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Original Article

Dentistry Section

Knowledge and Attitude Towards Radiation Hazards and Protection among Dental Students in Latur, Maharashtra, India: A Cross-sectional Study

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ABSTRACT

Introduction: In our day-to-day clinical practice, X-radiation plays a vital role in oral diagnosis and treatment planning in dentistry. However, radiations are harmful and cause biological damage to the human body. Hence, to have the benefits outweigh the risks, it is essential to inculcate awareness regarding radiation protection measures among the dental students.

Aim: To evaluate the knowledge and attitude towards radiation hazards and protection among the dental students.

Materials and Methods: A cross-sectional study was conducted on 200 randomly selected undergraduate including final year and third year dental students and interns, who had completed their 30 days rotatory posting in the Department of Oral Medicine and Radiology in Maharashtra Institute of Dental Science and Research, Latur, Maharashtra, India from the month February to July 2021. A prevalidated close ended questionnaire consisting of 25 questions was distributed among the students and data were collected and analysed using the Chi-square test. The p-value was set significant at 0.05.

Results: Out of 200 student participants, 91 (45.5%) were interns, 71 (35.5%) were final year students and 38 (19%) were third year students. The response of these participants was found to be non uniform and the knowledge and attitude towards radiation hazards and protection was highest in dental interns followed by final and third year students.

Conclusion: It is the need of hour to create awareness among dental students about radiation protection and safety in day-to-day clinical practice and update their knowledge by conducting relevant workshops.

Keywords: As low as reasonably achievable principle, Collimator, Lead apron, Thyroid collar

INTRODUCTION

Since past few years, the use of X-rays has been increased in medical and dental field and it plays a conspicuous role in dentistry from diagnosing minor carious lesions to significant periapical and maxillofacial lesions. It can also help in appropriate treatment planning. However, these X-rays are ionising electromagnetic radiations that may affect the biological molecules directly or indirectly through generation of free radicals which may depend on the dose and the duration of exposure [1]. Such biological effects may be classified into deterministic and stochastic effects. Deterministic effect is more lethal to the tissue due to enormous killing of the cells. The severity of response is proportional to the dose. Whereas, the stochastic effect is individual cell damage, which in turn damages the DNA leading to carcinogenesis and heritable defects [2].

Although radiation produced during diagnostic dental procedure is insignificant, it may pose a huge impact on individual over a period of time and may lead to tissue damage. Hence, it is of utmost importance to inculcate knowledge and awareness among the dental students regarding judicious use of this double-edged sword for the benefit of mankind [3]. In this context, Enabulele JE and Igbinedion BO [4] had conducted a study where he observed that 75.6% of the students were not having adequate knowledge. Mubeen SM et al., [5]. had conducted a study among medical students and concluded that majority of medical students have limited knowledge about radiation sources used, risk involved and radiation protection. Srivastava R et al., in his study assessed that the undergraduates de-emphasise the proper use of dental imaging tool, protective measures and their associated radiation risks [6]. A similar study has never been conducted in Latur and hence, the present study was proposed to assess the knowledge and attitude towards radiation hazards and protection among the undergraduate dental students of Maharashtra Institute of Dental Science and Research, Latur, India.

MATERIALS AND METHODS

This cross-sectional study was conducted in the Department of Oral Medicine and Radiology of Maharashtra Institute of Dental Science and Research, Latur, Maharashtra, India from the month February to July 2021. Ethical Committee approval was obtained from Institutional Ethics Committee prior to the study [Approval no. MIDSR/STU/837/919/2021].

Inclusion criteria: The students including interns, final year and third year students, irrespective of gender who had completed their rotatory 30 days posting in the Department of Oral Medicine and Radiology were included.

Exclusion criteria: Students who had not completed their posting in the department, first and second year students and students who did not answer all questions were excluded.

Sample size calculation: Sample size was calculated by using formula, $S=Z_{1-a/2}^2 P(1-p)/d^2$. $Z_{1-a/2}$ is standard normal variate (at 5% type 1 error ($p<0.05$) it is 1.96 and at 1% type 1 error ($p<0.01$) it is 2.58) as in majority of studies p-values are considered significant below 0.05 hence, 1.96 is used in formula, P=Expected proportion in population based on a previous study and d=absolute error or precision which has to be decided by researcher [7]. Therefore, present study sample size=$(1.96)^2 * 0.15 (1-0.15)/(0.05)^2$=196. Total 210 students were enrolled in the study out of which 200 were selected, which seems adequate with respect to the sample size desirable for the study.

Questionnaire

A questionnaire comprised of 25 questions, structured and validated from Medline/PubMed indexed similar studies on knowledge, attitude and perception of dental students towards radiation hazards and protection [8-11] was prepared and pretested by senior professionals, the validity and reliability scores were 0.80 and 0.70, respectively.

The students who were willing to participate were asked to assemble in lecture hall where the study questionnaire was distributed to each participant and after 30 minutes the response sheets were collected. A written informed consent was obtained from every participant after explaining the purpose of the study and before commencement of the test.

The questionnaire consisted of 25 multiple choice questions, out of which first 15 questions were formulated to evaluate the knowledge and the next 10 questions were meant to evaluate attitude of students about radiation safety. Demographic data were also collected from each participant which include age, gender and academic year.

STATISTICAL ANALYSIS

The data was analysed using Statistical Package for Social Sciences (SPSS) version 17.0. The Chi-square test was used to evaluate the association of Knowledge and Attitude (KA) with the participants having different educational qualification and the p-value was set to a value of 0.05.

RESULTS

Out of 200 students who participated in the study, 91 (45.5%) were interns, 71 (35.5%) were final year students and 38 (19%) were third year students. Majority (81%) of the students are from the age group of 22-24 years, 16% were from the age group of 20-21 years age group and 3% of students were from the age group of 25-26 years. Study included 91% females and 9% males. The knowledge of the participants about radiation hazards and protection practices has been compared in [Table/Fig-1]. Significant difference was evident among the participants regarding the knowledge relating to the properties of X-rays, biological effects of radiation, safety guidelines, ideal safe distance, radiation dosage and radiosensitivity of tissues and organs ($p<0.05$).

The participant's attitude toward radiation protection practices has been compared in [Table/Fig-2]. It was seen that there was a significant difference among the participants regarding the preference for using film holders, personal monitoring badges, lead barrier, position-distance rule and other safety guidelines during exposure

S. No.	Knowledge items	Response	Groups			Chi-square test value	p-value
			Interns N (%)	Final year N (%)	Third year N (%)		
1	Dental X-ray is harmful	Yes	90 (98.9)	71 (100)	38 (100)	1.270	0.736
		No	01 (1.1)	0	0		
2	X-ray beams are reflected from regular room walls	Yes	82 (90.1)	25 (35.2)	21 (55.3)	55.054	0.01*
		No	09 (9.9)	46 (64.8)	17 (44.7)		
3	Awareness of the usefulness of collimators and filters in dental radiography	Yes	77 (84.6)	49 (69)	29 (76.3)	7.452	0.059
		No	14 (15.4)	22 (31)	9 (23.7)		
4	Does high radiation lead to cancer	Yes	91 (100)	71 (100)	38 (100)	33.496	0.003*
		No	0	0	0		
5	Expansion of ALARA principle	As low as reasonably attainable	2 (2.2)	2 (2.8)	1 (2.6)	79.5	<0.0001*
		As low as reasonably achievable	86 (94.5)	55 (77.5)	18 (47.4)		
		As low as radiation allows	3 (3.3)	8 (11.3)	19 (50)		
		As low as reasonably allowable	0	6 (8.5)	0		
6	Digital radiography requires less exposure than conventional	Yes	89 (97.8)	70 (98.6)	35 (92.1)	4.248	0.236
		No	02 (2.2)	01 (1.4)	03 (7.9)		
7	High-speed film requires a reduced exposure	Yes	59 (64.8)	45 (63.4)	30 (78.9)	6.028	0.110
		No	32 (35.2)	26 (36.6)	08 (21.1)		
8	Dental radiograph is absolutely contraindicated in pregnant patients	Yes	53 (58.2)	47 (66.2)	10 (26.3)	17.678	0.001*
		No	38 (41.8)	24 (33.8)	28 (73.7)		
9	Dental radiograph is advised in lactating mothers	Yes	29 (31.9)	27 (38.0)	25 (65.8)	13.225	0.004*
		No	62 (68.1)	44 (62.0)	13 (34.2)		
10	The ideal distance an operator should stand while taking intraoral radiographic exposure	4 ft. 90-135°	0	04 (5.6)	13 (34.2)	70.441	0.001*
		4-6 ft. 90-130°	06 (6.6)	17 (23.9)	09 (23.7)		
		6 ft. 90-135°	85 (93.4)	47 (66.2)	16 (42.1)		
		7 ft. 90-130°	0	03 (4.2)	0		
11	Most radiosensitive organ/cell	Thyroid	89 (97.8)	66 (93.0)	22 (57.9)	55.468	0.002*
		Kidney	01 (1.1)	02 (2.8)	02 (5.3)		
		Neurons	01 (1.1)	02 (2.8)	14 (36.8)		
		Liver	0	01 (1.4)	0		
12	Most radioresistant organ/cell	Testes	06 (6.6)	03 (4.2)	0	36.766	0.001*
		Muscle cell	83 (91.2)	63 (88.7)	32 (84.2)		
		Lungs	2 (2.2)	05 (7.0)	06 (15.8)		
13	Which of the following do you use to measure radiation exposure dosage?	TLD badges	89 (97.8)	45 (63.4)	25 (65.8)	18.578	0.001*
		LED goggles	1 (1.1)	4 (5.6)	1 (2.6)		
		Gonad shield	0	1 (1.4)	0		
		Lead apron	1 (1.1)	21 (29.6)	12 (31.6)		

14	Most deleterious radiation source	Industry	49 (53.8)	44 (62.0)	31 (81.6)	44.161	0.001*
		Medical	09 (9.9)	22 (31)	03 (7.9)		
		Natural source	33 (36.3)	05 (7)	04 (10.5)		
15	Radiation dosage for single IOPAR	0.2 mSv	04 (4.4)	22 (31.0)	06 (15.8)	42.419	0.001*
		1.2 mSv	04 (4.4)	03 (4.2)	02 (5.3)		
		0.005 mSv	66 (72.5)	37 (52.1)	29 (76.3)		
		0.052 mSv	17 (18.7)	09 (12.7)	01 (2.6)		

[Table/Fig-1]: Knowledge of participants towards radiation hazards and safety.
ALARA: As low as reasonably achievable; TLD: Thermoluminescent dosimeter; IOPAR: Intraoral periapical radiographs

and preference of rectangular over round collimator and paralleling cone technique over bisecting angle technique. With regards to the use of lead aprons, there was a statistically significant difference in the response of the participants and mainly due to preference of following position-distance rule.

In the present study, 64.8% of interns, 63.4% of final years and 78.9% of third year were aware about use of high-speed film (E-speed). Whereas, in the study conducted by Eman A [11] the percentage is 66% and in Srivastava R et al., [6] study, 62.6% awareness was obtained for the use of high-speed film.

S. No.	Attitude items	Response	Groups			Chi-square test value	p-value
			Interns	Final year	Third year		
			N (%)	N (%)	N (%)		
1	Preference to use film holder during exposure	Yes	77 (84.6)	66 (93)	32 (84.2)	16.844	0.001*
		No	14 (15.4)	05 (7)	06 (15.8)		
2	Asking the patient to hold the film with their hand during exposure	Yes	21 (23.1)	18 (25.4)	06 (15.8)	3.763	0.288
		No	70 (76.9)	53 (74.6)	32 (84.2)		
3	Personal monitoring badges should be worn by the operator	Yes	81 (89)	51 (71.8)	21 (55.3)	18.578	0.001*
		No	10 (11)	20 (28.2)	17 (44.7)		
4	Usage of lead aprons on a regular basis	Frequently	56 (61.5)	34 (47.9)	26 (68.4)	15.995	0.014*
		Rarely	17 (18.7)	10 (14.1)	09 (23.7)		
		Never	18 (19.8)	27 (38)	03 (7.9)		
5	If rarely/never, the reason is	Weight of the apron	1 (1)	0	1 (2.6)	20.141	0.003*
		Common apron for all	2 (2.1)	1 (1.4)	0		
		Position-distance rule followed	32 (35.1)	36 (50.7)	11 (28.9)		
6	To stand behind lead barrier every time during exposure	Yes	90 (98.9)	71 (100)	38 (100)	75.278	0.003*
		No	01 (1.1)	0	0		
7	Do you follow Ideal distance while taking an intraoral radiograph	Yes	85 (93.4)	47 (66.2)	16 (42.1)	70.441	0.001*
		No	06 (6.6)	24 (33.8)	22 (57.8)		
8	Type of collimator which reduces radiation exposure	Round	64 (70.3)	34 (47.9)	30 (78.9)	15.483	0.001*
		Rectangular	27 (29.7)	37 (52.1)	08 (21.1)		
9	Preferred technique while taking a periapical radiograph	Paralleling Cone	44 (48.4)	37 (52.1)	27 (71.1)	48.410	0.001*
		Bisecting Angle	47 (51.6)	34 (47.8)	11 (28.9)		
10	Allowing subjects to enter the room during exposure	Yes	07 (7.7)	06 (8.5)	17 (44.7)	34.414	0.001*
		No	84 (92.3)	65 (91.5)	21 (55.3)		

[Table/Fig-2]: Attitude of participants towards radiation protection practices.
p-value <0.005, considered a highly significant*

The knowledge and attitude towards radiation hazards and protection was found to be highest in dental interns followed by third and final year students.

DISCUSSION

The knowledge and attitude among interns, final year and third year students has been found to be non uniform. It has been observed that in the present study, out of 200 students, 98.9% of interns, 100% of final year students and 100% of third year students were aware of use of lead barrier during exposure. When similar study was conducted by Prabhat MP et al., [10]. The response obtained for same question was 100%. Almost 77.5% out of which 84.6% interns, 69% final year, 76.3% third year students were aware of the usefulness of collimators and filters in present study, whereas, Eman A [11] reported 73% response for usefulness of collimator and filter in his study and 83.3% positive response was obtained in the study conducted by Srivastava R et al., in 2017 [6].

From this study, it was noticed that 94.5% of interns, 77.5% of final year and 47.4% of third year and total 79.5%. Students were aware about ALARA principle. However, in the study conducted by Arnout EA and Jafar A [9] 40% of total students were aware of ALARA principle. In the study conducted by Asha et al., [12] 34% dentist follow this rule during their practice and in the study conducted by Javali R and Dantu R [13] it was observed that 74% dental students follow the similar rule.

Almost 41.8% of interns, 33.8% of final years and 73.7% of third year students were against taking radiographs in pregnant patients in present study whereas according to Srivastava R et al., study [6], 59.8% of students were against taking radiographs during pregnancy and according to Kuzhalvaimozhi P and Vadivel JK [14] 58% of the students including interns, final and third year contraindicated X-rays in pregnant women. Rela R [15] reported 46% contraindication against radiography in pregnant ladies in her study.

S. No.	Authors' name and year	Place of study	Number of subjects	Population considered	Parameter compared	Conclusion
1	Ali SD et al., (2020) [17]	Iraq	255	Dental undergraduate students and interns, whose curriculum includes dental radiology	Knowledge, attitude, and perception (KAP)	The KAP level with regard to radiation protection protocol was highest in interns and the least with the third year students
2	Kuzhalvaimozhi P et al., (2020) [14]	Chennai	100	Interns	Awareness and knowledge between the gender of interns.	Majority of the interns were aware of the adverse effects of radiation but, there are some pitfalls regarding radiation safety used in dental clinics.
3	Rela R (2019) [15]	Eastern India	107	Undergraduate (UG) dental students, dental interns (Intern) and dental postgraduate students (PG)	Knowledge and awareness about radiation protection among dental students	The results were mixed and the result showed that knowledge, Awareness and Practice regarding radiation protection among dental student was not uniformly good.
4	Wazir SS et al., (2019) [18]	Parsa District of Nepal	120	Dental students, interns, and dental practitioners	Assessment of knowledge, attitude, and perception (KAP) towards radiation hazards	The KAP level mentioned in the objectives was significantly higher in dental practitioners and least with undergraduate students.
5	Javali R et al., (2018) [13]	North Karnataka	200	General dentist and specialist	To assess the attitude and awareness about Radiation protection among dental surgeons	The study showed that further need of implementation of radiation protection principles among dental surgeons in North Karnataka. Most of the dental surgeon did not practice radiation protection procedures.
6	Sultan R et al., (2018) [19]	Pakistan	480	Undergraduates, house officers and post graduate trainees	Knowledge, attitude and practices comparison among undergraduate and postgraduate	Undergraduates had less knowledge, attitude and practices towards dental radiography as compared to postgraduate students with significant difference between the two groups.
7	Srivastava R et al., (2017) [6]	Kanpur, Uttar Pradesh, India	174 dental students	3rd year, final year, and interns	Knowledge, attitude, and perception (KAP) of dental students	KAP level among dental students towards biological hazards of x-ray and protection was low to average
8	Swapna LA et al., (2017) [2]	Telangana, India	256	3rd and 4th year Bachelor of Dental Surgery (B.D.S.) students and interns	Knowledge, attitude and practice	KAP levels of the dental students regarding the biological effects of x-rays and the different protective measures were low to medium
9	Shah HG et al., (2014) [8]	Ahmedabad, Gujarat	136	Interns, graduates and postgraduate's students	Knowledge and practices	The participants had unsatisfactory knowledge about the radiation protection protocols and radiation hazards
10	Enabulele JE et al., (2013) [4]	Nigeria	78	Fifth year dental students	Assessment of knowledge and practice and correlating their knowledge to practice on dental radiography	The dental students in the present study did have good knowledge on radiation biology but show relatively poorer knowledge on radiation protection. Despite their poor radiation protection knowledge their practice was better
11	Present study	Maharashtra Institute of Dental Science, Latur	200	Intern, final year and third year students	Knowledge and attitude	Knowledge and attitude among interns were highest followed by third and final year students

[Table/Fig-3]: Comparison of the findings of present study with previous studies [2,4,6,8,13-15,17-19].

About 97.8% of interns, 93% of final years and 57.9% of third year students preferd to choose thyroid gland as the most sensitive organ of the body. When same study was conducted by, Rahman FBA et al., in Chennai in 2018, total 94% of participants were aware of thyroid as the most sensitive organ of the body [16].

When question asked "Which of the following do you use to measure radiation exposure dosage?" A total of 97.8% of interns, 63.4% final year students, 65.8% of third year students were aware of using TLD batches to measure radiation exposure. According to Shah HG et al., [8] 98.6% of the student use TLD, and in the study conducted by Prabhat MP et al., [10] 84% of students were aware of the use of TLD badges in their study. When the question was asked regarding the use of protective barriers, in the present study approximately 100% of students from final year and third year gave correct answer followed by interns.

In the present study, 61.5% of interns, 47.9% of final year students and 68.4% of third year students used lead apron regularly whereas in a similar study conducted by Rela R in 2019, [15] almost 97% of dental students were using lead apron. A lead apron is a primary protective measure against radiation and it is made up of 0.25 to 1 mm thick lead. About 0.5 mm thick apron can attenuate approximately 90% or more of scattered radiation [16].

Total 29.7% interns, 52.1% final years students and 21.1% of third years were aware of benefit of using rectangular type of collimator. Similar result were obtained in the study conducted by Javali R and Dantu R [13] where 43% of the dentists preferred to use rectangular collimator.

Similar study by Ali SD et al., in 2020 on KAP with respect to radiaion protection showec that interns were more aware of radiation safety than final and third year students [17]. The study conducted by Wazir SS et al., [18] which was similar to present study, concluded that, the KAP on radiation protection was higher in dental practitioners, followed by the interns and third year students. In 2018, Sultan R et al., [19] conducted a study on undergraduates, house officers and postgraduate trainees regarding KAP towards radiation protection and concluded undergraduates had less knowledge, attitude and practices towards dental radiography as compared to postgraduate students with significant difference between the two groups. Comparison of the findings of the present study with previous studies have been done in [Table/Fig-3] [2,4,6,8,13-15,17-19].

Limitation(s)

The present study did not consider the postgraduates. For more authentication of the study, large number of populations with equal numbers of male and female candidates and equal numbers of postgraduates and undergraduates should be included in the study.

CONCLUSION(S)

The obtained result from participants was non uniform and the maximum correct answers were obtained from interns followed by third year and final year students. So, it revealed that the knowledge and attitude between interns, final year and third year students towards radiation hazards and protection was highest among dental interns followed by final and third students. To fill the knowledge deficit among the students and to upgrade their

knowledge, regular workshops and Continuing Dental Education (CDE) programs can be conducted with emphasis on recent researches and protocols.

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