Original Article

Knowledge and Comprehension about Health Risk and Safe Radiographic Techniques among the Dental Students of Vivekanandha Dental College for Women – A Cross-sectional Study

Jennifer Monisha Rajan, Kavya Ganesh Kamaraj, Girish R. Shavi, Shankar Shanmugam, Senthil Kumar Sennan, Lalithambigai Gunasekaran

Department of Public Health Dentistry, Vivekanandha Dental College for Women, Tiruchengode, Tamil Nadu, India

Abstract

Introduction: Ionizing radiation has biological health hazards. Increased level of ionizing radiation has both stochastic and deterministic effect. **Aim:** The aim of the current study was to evaluate the knowledge, approach, and insight of the biological ill effects of dental X-ray and appropriate radiation safety measures among the female dental students from Tiruchengode and to compare it between the preclinical and clinical students. **Settings and Design:** This study was conducted at Vivekanandha Dental College for Women, Tiruchengode, a cross-sectional study. **Materials and Methods:** The current study was performed among 202 female dental students of Tiruchengode. The knowledge, approach, and insight about radiation safety were gathered by questionnaire survey. The questionnaire pertained to biological ill effects and radiation safety measures in the form of multiple choice was given to each subject through an online survey. **Statistical Analysis Used:** Descriptive analysis was performed. Mann–Whitney *U*-test was used to analyze the difference between the different answers of preclinical and clinical students. **Results:** The overall correct response was 39.14% and it was noted in descending order from clinical students to preclinical students. **Conclusions:** Thus, there is a vast difference in knowledge and awareness between the preclinical and clinical dental students. Moreover, this clearly shows that continuing education of radiology risk effects should be stressed, especially among female dental students, since they attain different milestones in their lives right from puberty.

Keywords: Dental students, female, health risk, knowledge, protection, radiation

Submitted: 28-Dec-2022; **Revised:** 03-Apr-2023; **Accepted:** 16-May-2023; **Published:** 03-Nov-2023

Introduction

Ionizing radiation has biological health hazards. It causes DNA damage including single- or double-strand breaks and DNA protein crosslinks. Increased level of ionizing radiations has both stochastic and deterministic effects. The International Commission on Radiation Protection (ICRP) principle says that radiation exposure of the patient should be kept as low as possible (as low as reasonably achievable [ALARA] principle).[1] Literature reveals that females of the age group 20–40 had higher levels of awareness on radiation hazards than the elderly population.[2] Hence, interest was kindled to evaluate the knowledge, approach, and insight of biological ill effects of dental X-ray and appropriate radiation safety measures among dental students of Vivekanandha Dental College for Women through questionnaire and to compare it between preclinical and clinical students of this young female population.

Materials and Methods

The circulation of questionnaire started on January 19, 2022, and took about 3 months for data collection and compilation.

Address for correspondence: Dr. Jennifer Monisha Rajan, Room No. 58, Narmadha Hostel, Vivekanandha Educational Institutions, Tiruchengode, Namakkal - 637 205, Tamil Nadu, India.
E-mail: drjennirajan511@gmail.com

Access this article online

Quick Response Code:

Website: https://journals.lww.com/DMRS

DOI: 10.4103/dmr.dmr_50_22

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: WKHLRPMedknow_reprints@wolterskluwer.com

How to cite this article: Rajan JM, Kamaraj KG, Shavi GR, Shanmugam S, Sennan SK, Gunasekaran L. Knowledge and comprehension about health risk and safe radiographic techniques among the dental students of Vivekanandha Dental College for Women – A cross-sectional study. Dent Med Res 2023;11:7-11.

It was circulated to 120 nonclinical and 120 clinical students. The knowledge, approach, and insight about radiation safety were gathered by a prevalidated questionnaire[3] survey. The questionnaire pertained to biological ill effects and radiation safety measures in the form of multiple choice was given to each subject through an online survey among the female dental students of Tiruchengode.

The questions were divided into three divisions:

1. The first category had demographic details
2. The second category of questions was to determine the knowledge, approach, and insight of the biological ill effects of the X-rays
3. The third category of questions was to determine the knowledge, approach, and insight of radiation safety measures.

Dental students studying in first and 2nd year BDS were included in the study as preclinical students and 3rd year, final year BDS students along with CRRI were included in the study as clinical students. Although it is well-known that preclinicals have less idea on radiation safety, both the preclinical and clinical groups were included for the study since both the groups belong to the same academic professional course. Preclinical students used radiation to expose on their dummy model works and clinical students used it in patients. Students who were not interested in the study were excluded from the study.

Sample size was calculated with the effect size of 0.5, α error with 0.04, and β error of 0.96, and the total sample was calculated to be 208. To cope up with attrition and no response by the participants, the sample size was rounded off to be 240 with 120 in each of the two groups.

Statistical analysis

It was done using SPSS (IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp). Descriptive analysis was performed. Mann–Whitney *U*-test was used to analyze the difference between the different answers of preclinical and clinical students. Statistical significance was determined at $P < 0.05$.

Results

Among the 202 responses obtained, 91 (45%) were nonclinical students and 111 (55%) were clinical students [Table 1].

The response for each question given by both the clinical and non-clinical students is shown in Table 2.

The overall correct response given by the preclinical students was 22.66% and the clinical students were 55.62%.

Discussion

As per the literature, radiation exposure causes numerous harmful effects such as hair loss, cancer development in later life, cataracts, and skin reddening. Hence, to check the knowledge on the harmfulness of X-rays, the question was asked as whether the X-rays are harmful. Surprisingly, the revelation of "No" (45.25%) was maximum among the responders. For the question about the reflection of X-ray beams from room walls, the maximum response (41.75%) was correct [Figure 1].

Both the National Council on Radiation Protection and ICRP have given numerous recommendations on appropriate levels of protection from ionizing radiation for both the public and professionals.[1] The results depict that 60.75% of the students were not aware of it. Filtration and collimation are done by filters and collimators as a safety measure by hindering the maximum amount of unwanted X-ray photons,[1] and 56.05% were not aware of this concept.

Deterministic effects mean short-term, adverse tissue reactions which result from a dose that is significantly

Table 1: Percentage of preclinical and clinical students participated

Response (%)	
Preclinical	Clinical
91 (45.0)	111 (55.0)

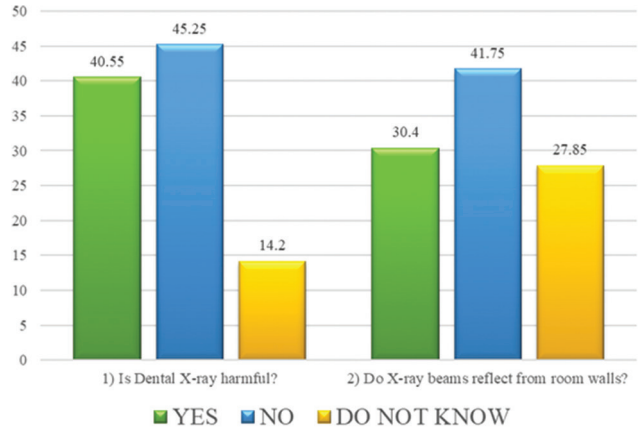

Figure 1: Graph with response of question 1 and 2

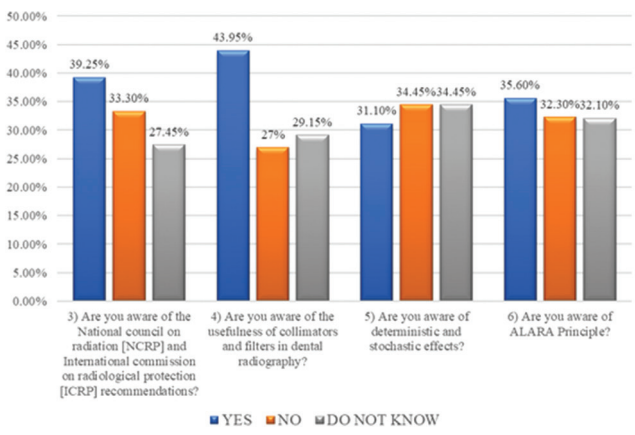

Figure 2: Graph with response of question 3 to 6

Table 2: The response segregated as preclinicals and clinicals

Question	Answers	Response (%)		χ^2	*P*
		Preclinical (I, II BDS)	Clinical (III, IV, CRRI BDS)		
Is dental X-ray harmful?	Yes	27 (29.7)	57 (51.4)	33.345	0.000
	No	39 (42.9)	53 (47.7)		
	Do not know	25 (27.5)	1 (0.9)		
Do X-ray beams reflect from room walls?	Yes	25 (27.5)	37 (33.3)	14.343	0.001
	No	30 (33.0)	56 (50.5)		
	Do not know	36 (39.6)	18 (16.2)		
Are you aware of the NCRP and ICRP recommendations?	Yes	28 (30.8)	53 (47.7)	15.582	0.000
	No	27 (29.7)	41 (36.9)		
	Do not know	36 (39.6)	17 (15.3)		
Are you aware of the usefulness of collimators and filters in dental radiography?	Yes	16 (17.6)	78 (70.3)	60.838	0.000
	No	31 (34.1)	22 (19.8)		
	Do not know	44 (48.4)	11 (9.9)		
Are you aware of deterministic and stochastic effects?	Yes	9 (9.9)	58 (52.3)	47.977	0.000
	No	34 (37.4)	35 (31.5)		
	Do not know	48 (52.7)	18 (16.2)		
Are you aware of ALARA Principle?	Yes	9 (9.9)	68 (61.3)	62.253	0.000
	No	35 (38.5)	29 (26.1)		
	Do not know	47 (51.6)	14 (12.6)		
Does digital radiography require less exposure than conventional?	Yes	27 (29.7)	85 (76.6)	48.040	0.000
	No	8 (8.8)	8 (7.2)		
	Do not know	56 (61.5)	18 (16.2)		
Does the high-speed film require a reduced exposure?	Yes	26 (28.6)	65 (58.6)	21.036	0.000
	No	12 (13.2)	15 (13.2)		
	Do not know	53 (58.2)	31 (58.2)		
Do you prefer to hold the films during exposure?	Yes	19 (20.9)	34 (30.6)	57.045	0.000
	No	21 (23.1)	68 (61.3)		
	Do not know	51 (56.0)	9 (8.1)		
Are you aware of deterministic and stochastic effects?	Yes	22 (24.2)	46 (41.4)	29.612	0.000
	No	37 (40.7)	59 (53.2)		
	Do not know	32 (35.2)	6 (5.4)		
Is dental radiograph absolutely contraindicated in pregnant patients?	Yes	27 (29.7)	78 (70.3)	67.632	0.000
	No	11 (12.1)	27 (24.3)		
	Do not know	53 (58.2)	6 (5.4)		
Should personal monitoring badges be worn by the operator?	Yes	28 (30.8)	92 (82.9)	57.964	0.000
	No	10 (11.0)	6 (5.4)		
	Do not know	53 (58.2)	13 (11.7)		
What is the maximum permissible dosage that a dental professional can tolerate per year?	50 mSv	6 (6.6)	32 (28.8)	45.863	0.000
	0.5 mSv	4 (4.4)	12 (10.8)		
	5 mSv	6 (6.6)	28 (25.2)		
	Do not know	75 (82.4)	39 (35.1)		
Will you adhere to the radiation protection protocol in the future?	Yes	44 (48.4)	107 (96.4)	61.490	0.000
	No	4 (4.4)	1 (0.9)		
	Do not know	43 (47.3)	3 (2.7)		
What is the ideal distance an operator should stand while taking intraoral radiographic exposure	4 feet and 90°-135°	5 (5.5)	16 (14.4)	53.813	0.000
	4 feet and 60°-90°	11 (12.1)	15 (13.5)		
	6 feet and 90°-135°	5 (5.5)	34 (30.6)		
	6 feet and 60°-90°	6 (6.6)	22 (19.8)		
	Do not know	64 (70.3)	24 (21.6)		
Do you use lead aprons on a regular basis?	Always	7 (7.7)	12 (10.8)	33.043	0.000
	Often	3 (3.3)	10 (9.0)		
	Sometimes	17 (18.7)	26 (23.4)		
	Rarely	4 (4.4)	10 (9.0)		

Contd...

Table 2: Contd...

Question	Answers	Response (%)		χ^2	*P*
		Preclinical (I, II BDS)	Clinical (III, IV, CRRI BDS)		
If never/rarely/sometimes, why not?	Never	10 (11.0)	33 (29.7)	39.031	0.000
	Do not know	50 (54.9)	20 (18.0)		
	No availability of apron	3 (3.3)	27 (24.3)		
	Due to weight of the apron	3 (3.3)	5 (4.5)		
	Common apron for all	9 (9.9)	6 (5.4)		
	Follow only position rule	8 (8.8)	8 (7.2)		
	I follow only distance rule	3 (3.3)	23 (20.7)		
	Do not know	65 (71.4)	42 (37.8)		

NCRP: National Council on Radiation Protection; ICRP: International Commission on Radiological Protection; ALARA: As low as reasonably achievable

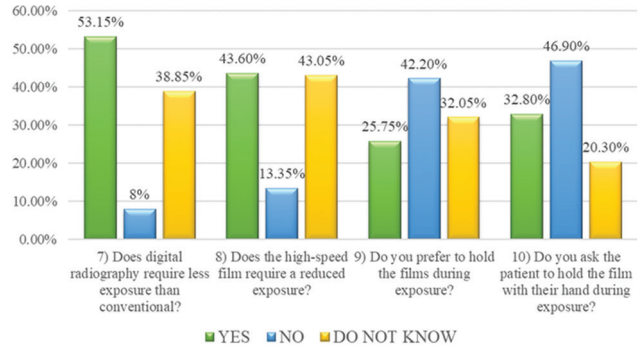

Figure 3: Graph with response of questions 7–10

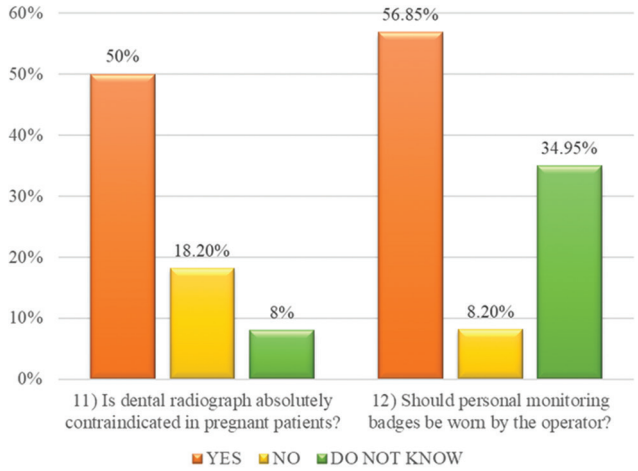

Figure 4: Graph with response of questions 11 and 12

high enough to damage living tissues. The severity of a deterministic effect increases with radiation dose above a threshold. Stochastic effects are the effects that occur by chance, without a threshold level of dose, where probability is proportional to the dose and severity is independent of the dose. The main stochastic effects are cancer and genetic effects. Moreover, 68.9% of dental students were not aware of what these two effects were.[4] The ALARA principle stands for "as low as reasonably achievable."[5-7] It means to avoid being exposed to radiation that does not have a direct benefit, even if the dose is small, and 64.4% of the study subjects were not aware of this principle. Thus, these four questions (question number 3–question number 6) clearly depict that the majority of the students were not aware of the protocols for radiation safety [Figure 2].

Figure 3 shows that 53.15% knew that digital radiography requires less radiation than conventional and 43.6% knew that high-speed films reduce the exposure and also majority of them knew that it is not correct to hold the film or making the patient to hold the film during exposure.

Figure 4 shows that the majority (50%) of the students have said that dental radiographs are absolutely contraindicated in pregnant women, which is not at all true. Moreover, in the next question, 56.85% of students have answered correctly that personal monitoring badges should be worn by the operator. This finding is similar to the results of the study done by Arnout and Jafar in 2014.[3] On comparing with the previous study done in 250 general dentists, it was concluded that the dentists involved in the study does not seem to have sufficient knowledge regarding the dental radiation risk which is used for diagnosis during pregnancy.[8]

Many (58.8%) were not aware of the maximum permissible dosage that a dental professional can tolerate per year although they belonged to the dental profession [Figure 5].

Majority of clinical students (30.6%) have responded that the ideal distance for an operator is 6 feet and 90°–135°.[9] This is really surprising since it is mandatory for all the clinical students to take dental radiographs for patients.

Since dental radiographs taking techniques are taught only when the student enters into the clinical, it is considered a major limitation of our study.

Conclusions

In this study, the overall correct response was 39.14% and it was noted in descending order from clinical students to preclinical students. Thus, there is a vast difference in knowledge and awareness between preclinical and clinical dental students. This can be overcome in the future through

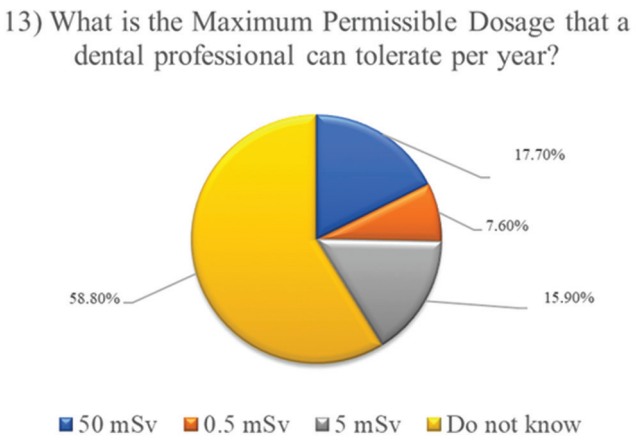

Figure 5: Response of question 13

Continuing Dental Education programs and other seminars about the proper techniques to handle pregnant patients based on their trimester.

Ethical clearance

Obtained from the Institutional Review Board of Vivekanandha Dental College for Women.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Valentin J. The 2007 Recommendations of the International Commission on Radiological Protection. Oxford: Elsevier; 2007.
2. Aldrin Joshua A, Priyadharshini R, Sinduja P. Comparison on awareness of radiation hazards among females of different age group. Journal of Pharmaceutical Research International 2021;33:174-85.
3. Arnout EA, Jafar A. Awareness of biological hazards and radiation protection techniques of dental imaging-a questionnaire based cross-sectional study among Saudi dental students. J Dent Health Oral Disord Ther 2014;1:1-7.
4. Prabhat MP, Sudhakar S, Kumar BP. Knowledge, attitude and perception (KAP) of dental undergraduates and interns on radiographic protection-a questionnaire based cross-sectional study. J Adv Oral Res 2011;2:45-50.
5. White SC, Pharoah MJ. Oral Radiology Principles and Interpretation. 5th ed. St. Louis, Mo: Mosby-Year Book; 2004. p. 639-57.
6. Karjodkar FR. Protection from radiation in Textbook of Dental and Maxillofacial Radiology. 1st ed., Ch. 6. New Delhi, India: Jaypee Brothers Medical Publishers; 2004. p. 49-65.
7. World Health Organization. Efficacy and Radiation Safety in Interventional Radiology. Radiation Safety. 1st ed. Ch. 2. Delhi, India: A.I.T.B.S. Publishers and Distributors; 2000. p. 26-55.
8. Razi T, Bazvand L, Ghojazadeh M. Diagnostic dental radiation risk during pregnancy: Awareness among general dentists in Tabriz. J Dent Res Dent Clin Dent Prospects 2011;5:67-70.
9. Haring JI, Lind LJ. Radiation Protection in Textbook of Dental Radiography Principles and Techniques. Ch. 5. Filadelfia: WB Saunders Company; 1996. p. 64-79.