



Research Article

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Knowledge and Attitude amongst the Dental and Medical students towards radiation hazards and radiation protection: A Questionnaire survey

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Abstract

Aim and objective: To assess the knowledge and attitudes regarding radiation hazards and protection amongst medical and dental students. **Materials and method:** A validated 20 point questionnaire about radiation protocol in the form of multiple choices was used for the study where 400 participants (undergraduate students and interns) were included from medical and dental field. Results were analyzed using SPSS 20.0. **Results:** The knowledge, attitude and awareness about radiation protection was highest in dental interns followed by dental students, medical interns and medical students. Among the total participants, majority felt that lectures and workshops should be conducted to acquire knowledge on radiation hazards and protection. **Conclusion:** There is need "to fill" the knowledge deficit for students from both medical and dental fraternity thereby creating awareness about radiation hazards and protection. There is a need to educate current and future doctors regarding unnecessary exposure of individual to radiation.

Keywords: Radiation hazards, Deterministic effects, stochastic effects, NCRP, ICRP, radiation protection, knowledge, attitude.

INTRODUCTION

Wilhelm Conrad Rontgen, German physics professor discovered the X-ray on November 8, 1895, and stated that the X rays could pass through human and received the first Nobel Prize in Physics for his discovery [1].

Since then radiographs have become an important tool for diagnosis and treatment planning. As radiographic examination is the most routinely used investigative procedures, the health of patients should be taken into consideration [2]. Dr. William Herbert Rollins (1852-1929) known as the Father of Radiation Protection, was the first person to study the hazards caused by radiation.

Due to production of low energy X ray photons, creation of reactive free radicals which are capable of producing substances that are poisonous to the cell, production of unstable atoms and free electrons, injury to the cell that may itself manifest as loss of function, these all are the consequences of ionization to the human cells [3].

The biological effects to the human body can be divided into: Deterministic and stochastic effects. Deterministic effects are proportional to the dose whereas stochastic effects are caused by sublethal radiation-induced damage to DNA [4].

So the radiographs should be prescribed only for a patient when it is required to diagnose and treat the pathology. The radiation exposure amount from dental radiographs depends on variable factors like speed of film, exposure factors, technique used to take radiograph, collimators and use of protective barrier [2].

Physicians who advise radiological examinations they tend to underestimate the actual doses involved and may have less knowledge about the risks of the health of people, and do not discuss with their patients [5].

In many studies it was indicated that the doctors were unaware of the radiation hazards and do not take this into consideration when prescribing radiographic examination. In today's world with the advent of

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CT and CBCT giving much better results, one tends to advise these even in situations where it is not justified.

Dental and medical students acquire knowledge about fundamentals of radiology in their final year, and they practice interpretation of clinical radio-diagnosis during their internship. Most of them usually underestimate the proper use of dental imaging tools, protective measures, and their associated radiation risks.

So, the current study was done to evaluate the knowledge, attitude and awareness of dental and medical students and interns.

Aim and Objective

To analyze the current status of knowledge and attitude amongst the dental and medical participants towards radiation hazards and their protection.

MATERIALS AND METHOD

The study sample consisted of 400 undergraduate students and interns from dental and medical field. Among 400 samples enrolled in the study, 200 were from dental field (100 final year students and 100 interns) and 200 were from medical field (100 final year students and 100 interns). This study was conducted after getting an approval from the Institutional Ethics Committee. The questionnaire was prepared and validated by the expert faculty from the Department of Oral medicine and Radiology, VSPM DC & RC Nagpur and Department of PSM, NKPSIMS Nagpur and pilot study on 100 participants (50 each from dental and medical participants).

Study was conducted for a period of 2 months. A 20 validated questionnaire related to radiation hazards and protection (multiple choices questions) was given to each participant and after 15 minutes the response sheets were collected.

Data Analysis

Real scale data generated on various parameters was compared using parametric tests like Student's t- test, one-way ANOVA. The significance level was set at 5% and the analyses was performed using SPSS 20.0 (SPSS Inc.) The sample size of 400 was selected as the total number of students and interns from both the fraternity were 100 each.

RESULTS

Out of 400 participants, 313 (78.23%) participants were females and 87 (27.15 %) were male. Over all response among 400 participants showed 56.29% correct responses. Dental interns were accurate upto 63.7% followed by dental students (58.29%) followed by medical interns (55.11%) and then Medical students (48.05 %).

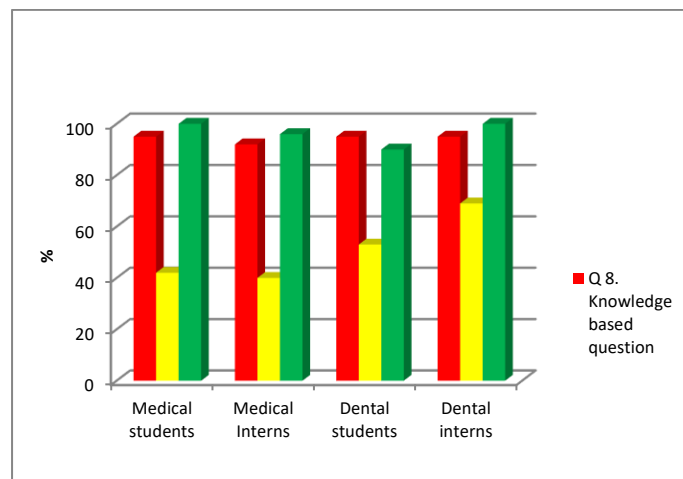





Figure 1: figure shows knowledge, attitude and practice among medical students, medical interns, dental students and dental interns. (Q 8, Q 9, Q 13)

Table 1: The results of the study shown in the table

| | | Medical students | Medical Interns | Dental students | Dental interns | Medical | Dental |
|--|-------------------------|------------------|-----------------|-----------------|----------------|-----------|--------|
| Q 1. How confident are you in your knowledge of radiation hazards and their protection | a.Very confidence | 72% | 72% | 63% | 95% | 144 | 158 |
| | b.Not really confidence | 28% | 28% | 37% | 5% | 56 | 42 |
| | c.do not have any idea | - | - | - | - | - | - |
| | p-value | 1.000,NS | | <0.0001,HS | | 0.104,NS | |
| Q 2. X rays are harmful | a.Strongly agree | 82% | 71% | 75% | 81% | 153 | 156 |
| | b.agree | 18% | 29% | 25% | 19% | 47 | 44 |
| | c.not sure | | | | | | |
| | d.strongly disagree | | | | | | |
| | e.disagree | | | | | | |
| | p-value | 0.067,NS | | 0.306,NS | | 0.720,NS | |
| Q 3. ALARA principle should be applied while taking radiographs. | a.Strongly agree | 44% | 36% | 49% | 53% | 80 | 102 |
| | b.agree | 29% | 28% | 31% | 17% | 57 | 48 |
| | c.not sure | 27% | 36% | 20% | 30% | 63 | 50 |
| | d.strongly disagree | - | - | - | - | | |
| | e.disagree | - | - | - | - | | |
| | p-value | 0.349,NS | | 0.044,S | | 0.085,NS | |
| Q 4. Are you aware of NCRP and AERB recommendation? | a.yes | 22% | 26% | 54% | 54% | 48 | 108 |
| | b.no | 78% | 74% | 46% | 46% | 152 | 92 |
| | p-value | 0.508,NS | | 0.915,NS | | <0.001,HS | |

| | | | | | | | |
|---|----------------------|-----------|-----|-----------|-----|-----------|-----|
| Q 5. X-rays reflect from walls | a.Strongly agree | 0% | 1% | 2% | 1% | 1 | 3 |
| | b.agree | 5% | 0% | 21% | 2% | 5 | 23 |
| | c.not sure | 23% | 53% | 42% | 47% | 76 | 89 |
| | d.strongly disagree | 66% | 45% | 24% | 45% | 111 | 69 |
| | e.disagree | 6% | 1% | 11% | 5% | 7 | 16 |
| | p-value | <0.001,HS | | <0.001,HS | | <0.001,HS | |
| Q 6. Ideal position distance should be followed while taking radiographs. | a.Strongly agree | 37% | 44% | 51% | 82% | 81 | 133 |
| | b.agree | 63% | 38% | 44% | 16% | 100 | 60 |
| | c.not sure | 0% | 15% | 5% | 2% | 15 | 7 |
| | d.strongly disagree | | | | | | |
| | e.disagree | | | | | | |
| | P-VALUE | <0.001,HS | | <0.001,HS | | <0.001,HS | |
| Q 7. While taking radiographs one must stand behind a protective screen. | a.Strongly agree | 91% | 56% | 81% | 95% | 147 | 176 |
| | b.agree | 9% | 36% | 18% | 5% | 45 | 23 |
| | c.not sure | 0% | 8% | 1% | 0% | 8 | 1 |
| | d.strongly disagree | | | | | | |
| | e.disagree | | | | | | |
| | P-VALUE | <0.001,HS | | 0.009,HS | | 0.001,HS | |
| Q 8. Which material does the screen consist of? | a.Lead | 95% | 92% | 95% | 95% | 187 | 190 |
| | b.Glass | 5% | 8% | 5% | 5% | 13 | 10 |
| | c.Steel | | | | | | |
| | P-VALUE | 0.390,NS | | 1.000,NS | | 0.519,NS | |
| Q 9. Personal monitoring badges should be worn by the operator. | a.Strongly agree | 42% | 40% | 53% | 69% | 82 | 122 |
| | b.agree | 48% | 52% | 44% | 31% | 100 | 75 |
| | c.not sure | 10% | 8% | 3% | 0% | 18 | 3 |
| | d.strongly disagree | | | | | | |
| | e.disagree | | | | | | |
| | P-VALUE | 0.806,NS | | 0.016,S | | <0.001,HS | |
| Q 10. Dosimeter is used to measure the radiation dose | a.Strongly agree | 20% | 16% | 57% | 69% | 36 | 126 |
| | b.agree | 51% | 52% | 31% | 30% | 103 | 61 |
| | c.not sure | 29% | 30% | 12% | 1% | 59 | 13 |
| | d.strongly disagree | | | | | | |
| | e.disagree | | | | | | |
| | P-VALUE | 0.798,NS | | 0.005,HS | | <0.001,HS | |
| Q 11. Digital radiography requires less exposure than conventional | a.Strongly agree | 23% | 13% | 47% | 20% | 36 | 67 |
| | b.agree | 44% | 40% | 40% | 41% | 84 | 81 |
| | c.not sure | 9% | 24% | 13% | 15% | 33 | 28 |
| | d.strongly disagree | 17% | 13% | 0% | 15% | 30 | 15 |
| | e.disagree | 7% | 7% | 0% | 9% | 14 | 6 |
| | P-VALUE | 0.036,S | | <0.001,HS | | 0.001,HS | |
| Q 12. Radiographs are absolutely contraindicated for pregnant patients. | a.Strongly agree | 32% | 15% | 32% | 18% | 47 | 50 |
| | b.agree | 29% | 20% | 32% | 23% | 49 | 55 |
| | c.not sure | 20% | 23% | 27% | 21% | 43 | 48 |
| | d.strongly disagree | 9% | 17% | 0% | 25% | 26 | 25 |
| | e.disagree | 10% | 25% | 89% | 13% | 35 | 22 |
| | a.Strongly agree | | | | | | |
| | P-VALUE | 0.002,hs | | <0.001,hS | | 0.376,NS | |
| *Q 13. What do you use as a protective barrier. | a.Lead apron | 100 | 96 | 90 | 100 | 196 | 190 |
| | b.Thyroid collar | 14 | 7 | 33 | 11 | 21 | 32 |
| | c.shielding gloves | 4 | 3 | 9 | 3 | 7 | 10 |
| | d.protective devices | 11 | 2 | 23 | 3 | 13 | 16 |

| | | | | | | | |
|---|--|----------|----|-----------|-----|-----------|-----|
| | p-value | 0.062,NS | | <0.001,hs | | | |
| Q 14. Which among the following is the most radiosensitive organ | a.Bone marrow | 73 | 53 | 66 | 56 | 126 | 122 |
| | b.Kidney | 22 | 35 | 19 | 36 | 57 | 55 |
| | c.Nerrons | 5 | 12 | 15 | 8 | 17 | 23 |
| | p-value | 0.011,S | | 0.017,S | | 0.606,NS | |
| Q 15. Which among the following is the most radioresistant organ | a.Tests | 10 | 28 | 25 | 8 | 38 | 33 |
| | b.Muscle cells | 86 | 65 | 61 | 87 | 151 | 148 |
| | c.Lungs | 4 | 7 | 14 | 5 | 11 | 19 |
| | p-value | 0.002,HS | | <0.001,HS | | <0.001,HS | |
| *Q 16. Which among the following modalities do you think use x ray. | a.CT scan | 15 | 11 | 27 | 14 | 26 | 41 |
| | b.MRI | 4 | 5 | 14 | 5 | 9 | 19 |
| | c.Conventional fluoroscopy | 99 | 97 | 99 | 100 | 196 | 199 |
| | d.dental radiography | 0 | 0 | 0 | 0 | 0 | 0 |
| | p-value | 0.727,NS | | 0.040,S | | 0.068,NS | |
| Q 17. High radiation doses lead to cancer. | a.Strongly agree | 79 | 69 | 59 | 72 | 148 | 131 |
| | b.agree | 21 | 31 | 41 | 28 | 52 | 69 |
| | c.not sure | | | | | 0 | 0 |
| | d.strongly disagree | | | | | 0 | 0 |
| | e.disagree | | | | | 0 | 0 |
| | p-value | 0.107,NS | | 0.053,NS | | <0.001,HS | |
| Q 18. Are you aware of the protocol for radiographic waste management? | a.Yes | 40 | 51 | 47 | 36 | 91 | 83 |
| | b.No | 60 | 49 | 53 | 64 | 109 | 117 |
| | p-value | 0.118,NS | | 0.114,NS | | 0.420,NS | |
| *Q 19. Which among the following you think will be the most appropriate way of awareness of radiation protection and hazards? | a.Lectures | 59 | 58 | 52 | 63 | 157 | 115 |
| | b.Tutorials or workshop | 66 | 68 | 66 | 64 | 134 | 198 |
| | c.Case studies | 0 | 0 | 0 | 0 | 0 | 0 |
| | d.Learning modules | 0 | 0 | 0 | 0 | 0 | 0 |
| | p-vslue | 0.853,NS | | 0.426,NS | | | |
| Q 20. Radiation protection icon | a.  | 93 | 86 | 80 | 94 | 179 | 174 |
| | b.  | 3 | 8 | 17 | 5 | 11 | 22 |
| | c.  | 2 | 3 | 1 | 0 | 5 | 1 |
| | p-value | 0.206,NS | | 0.007,HS | | 0.052,NS | |

DISCUSSION

In today's world everyone is being exposed to ionizing radiations. It is believed that a linear relationship exists between radiation exposure and development of cancer. Even though the absolute risk to an individual may be small, exposure of repeated radiation to large number of patients over time may lead to a significant increase in cancer cases [6].

In radiology, the use of x-ray requires good practice and knowledge about the required dose of all types of procedures. The National Council on Radiation Protection, International Commission on Radiological Protection (ICRP) and Measurements (NCRP) and Atomic Energy Regulatory Board (AERB) have established guidelines regarding the specifications of x ray equipment, room layout of x ray installation, protective devices and personnel safety [7, 8].

The protection of patients is related many factors like the equipment and film, appropriate selection criteria, and quality assurance programs. Among these the most significant factor is patient selection criteria. Based on patient signs, symptoms and history the selection criteria of patients requiring radiographs are identified and prescribed accordingly [9].

As the dental and medical students and interns represent future practitioners, they must be aware through knowledge about radiation protection and their hazards.

In the present study, 77.25% of participants strongly agreed that x rays are harmful. However, Prabhat *et al.* reported 100% agreement among dental interns, IV year dental students and III years dental students. Also in a study conducted by Asha *et al.*, 84.4% of dental practitioners reported agreement while Rahul *et al.* reported 83.3% agreement among dental participants.

Although 95% of dental interns strongly agreed that while taking radiographs one must stand behind protective screen, only 56% of medical interns gave the response. In contrast, in the study by Asha *et al.* 56.3% participants agreed that they did not stand behind the screen while 43.8% of participants agreed that they stand behind the screen. In the study by Nagaraj *et al.*, 76% of participants stand behind the protective screen.

Almost 95% of all participants agreed that protective screen consists of lead and used lead aprons as protective barrier. In a study by Asha *et al.*, only 43.8% of practitioners stood behind protective wall and lead apron was used by only 40% of practitioners.

As regards the radiation protection symbol as many as 94% of dental and medical interns were aware of the same. Prabhat *et al.* in their study also reported a similar trend regarding awareness about radiation protection. This finding signifies that students from both medical and dental fraternity are aware of the hazards of x-rays and the protective measures to be used against them.

Only 40% of the medical students and 51% of the dental students were aware of the ALARA principle. In the study by Enabulele, only 17.9 % of the participants know what ALARA means. 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.

Only 54% of dental participants and 24% of medical participants of the present study were aware of NCRP and AERB recommendation, in contrast to the study conducted by Prabhat *et al.* where 96- 100% awareness was reported among dental interns and students. Asha *et al.* in their study, reported 59.4% of awareness while Rahul *et al.* reported 38.5% of awareness which is almost similar to our study.

Since the overall percentage of awareness is less, it indicates that students from both medical and dental fraternity are not made aware about the various organizations of radiation protection. This can be improved by including the topic of radiation protection in the early academic years of both medical and dental students.

In the present study about 74% of dental participants and 60% of medical participants agreed that digital radiography requires less exposure than conventional. In a study conducted on dental undergraduates by Rahul *et al.* 128 out of 174(73.6%) showed correct response, 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%).

It can be inferred that students and interns from dental fraternity are more aware about digital radiography and its advantages than students from medical fraternity.

When they were asked, whether radiographs are absolutely contraindicated during pregnancy, 32% of dental students agreed followed by medical students (29%), dental interns (23%) and medical interns (20%). From our study it is observed that dental and medical students were equally aware about contraindication of radiograph in pregnant patients. To our surprise it was found that dental and medical interns were less aware than dental and medical students. In a study conducted by Prabhat *et al.* III year dental students gave maximum number of correct response(63.7%) followed by IV year dental students (18.5%) and dental interns (6.4%), which is in contrast to our study.

51% of medical interns were aware of radiographic waste management followed by dental students (47%), medical students (40%), dental interns (36%). Whereas, 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. Medical interns were more aware than students and interns from dental

fraternity about radiographic waste management. This implies that special effort need to be taken to improve knowledge of dental students in this field.

On the whole when the knowledge regarding radiation hazards and radiation protection was compared between final year students and interns from medical and dental fraternity, it was observed that the students and interns from dental fraternity were relatively more knowledgeable than their counterpart. This could be attributed to the inclusion of the subject of Oral Radiology in the curriculum of dental students whereas, the medical students are not exposed to the subjects until they enter their internship. This should be taken into account by the health science universities and the necessary improvisations should be done in the syllabus of the medical students. Introduction to the subject of Radiology in the third and final year of the M.B.B.S. course will drastically improve their knowledge and awareness regarding radiation hazards and protection.

CONCLUSION

The results of our study showed the lack of awareness regarding ionizing radiation doses among dental and medical students and interns.(figure 1) In our study, Dental interns were more aware followed by Dental students, Medical interns and Medical students respectively. Difference between medical and dental students could be due to the curriculum difference as dental students have detailed chapter/curriculum as compared to medical. But since it is a major issue, one should make sure that every practitioner is aware about the hazards of radiation irrespective of the specialty. Amongst the total participants, 68 % of them felt lectures and 83% of them felt workshops should be conducted to acquire knowledge on radiation hazards and their protection.

There is need "to fill" the knowledge for both medical and dental field by providing lectures and workshops about radiation hazards and their protection and need to educate current and future doctors regarding unnecessary exposure of individual to radiation.

Conflicts Of Interest: No conflict of interest

Authors contribution

1. Dr. Motwani Mukta B- editing and reviewing of manuscript, Professor and Head, Dept. of Oral Medicine and Radiology, VSPM Dental College and Research Centre, Nagpur, India.
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