

# Assessment of Knowledge, Attitude and Practice of Undergraduate Final Year Dental Students and House Officers Regarding Radiation Protection Protocols: A Question Based Cross-Sectional Study

Knowledge of  
Students about  
Radiation  
Protection  
Protocols

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## ABSTRACT

**Objective:** To assess the baseline knowledge and attitude of undergraduate final year BDS dental students and house officers regarding radiation exposure effects and its precautionary measures.

**Study Design:** Cross Sectional study

**Place and Duration of Study:** This study was conducted at the Operative Dentistry, Margalla Institute of Health Sciences, Rawalpindi for 6 months from 1<sup>st</sup> September 2021 till 31<sup>st</sup> December 2021.

**Methods:** A total of 141 participants took part in this study. The study was carried out using an online Google survey form. The questioner was formulated to get responses from the dental students and house officers regarding the effects of radiations and the use of precautionary measures.

**Results:** Of the total of 141 responses, 97 were dental students and 44 house officers that participated in the study. The results regarding the hazards of dental radiographs that were responded accurately ranged from 26.8% to 87.6 % for dental students and 22.7% to 93.2% of the house officers. There was unanimity among students and the interns regarding the questions.

**Conclusion:** The knowledge and attitude of undergraduate final year BDS dental students and house officers regarding radiation exposure effects and its precautionary measures ranged from medium to low in all groups. This mandates the demand for continual teaching and awareness regarding the safety protocols and use of dental radiographs in dentistry.

**Key Words:** Attitude, Hazards, Knowledge, Practice, Protection, Radiography

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## INTRODUCTION

Exposure of living body to radiation exposure has pernicious effects on health. Ionizing radiation has potential to damage normal human body cells and can cause acute effects such as skin burns and long-term effects like cancers.

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Variation in harmful effects of radiation exist depending upon dose and duration of radiation exposure. <sup>(1),(2)</sup> Diagnosis and treatment via radiations is a common and reliable practice in medicine as well as in dentistry. Radiation tools in dentistry range from x-ray to cone beam computed tomography<sup>(2)</sup>. In dentistry dental radiograph is mainstay for diagnosis of oral diseases.<sup>(3)</sup> According to the IAEA (International Atomic Energy Agency) typical effective dose for intra oral dental x-ray imaging procedure 1-8 $\mu$ Sv; the dose for the intra oral dental radiograph is although lower but various epidemiological surveys contribute evidence that prolonged exposure cause the risk of brain, salivary glands and thyroid tumours.<sup>(4-7)</sup> Long term exposure to low dose ionizing radiations can cause permanent DNA damage.

Use of lead aprons, thyroid collars, type of radiographic film, proper positioning of patient and doctor, proper angulation of tube head and positioning of film are important tools and techniques for protection from radiation while taking of dental imaging in order to

reduce radiation<sup>(2)</sup>. Although the selection criteria for dental radiographs has been revised and published in agreement with guidelines and peer- dental radiograph.<sup>[8,9]</sup> The radiation reducing techniques like thyroid shield must be applied only when they do not interfere with imaging results.<sup>(2,9)</sup>

Since 1977, the International Commission on Radiological Protection (ICRP) began to develop the risk/benefit concept. This concept is recommended that all patients exposure must be justified and kept as low as possible<sup>(14,15)</sup>. Therefore, it is mandatory to follow ALARA principle “As Low as Reasonably Achievable” during dentist routine work. However, ALARA principles are not strictly applied in the dental field. The dentists should justify the criteria reviewed research materials of USA, Europe & Korea, little has been published on this subject in Pakistan<sup>(3)</sup>. Exposure to the radiation is very common for the dentist and undergraduate dentals students during their clinical rotations. Awareness of radiation hazards is very crucial for the dental students so that they can practice proper precautionary protocols for their and patient’s health.<sup>(10,11)</sup>

This mandates the need to assess the undergraduate dental student’s and house officer’s knowledge and practice of precautionary protocols regarding radiation exposure.<sup>(1), (3)</sup>

**METHODS**

A total of 141 participants took part in this cross-sectional study. The number of dental students was 97 while 44 house officers filled out the questioners. This differentiation of dental students and house officers was done to verify if the experience had any relevance regarding knowledge about the radiation hazards and safety protocols. Table 1 depicts the distribution and gender of house officers and dental students.

The assessment was carried out using a questioner which was disseminated online with modifications from Binti Abd Rahman et al., 2018<sup>(1)</sup>. The responders filled out a consent form and showed their willingness to be part of this survey. The data collection was carried out online through Google survey online among the undergraduate and house officers of Dental colleges of Rawalpindi and Islamabad region. A non-probability consecutive sampling technique was employed.

The questioner was divided broadly into two categories dealing with knowledge regarding radiation exposure and secondly about the safety protocols concerning dental radiology.

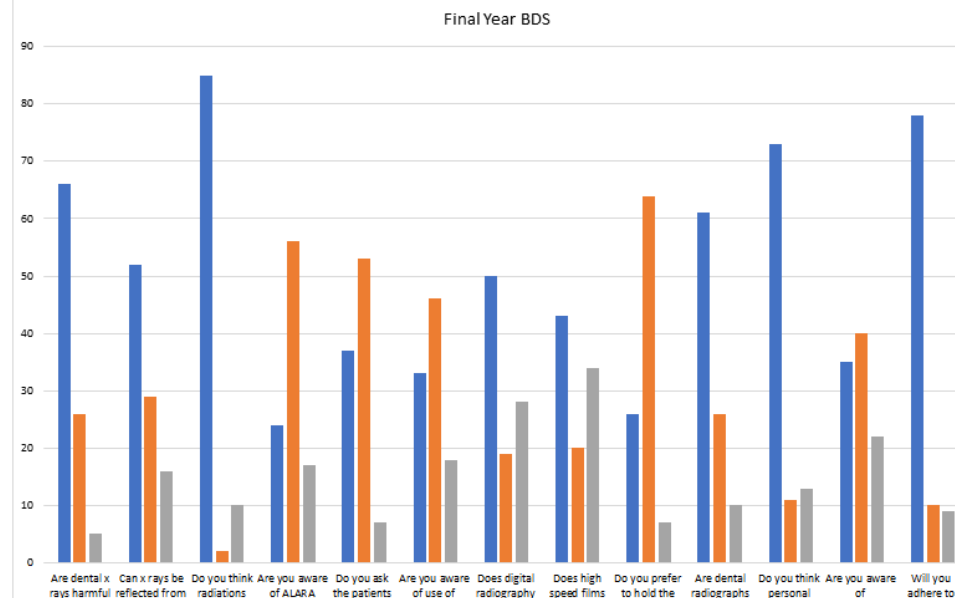
**Statistical Analysis:** A non-parametric Spearman rank correlation test was used to analyse the differences between the responses of students and house officers. Statistical analysis was carries out with IBM<sup>R</sup> SPSS Version 26 for Windows.

**RESULTS**

The study comprised of total 141 participants of which 97 were final year BDS students. The male participation was 54.6% while females were 45.4%. The house officers were total of 44 who took part in the study and the male and female distribution was equal. Table 1.

**Table No.1: Classification of participants.**

		Group				Total
		Final year BDS		House officers		
		Count	%	Count	%	
Gender	Male	53	54.6%	22	50.0%	75
	Female	44	45.4%	22	50.0%	66
<b>Total</b>		<b>97</b>		<b>44</b>		<b>141</b>

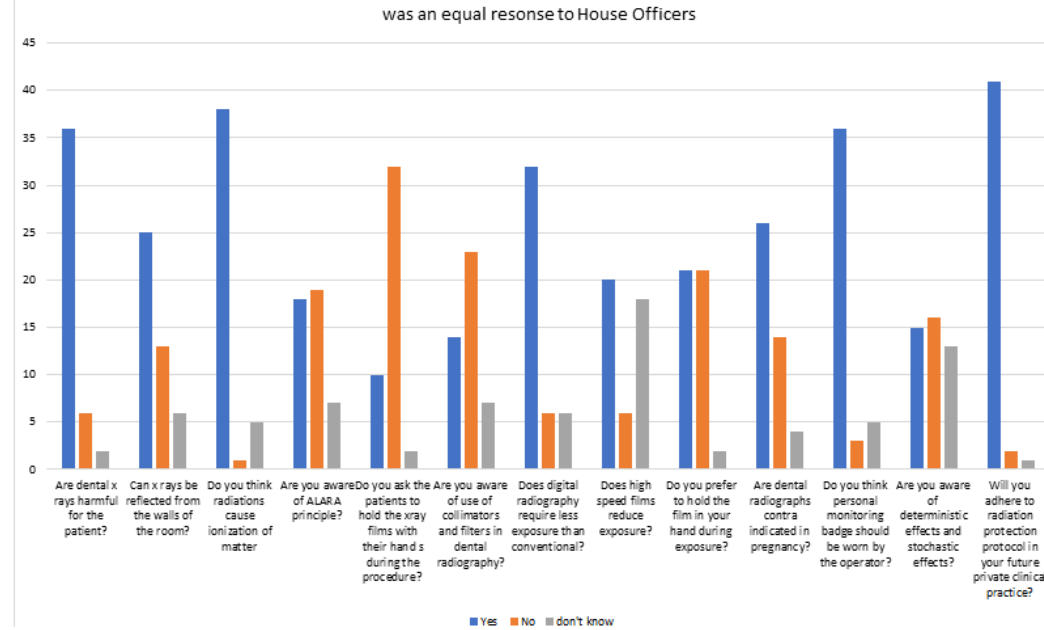


Graph No.1 Student data regarding the hazards of radiation

Table No. 2: Responses entered by the undergraduates and house officers.

No.	Questions	Group				P-value	
		Final year BDS		House officers			
		Count	%		%		
1	Are dental x rays harmful for the patient	Yes	66	68.0%		81.8%	0.22
		No	26	26.8%	6	13.6%	
		Don't know	5	5.2%	2	4.5%	
2	Can x rays be reflected from the walls of the room	Yes	52	53.6%	25	56.8%	0.41
		No	29	29.9%	13	29.5%	
		Don't know	16	16.5%	6	13.6%	
3	Do you think radiations cause ionization of matter	Yes	85	87.6%	38	86.4%	0.57
		No	2	2.1%	1	2.3%	
		Don't know	10	10.3%	5	11.4%	
4	Are you aware of ALARA principle	Yes	24	24.7%	18	40.9%	0.80
		No	56	57.7%	19	43.2%	
		Don't know	17	17.5%	7	15.9%	
5	Do you ask the patients to hold the x-ray films with their hands during the procedure	Yes	37	38.1%	10	22.7%	0.11
		No	53	54.6%	32	72.7%	
		Don't know	7	7.2%	2	4.5%	
6	Are you aware of use of collimators and filters in dental radiography	Yes	33	34.0%	14	31.8%	0.48
		No	46	47.4%	23	52.3%	
		Don't know	18	18.6%	7	15.9%	
7	Does digital radiography require less exposure than conventional	Yes	50	51.5%	32	72.7%	0.97
		No	19	19.6%	6	13.6%	
		Don't know	28	28.9%	6	13.6%	
8	Does high speed films reduce exposure	Yes	43	44.3%	20	45.5%	0.35
		No	20	20.6%	6	13.6%	
		Don't know	34	35.1%	18	40.9%	
9	Do you prefer to hold the film in your hand during exposure	Yes	26	26.8%	21	47.7%	0.97
		No	64	66.0%	21	47.7%	
		Don't know	26	26.8%	2	4.5%	
10	Are dental radiographs contra indicated in pregnancy	Yes	61	62.9%	26	59.1%	0.43
		No	26	26.8%	14	31.8%	
		Don't know	10	10.3%	4	9.1%	
11	Do you think personal monitoring badge should be worn by the operator	Yes	73	75.3%	36	81.8%	0.35
		No	11	11.3%	3	6.8%	
		Don't know	13	13.4%	5	11.4%	
12	Are you aware of deterministic effects and stochastic effects	Yes	35	36.1%	15	34.1%	0.036*
		No	40	41.2%	16	36.4%	
		Don't know	22	22.7%	13	29.5%	
13	Will you adhere to radiation protection protocol in your future private clinical practice	Yes	78	80.4%	41	93.2%	0.34
		No	10	10.3%	2	4.5%	
		Don't know	9	9.3%	1	2.3%	
14	How do you think x rays cause hazard to humans?	Due to direct effect of x rays	40	41.2%	14	31.8%	0.23
		Due to indirect effect of x-rays	10	13.4%	2	4.5%	
		Due to effect on somatic cells	11	11.3%	7	15.9%	
		Due to effect on genetic cells	13	10.3%	6	13.6%	
		All of above	22	22.7%	14	31.8%	
		None of the above	1	1.0%	1	2.3%	
15	The ideal distance an operator	4 feet (90-135 degrees)	19	19.6%	5	11.4%	0.50

	should stand while dental radiographic exposure is:	4 feet (60-90 degrees)	43	44.3%	9	20.5%	
		6 feet (90-135 degrees)	24	24.7%	22	50.0%	
		6 feet (60-90 degrees)	11	11.3%	8	18.2%	
16	Do you regularly prefer using lead aprons?	Always	30	30.9%	15	34.1%	0.85
		Often	25	25.8%	8	18.2%	
		Sometimes	26	26.8%	9	20.5%	
		Rarely	12	12.4%	6	13.6%	
		Never	4	4.1%	6	13.6%	
17	If never, rarely or sometimes then why not?	Aprons not available	44	45.4%	21	47.7%	0.99
		Due to weight of apron	14	14.4%	5	11.4%	
		Common apron for all	22	22.4%	9	20.5%	
		I follow only distance rule	14	14.4%	6	13.6%	
		I follow only position rule	3	3.1%	3	6.8%	



Graph No.2: House Officer Data

Graph 1 showing all the results of dental students regarding the hazards of radiation.85% of the students knew about the ionization effects of the radiation.47.4%of the students were unaware of the collimators and filters used in dental radiology.80.4% of the respondents opted to adhere to the radiation safety protocol in future. 40 % of the students were unaware while 36.1% were aware of the deterministic effects and stochastic effects of radiations.

Graph 2 depicting the data gathered from the house officers.81.8% were sure about the radiation damage.87 % of the house officers were aware of the ionizing radiation damage.52.3%of the house officers didn't have knowledge about the collimators and the filters. There was an equal response to film holding of 47.7%. 93.3% of the house officers responded that they would adhere to radiation protection protocol in future.

**Comparison of responses between final year BDS students and house officers:** Regarding the safety protocols of dental radiographs, the knowledge of undergraduates and house officers was comparable except for the question regarding the awareness of

deterministic and stochastic effects 36.4% students and 34.1% responded in affirmation while 41.2% students opted for No and 22.7% didn't know about that. On the other hand 36.4% of house officers response was negative while 29.5% opted for don't know (P = 0.036).

## DISCUSSION

The study sought to evaluate the radiation protection approach adopted by undergraduate students and house officers. The findings revealed that both groups exhibited a certain level of awareness regarding radiation hazards, yet there remains a pressing need for further education to bolster their proficiency in safeguarding both patients and themselves. Recognizing the paramount importance of personal safety, both house officers and undergraduates widely endorsed the use of personal monitoring badges. A significant proportion, 75.3% of students and 81.8% of house officers, expressed the necessity of using these safety badges.

The foundational principle of "as low as reasonably achievable" (ALARA) in managing radiation exposure emerged as a critical imperative. Clear guidelines encompassing the use of thyroid collars, the appropriate X-ray film types, minimum damaging dosage, safety distances, as well as the deployment of collimators and filters were meticulously detailed. Ensuring that these principles are ingrained in the understanding of undergraduate students and house officers becomes pivotal. To enforce these principles, it is recommended that mandates be implemented, and the mentorship of supervisors and peers should be actively engaged. It is noteworthy that when surveyed about the ALARA principles, 24.7% of students demonstrated familiarity, 57.7% possessed limited knowledge, while 17.5% were entirely unaware of the concept. Similarly, among house officers, 40.9% exhibited awareness, 43% indicated limited knowledge, and 15.9% professed ignorance regarding ALARA.

Given the potential for both stochastic and deterministic radiation effects, a comprehensive comprehension of the biological hazards of X-rays is indispensable prior to subjecting patients to dental radiographs and avoidable radiations. The evaluation of using dental radiographs during pregnancy and ensuring fetal safety yielded similar responses from both groups. A substantial majority, 62.9% of students and 59.11% of house officers, recognized the adverse effects of radiation on pregnant patients.

The advent of digital radiology and its widespread adoption has ushered in significant reductions in exposure dosage, distinguishing it from conventional radiographs. A considerable proportion from both students (51.5%) and house officers (72.7%) demonstrated familiarity with the concept of radiation reduction through modern digital tools.

ALARA's distinct directives concerning the use of thyroid collars and lead aprons in shielding patients from ionizing radiations demand attention. Participants were presented with multiple options. Notably, 30.9% of students and 34.5% of house officers affirmed their commitment to consistently employing lead aprons. Conversely, 4.1% of students and 13.6% of house officers acknowledged never using these protective barriers. Notably, reasons for non-compliance often stemmed from the unavailability of these protective measures within respective radiology departments. Concerning the utilization of protective aprons, 45.4% of students and an almost equivalent number of house officers (47.7%) reported unavailability within their departments.

Addressing the recommended operator positioning according to ALARA principles (6 ft, 90° to 135°) unveils another realm of divergence. While only a modest 42.4% of general practitioners demonstrated familiarity with the advocated operator positioning, a notably larger proportion of specialists (70.4%)

showcased comprehension of this aspect. This divergence could be attributed to the scholarly engagement of consultants and post-graduate residents, often resulting in a more current and comprehensive knowledge repository.

Integral radiation protection measures, articulated by NCRP, ICRP, and the American Dental Association, mandate the use of thyroid collars and lead aprons. Nevertheless, adherence to these protocols demonstrated considerable variability across practitioner cohorts. The study highlights the need for continuous education to bridge this knowledge-application gap and reinforces the importance of fostering a culture of radiation protection in healthcare environments.

The narrative articulated in this study aligns harmoniously with prior research, underlining the symbiotic relationship between education levels and awareness. It also accentuates the urgency of bridging the gap between theoretical knowledge and practical implementation, especially in the context of practitioners operating within the government sector.

It becomes evident that addressing these disparities and fostering a culture of radiation protection requires a multifaceted approach, encompassing robust education, collaboration between senior and junior practitioners, and consistent reinforcement of best practices.

## CONCLUSION

From the responses that were obtained by the study, it has become quite clear that both the students and the house officers need to be appraised about the hazards of radiation exposure. Principles of radiation protection should be obeyed to cut down the exposure not only to the practitioners but to the patients as well. The knowledge regarding the safety of radiation exposure ranged from medium to low in both groups. Therefore, it is suggested that refresher programmes should be offered at regular intervals at the institutional level for strict adherence to the safety regulation protocols. Moreover, it is the responsibility of the institutions to equip their radiology departments with essential equipment to minimize radiation exposure.

### Author's Contribution:

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Final Approval of version:	Sana Jalil Hasan, Amna Riaz

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