

# Knowledge about Radiation Protection among Undergraduate Dental Students

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**Abstract:** Aim: The aim of this study is to analyse the knowledge about radiation protection among undergraduate dental students. Objective: To determine the level of awareness among dental students towards radiation hazards and protection measures. Background: Dental students and personnel are constantly exposed to ionising radiation due to their work nature in oral radiology department. The awareness of possible hazardous effects and the measures to protect themselves is mandatory. This study aims to ascertain the level of awareness amongst dental undergraduates in this regard through a questionnaire based study. Dental students and practitioners should be aware of radiation and its harmful effects to the human body and correct protocol needed to be followed during radiographic procedures. Results: Among 150 undergraduate dental students surveyed, 135 students (90%) are aware of harmful radiation effects, 15 of them (10%) are not aware of harmful radiation effects. 84 students (56%) were aware about ALARA and 66 (44%) were ignorant about ALARA. Among the 84 (56%) students who are aware of ALARA, 27 students (32.1%) practice the principles of ALARA and 57 (67.9%) don't. Among 150 undergraduate dental students, 142 students (94.7%) definitely take safety precautions during radiation exposure and 8 (5.3%) are of opinion it is not necessary. 68 students (45.3%) think the clinician is more prone to the harmful radiation effects, 54 (36%) think the patient is more prone and 28 students (18.7%) felt the accompanying person is more prone to radiation harmful effects. 77 students (51.3%) practice a safe distance of more than 3 meter away from the patient during exposure, 73 students (48.7%) do not do. 114 (76%) undergraduate dental students are aware of mandatory use of a film badge, 36 (24%) feel otherwise. Among 150 students, 33 students (22%) think alarm rate meter is a personal monitoring device, 20 students (13.3%) answered survey meter, 23 (15.3%) for Geiger counter and 74 students (49.3%) correctly knew that film badge is a personal monitoring device. 37 (24.7%) students felt film badge as the most accurate method for monitoring and measuring radiation dose, 43 (28.7%) for thermoluminescent dosimeter badge, 51 students (34%) for thermoluminescent dosimeter extremity monitor, 19 students (12.7%) felt ionization chamber is the most accurate method for monitoring and measuring radiation dose. 88 students (58.7%) indicate need to use high speed film, while 62 (41.3%) favours a low speed film. 21 students (14%) stand behind a lead barrier while exposing, 129 (86%) don't always stand behind a lead barrier while exposing. 133 students (88.7%) felt cancer is the primary risk from occupational radiation exposure, 36 students (24%) feel radiation exposure to dentists and their staffs comes from primary beam if they stand in the path of radiation, 22 students (14.7%) feel it comes from scattered radiation from the patient, 30 students (20%) are of view of radiation leakage from the tube head and 62 students (41.3%) think radiation exposure is from all the above. Conclusion: The present study shows that undergraduate dental students have knowledge on radiation protection. This study also suggests that more knowledge and awareness about radiation protection should be implemented and safety measures should be practiced at all times while in radiology unit.

**Keywords:** radiation, dental students, x-ray beam

## 1. Introduction

Radiobiology is the study of effects of ionising radiation on living systems. The initial interaction between ionising radiation and matter occurs at the level of the electron. These changes result in modification of biological molecules within the ensuing seconds to hours. These molecular changes may lead to alterations in cells and organisms. Radiation acts on living system through direct and indirect effect. When the energy of a photon or secondary electron ionises biological macromolecules, the effect is termed as direct. Indirect effects are those in which hydrogen and hydroxyl free radicals produced by the action of radiation on water, interact with organic molecules forming organic free radicals.

Radiation injury to organisms results either the killing of large number of cells (deterministic effects) or sub lethal damage to individual cells that results in cancer formation or heritable mutation (stochastic effect). Deterministic effects only occur once a threshold of exposure has been exceeded. The severity of deterministic effects increases as the dose of exposure increases. Because of an identifiable threshold level, appropriate radiation protection mechanisms and occupational exposure dose limits can be put in place to reduce the likelihood of these effects occurring. Deterministic effects are caused by

significant cell damage or death. The physical effects will occur when the cell death burden is large enough to cause obvious functional impairment of a tissue or organ for example, radiation sickness involves nausea, vomiting, and diarrhea developing within hours or minutes of a radiation exposure. This is due to deterministic effects on the bone marrow, gastrointestinal tract and central nervous system.

Stochastic effect occurrence follows a linear no-threshold hypothesis. This means that although there is no threshold level for these effects, the risk of an effect occurring increases linearly as the dose increases. Stochastic effects occur due to the ionizing radiation effect of symmetrical translocations taking place during cell division. Examples of stochastic effects are radiation induced cancer and heritable effects.

It is well known that ionizing radiation has biological damaging effects, either affecting the cell directly or indirectly via the production of free radicals. Both lead to DNA damage, including single or double-strand breaks, and or DNA protein cross-links.(1) Both dentist and patients are at high risk of stochastic effects as it has no dose threshold. The benefit of disease detection should be weighed against the risk of biological hazards of x-ray. Additionally, the amount of radiation exposure from

dental radiographs depends on many variables starting from film speed, going through exposure factors, selected technique, collimation and protecting barriers used. Dental students should have thorough knowledge towards the biological hazards of x-ray and different protection protocols and should strictly the protective methods from their learning period. They should be aware of different radiation protective measures.(2)

## 2. Materials and Method

A survey questionnaire of 12 items was given to undergraduate dental students. A total of n=150 undergraduate dental students participated in the study, n=50 each in III, IV BDS and CRRI. The questions were about knowledge on radiation and its protection.

## 3. Questionnaire

### Knowledge about Radiation Protection among Undergraduate Dental Students

Year:

Sex: (M / F)

1. Are you aware of the harmful radiation effects? (yes / no)

2. Do you know what is ALARA? (yes / no)

If yes, do you practice the principles of ALARA? (yes / no)

3. Do you think its necessary to take safety precautions during radiation exposure? (yes / no)

4. When taking a radiograph, who is more prone to the harmful effects of radiation?

- a) The clinician
- b) The patient
- c) The accompanying person

5. Is it necessary to keep a distance of more than 3 meter away from the patient during exposure? (yes / no)

6. Is it necessary to wear a film badge? (yes / no)

7. Which of the following is a personal monitoring device

- a) Alarm rate meter
- b) Survey meter
- c) Geiger counter
- d) Film badge

8. Which is the most accurate method for monitoring and measuring radiation dose

- a) Film badge
- b) Thermoluminescent dosimeter badge
- c) Thermoluminescent dosimeter extremity monitor
- d) Ionization chambers

9. In your practice, the speed film used is?

- a) High speed
- b) Low speed

10. Do you always stand behind a lead barrier while exposing? (yes / no)

11. Primary risk from occupational radiation exposure is the increased risk of

- a) Cancer
- b) Blindness
- c) Abrasions
- d) None of the above

12. Radiation dose to dentists and their staffs can come from

- a) Primary beam, if they stand in its path
- b) Scattered radiation from the patient
- c) Radiation leakage from the tube head
- d) All of the above

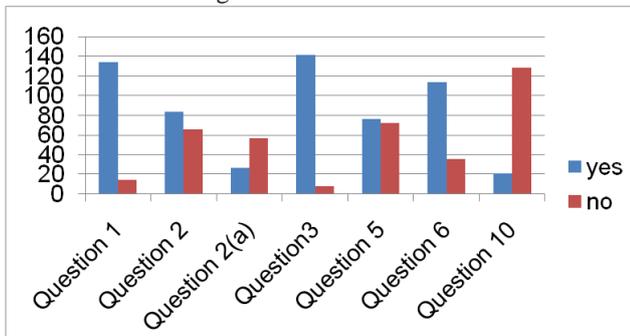
## 4. Results

The responses were analysed question wise and percentage responses were statistically analysed.

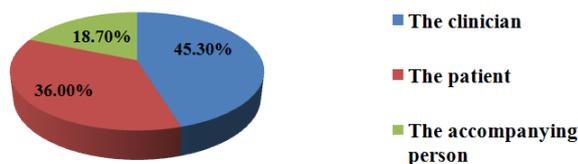
Among 150 undergraduate dental students,135 students (90%) are aware of harmful radiation effects,15 of them (10%) are not aware of harmful radiation effects.84 students (56%) knows about ALARA and 66 students (44%) doesn't know about ALARA. Among the 84 (56%) of students who are aware or ALARA,27 of them (32.1%) practice the principles of ALARA and 57 students (67.9%) don't. Among 150 undergraduate dental students, 142 students (94.7%) thinks it's necessary to take safety precautions during radiation exposure and 8 students (5.3%) thinks it's unnecessary. 68 students (45.3%) thinks the clinician is more prone to the harmful radiation effects,54 students (36%) thinks the patient is more prone and 28 students (18.7%) felt the accompanying person is more prone to radiation harmful effects.77 students (51.3%) thinks it's necessary to keep a distance of more than 3meter away from the patient during exposure, and 73 (48.7%) feels it's unnecessary. 114 (76%) of undergraduate dental students thinks it's necessary to wear a film badge, 36 students (24%) thinks it's not necessary to wear a film badge. Among 150 students, 33 (22%) thinks alarm rate meter is a personal monitoring device ,20 (13.3%) answered survey meter,23 (15.3%) for Geiger counter and 74 students (49.3%) thinks film badge is a personal monitoring device.37 (24.7%) students felt film badge as the most accurate method for monitoring and measuring radiation dose,43 students (28.7%) for thermoluminescent dosimeter badge,51 (34%) for thermoluminescent dosimeter extremity monitor and 19 students (12.7%) felt ionization chamber is the most accurate method for monitoring and measuring radiation dose. 88 students (58.7%) feels a high speed film is used during clinical practice,62 (41.3%) feels a low speed film is used. 22 students(14%) stands behind a lead barrier while exposing,129 (86%) don't always stand behind a lead barrier while exposing.133 students (88.7%) felt cancer is the primary risk from occupational radiation

exposure, 3 students (2%) feels blindness is the primary risk, 4 (2.7%) for abrasions and 10 (6.7%) felt it was none of the choices given. 36 students (24%) thinks radiation dose to dentists and their staffs comes from primary beam if they stand in its path, 22 (14.7%) thinks it comes from scattered radiation from the patient, 30 students (20%) thinks it's from radiation leakage from the tube head and 62 of them (41.3%) thinks radiation dose comes from all the given choices.

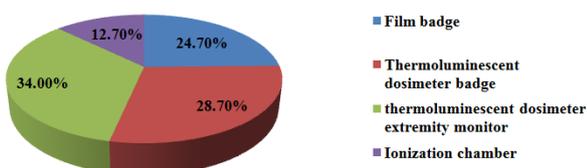
Knowledge about radiation protection among undergraduate dental students



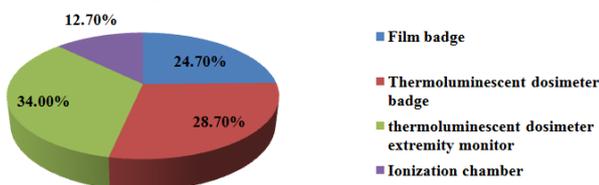
Q4: When taking a radiograph who is more prone to the harmful effects of radiation



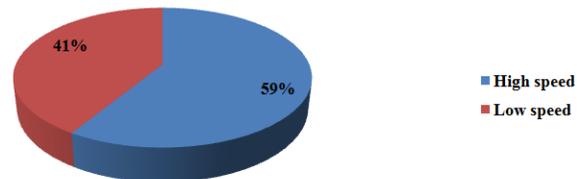
Q7: Which of the following is the personal monitoring device



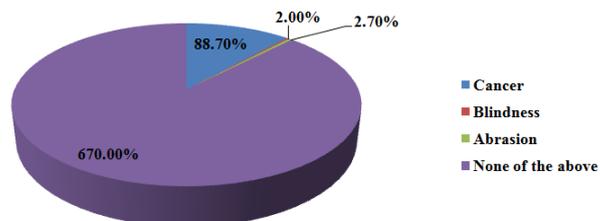
Q8: Which is the most accurate method for monitoring and measuring radiation dose



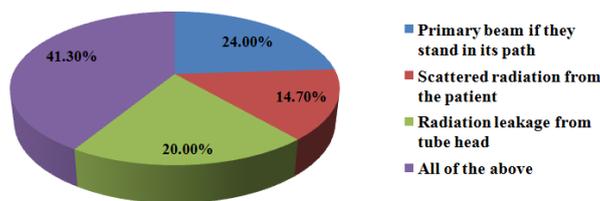
Q9: In your practice the speed film used is?



Q11: Primary risk from occupational radiation exposure is the increased risk



Q12: Radiation dose to dentist and their staff can come from



## 5. Discussion

This study is to access the knowledge of undergraduate dental students on radiation protection. Among 150 dental students that participated in this study, 90% are aware of the harmful radiation effects and 10% are not aware. 56% of students are aware of the principles of ALARA and out of that 32.1% practice the principles. 44% of students are not aware of ALARA. Based on this data, it shows that the students are not well aware of radiation and its harmful effects and have not been implementing the safety precautions in practice. Poor knowledge of the meaning of ALARA was observed. It can be deduced that these students who were unfamiliar with the term may not be able to apply the principle of ALARA in practice. Consequently, patients may receive unnecessary radiation dose if the ALARA principle is not put into practice. Radiation causes cell damage by ionization with the consequent formation of ions that can produce free radicals, break chemical bonds, creates cross-linkage between macromolecules or damage molecules and genes. Thus, adequate justification for the dental radiograph is met and that minimal permissible exposure is given. Dentists should be knowledgeable on radiation protection in order to properly protect the patients, themselves and others around them.

Film speed can be an important aspect in determining the amount of radiation exposure received by a patient. The greater the film speed, the lesser the exposure received by

the patient. Thus, it's better to use a high speed film in practice to minimise to risk of exposure to harmful radiation doses. Several other steps can be taken to reduce the chance of exposure like adhering to the position-and-distance rule. The operator should stand at least 3meter away from the patient to reduce x-ray exposure to the operator. The best way to ensure that personnel are following office safety rules such as personal monitoring device, commonly referred to as film badge. These devices provide a useful record of occupational exposure.

This study concludes that there is inadequate knowledge about radiation protection among the undergraduate dental students although they have been educated recently. It should be strongly recommended to improve their knowledge around biological effects and update them through growing their expertise. They as practitioners should remain informed about safety updates and the availability of new equipment, supplies and techniques that could further improve the diagnostic quality of radiograph and decrease radiation exposure.

## References

- [1] Awareness and attitude of radiographers towards radiation protection Maryam Mojiri\*, Abbas Moghimbeigi
- [2] Davies C, Grange S, Trevor MM. Radiation protection practices and related continuing professional education in dental radiography: a survey of practitioners in the North-east of England. *Radiography* 2005; 11: 255–261.
- [3] Journal of Dental Health, Oral Disorders & Therapy Awareness of Biological Hazards and Radiation Protection Techniques of Dental Imaging- A Questionnaire Based Cross-Sectional Study among Saudi Dental Students
- [4] An assessment of Dental Students' knowledge of radiation protection and practice, Joan E Enabulele, B O Igbinedion Address for correspondence: Dr. Enabulele Joan, Department of Restorative Dentistry
- [5] National Council for Radiation protection and Measurements (NCRP). Radiation protection in dentistry. Bethesda Md: National council for radiation protection and measurements; 2003.
- [6] Knowledge About Ionising and Non-Ionising Radiation among Medical Students, Syed Mohammed Mubeen, Qamar Abbas\*, Nighat Nisar\*\*
- [7] Radiation Risk From Medical Imaging Eugene C. Lin, MD