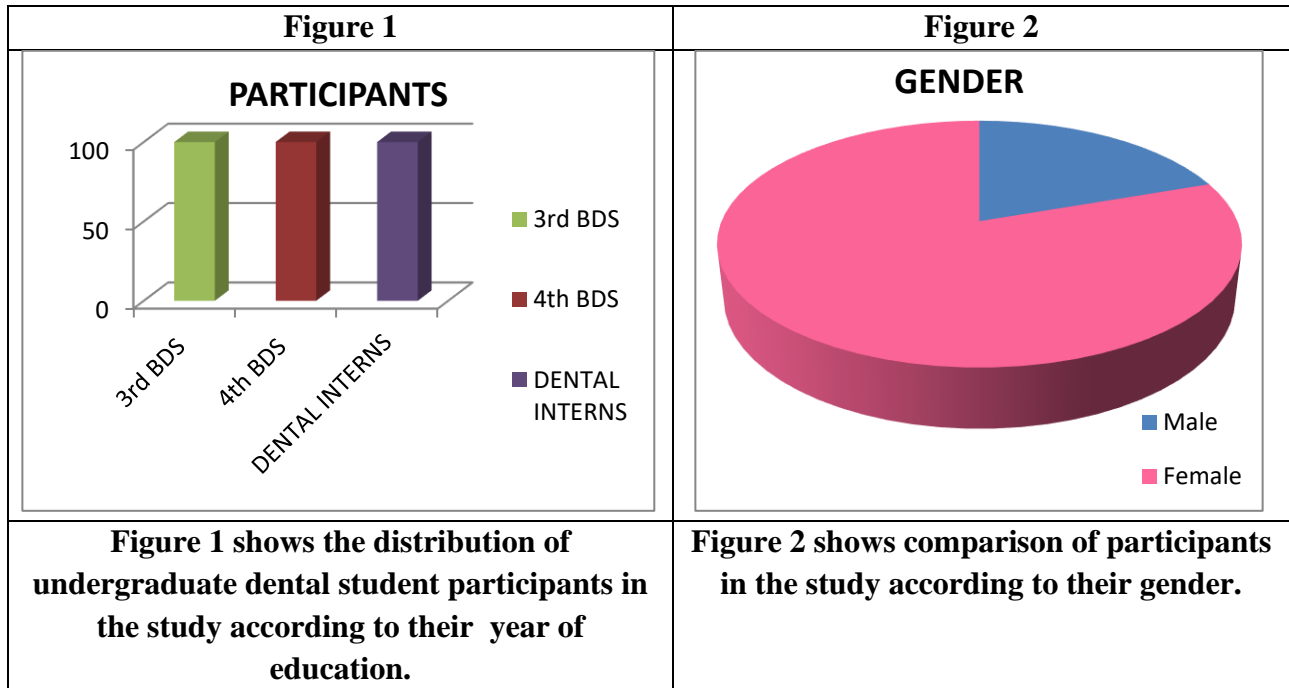


Table: 1 Distribution of study sample by gender, age and year of education.

VARIABLES	n (%)
Gender:	59 (19.66)
Male	241 (80.33)
Female	
Age (years)	22.72 ± 1.05
Mean ± SD	
Year of Education	
III BDS	100 (33.33)
IV BDS	100 (33.33)
Dental Interns	100 (33.33)




Table 2 shows the results of the study.

QUESTIONS	OPTIONS	3 BDS	4 BDS	INTER N	n%	p-value
<p>Q 1. How confident are you in your knowledge of radiatic hazards and the protection?</p>	<p>1)Very confident 2) Not really confident 3)Do not have any idea</p>	<p>58% 42% 0%</p>	<p>43% 55% 2%</p>	<p>74% 26% 0%</p>	<p>58% 41% 1%</p>	<p>0.00 0</p>

Q 2. X-rays are harmful.	1) Strongly agree 2) Agree 3) Not sure 4) Strongly disagree 5) Disagree	50% 44% 6% 0% 0%	43% 51% 4% 0% 0%	50% 47% 1% 2% 0%	47.60% 47.30% 3.60% 0.60% 0%	0.37 9
Q 3. As Low As Reasonably Achievable (ALARA) principle should be applied while taking radiographs.	1) Strongly agree 2) Agree 3) Not sure 4) Strongly disagree 5) Disagree	53% 34% 13% 0% 0%	34% 55% 11% 0% 0%	59% 37% 4% 0% 0%	48.60% 42% 9.30% 0% 0%	0.00 2
Q 4. Are you aware of National Council On Radiation Protection And Measurements (NCRP) and Atomic Energy Regulatory Board (AERB) recommendation?	1) Yes 2) No	62% 38%	50% 50%	69% 31%	60.30% 40%	0.02 6
Q 5. X-rays reflect from walls.	1) Strongly agree 2) Agree 3) Not sure 4) Strongly disagree 5) Disagree	57% 35% 8% 0% 10%	34% 28% 28% 10% 0%	42% 34% 16% 0% 0%	44.30% 32.30% 0.30% 0% 0%	0.00 0
Q 6. Ideal position distance should be followed while taking radiographs.	1) Strongly agree 2) Agree 3) Not sure 4) Strongly disagree 5) Disagree	52% 33% 15% 0% 0%	54% 43% 3% 0% 0%	61% 36% 2% 1% 0%	55.60% 37.30% 6.60% 0.30% 0%	0.00 3

Q 7. While taking radiographs one must stand behind a protective screen.	1) Strongly agree 2) Agree 3) Not sure 4) Strongly disagree 5) Disagree	59% 26% 15% 0% 0%	67% 24% 6% 3% 0%	73% 19% 4% 2% 2%	66.30% 23% 8.30% 1.60% 0.60%	0.021
Q 8. Which material does the screen consist of?	1) Lead 2) Glass 3) Steel	71% 19% 10%	92% 7% 1%	84% 13% 3%	82.30% 13% 4.70%	0.001
Q 9. Personal monitoring badges should be worn by the operator.	1) Strongly agree 2) Agree 3) Not sure 4) Strongly disagree 5) Disagree	55% 33% 12% 0% 0%	57% 37% 6% 0% 0%	63% 30% 5% 1% 1%	58.30% 33.30% 77.60% 0.30% 0.30%	0.328
Q 10. Dosimeter is used to measure the radiation dose.	1) Strongly agree 2) Agree 3) Not sure	53% 34% 13%	37% 43% 20%	59% 35% 6%	49.66% 37.30% 13%	0.010
Q 11. Digital radiography requires less exposure than conventional.	1) Strongly agree 2) Agree 3) Not sure 4) Strongly disagree 5) Disagree	52% 32% 16% 0% 0%	40% 41% 18% 1% 0%	55% 42% 2% 1% 0%	49% 38.30% 12% 0.60% 0%	0.008
Q 12. Radiographs are absolutely contraindicated for pregnant patients.	1) Strongly agree 2) Agree 3) Not sure 4) Strongly disagree 5) Disagree	34% 48% 18% 0% 0%	49% 36% 10% 5% 0%	54% 38% 5% 2% 1%	45.60% 40.60% 11% 2.30% 0.30%	0.006
Q 13. What do you use as a protective	1) Lead apron 2) Thyroid collar 3) Shielding gloves	58% 41% 1%	67% 14% 7%	85% 12% 0%	70% 22.30% 2.60%	0.000

barrier?	4) Protective devices	0%	12%	3%	5%	
Q 14. Which among the following is the most radio sensitive organ?	1) Bone marrow 2) Kidney 3) Neurons	60% 34% 6%	72% 10% 18%	78% 18% 4%	70% 20.60% 9.30%	0.00 0
Q 15. Which among the following is the most radio resistant organ?	1) Testes 2) Muscle cells 3) Lungs	39% 57% 4%	21% 66% 13%	29% 63% 8%	29.60% 62% 8.30%	0.02 3
Q 16. Which among the following modalities do you think use X-ray?	1) CT Scan 2) MRI 3) Conventional fluoroscopy 4) Dental radiography	48% 33% 4% 15%	15% 13% 6% 66%	22% 10% 0% 68%	28.30% 18.60% 3.30% 49.60%	0.00 0
Q 17. High radiation doses lead to cancer.	1) Strongly agree 2) Agree 3) Not sure 4) Strongly disagree 5) Disagree	57% 37% 5% 1% 0%	54% 42% 4% 0% 0%	55% 44% 1% 0% 0%	55.30% 41% 3.30% 0.30% 0%	0.51 3
Q 18. Are you aware of the protocol for radiographic waste management?	1) Yes 2) No	75% 25%	75% 25%	92% 8%	80.60% 19.30%	0.00 2
Q 19. Which among the following you think will be the most appropriate way of	1) Lectures 2) Tutorials or workshop 3) Case studies 4) Learning modules	75% 24% 1% 0%	34% 48% 14% 4%	57% 41% 1% 1%	55.30% 37.60% 5.30% 1.60%	0.00 0

awareness of radiation protection and hazards?						
Q 20. Radiation protection icon?	1) 	79%	77%	82%	79.30%	0.015
	2) 	21%	14%	15%	16.60%	
	3) 	0%	9%	3%	4%	

Discussion:

In the present study 94.9% of participants were aware that x rays are harmful, out of which 47.6% strongly agreed while 47.3 have showed agreement. However, Motwani *et al* reported 77.25% of participants strongly agreed.⁷ Rahul *et al.* reported 83.3% agreement among dental participants.¹⁰ Also in a study conducted by Asha *et al.*, 84.4% of dental practitioners reported agreement.¹² While study by Prabhat *et al.* reports 100% agreement among the participants.¹³

Although 89.3% of the participants have shown agreement to standing behind a protective screen while taking radiographs. In contrast, study by Motwani *et al.*, 95% of dental interns strongly agreed.⁷ In the study by Asha *et al.*, 43.8% of participants agreed that they stand behind the screen.¹² In the study by Nagaraj *et al.*, 76% of participants were reported to stand behind the protective screen while taking radiographs.¹⁴

Almost 82.3% of all the participants agreed that protective screens consist of lead and 70% used lead apron as a protective barrier. In a study by Motwani *et al.*, 95% of all agreed for using lead as protective screen and protective barrier.⁷ In the study by Asha *et al.*, lead apron was used by only 40% of practitioners.¹²

As regards the radiation protection symbol as many as 79.3% of the participants were aware of the same which comprises of 82% of dental interns. Motwani *et al* in their study claimed that 94% of dental interns were aware about the radiation protection symbol.⁷

About 90.6% of the participants have shown agreement to using ALARA principle while taking radiographs. In the study by Motwani *et al.*, only 51% of the dental students were aware of the ALARA principle.⁷ In the study by Enabulele, only 17.9 % of the participants know what ALARA means.¹⁵ It can be inferred that these students who were unfamiliar with the term cannot apply ALARA in practice and consequently patient receive unnecessary radiation exposure.

About 60.30% of the students in the present study were aware of NCRP and AERB recommendation, in contrast to the study conducted by Motwani *et al.*, were 54% of the dental participants were aware.⁷ While Rahul *et al.* reported 38.5% of awareness.¹⁰ Asha *et al.* in their study, reported 59.4% of awareness.¹² In the study by Prabhat *et al.* were 96- 100% awareness was reported among dental interns and students.¹³ Participant's awareness can be improved by including the topic of radiation protection in the early academic years dental students.

In the present study about 87.3% of dental participants agreed that digital radiography requires less exposure than conventional. In a study by Motwani *et al.*, 74% of dental participants have shown agreement.⁷ While study conducted on dental undergraduates by Rahul *et al.* 128 out of 174(73.6%) showed correct response.¹⁰ Whereas, Prabhat *et al.* in his study showed correct response of 98.4% by dental interns followed by IV year dental students(95.5%) and III year students(31.2%).¹³ It can be inferred that dental interns are more aware about digital radiography and its advantages than dental students from third and final year.

When they were asked, whether radiographs are absolutely contraindicated during pregnancy, 86.2% of the participants have shown agreement out of which dental interns were 92% followed by final year (85%) followed by third year (82%). From our study it is observed that dental interns were most aware about contraindication of radiograph in pregnant patients. In a study conducted by Motwani *et al.*, 23% dental interns and 32% dental students had agreed.⁷

In the present study, 80.60% of all the participants were aware of radiographic waste management. Whereas, study by Motwani *et al.*, shows 47% of dental students and 36% of dental interns were aware.⁷ Asha *et al.* in her study out of 40 dental practitioners, 28.1% practitioners disposed them with general waste, 12.5% with medical waste and 12.5% buried the radiographic waste.¹² This implies that special efforts need to be taken to improve knowledge of dental students in this field.

On the whole when the responses of all the participants regarding radiation hazards and radiation protection were compared, it is observed that the dental interns were more knowledgeable than third and final year dental students.

Hence, the present study was conducted to explore the awareness, knowledge, attitude and practice regarding radiation hazards and radiation protection among dental undergraduate students.

Conclusion:

The present study revealed that the awareness and knowledge regarding radiation hazards and protection were less among the participants. The study highlights the importance of lectures and training programs for improving the awareness, knowledge, attitude and practice of future dental practitioners. It is recommended that the curriculum of dental school should be expanded further for third and final year dental students to improve their knowledge about radiation so that it highlights awareness and acknowledge their willingness to gain and implement the knowledge about radiation hazards and protection as future dental practitioners.

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