



Knowledge, Attitude and Practice of Radiation Protection among Dental Students

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Authors' contributions

This work was carried out in collaboration between both authors. Author PK designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Author JKV managed the analyses of the study and the literature searches. Both authors read and approved the final manuscript.

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ABSTRACT

Radiology is one the key cornerstone of investigation in Dentistry. The application of radiology in Dental practice has grown by leaps and bounds in the years gone by. Along with this there is an increase in the number of radiation hazards. The effect of radiation on human beings is very negative. This survey was conducted with the intent of studying the awareness and knowledge of radiation protection in practice. The survey consisted of 10 closed ended questions which were circulated among 100 interns of a dental college. The data collected was entered into microsoft excel and the data was analysed for an association between the gender and the responses using Chi-square analysis. The majority of the participants were females and they believed that radiation causes harm to humans and surprisingly they had also believed that ionised radiation remains suspended in the air after making a radiographic exposure where there was no statistically significant difference between the genders($p>0.05$). The questions also assessed whether a clinical examination is advised before a radiographic examination and the majority were of the view it is

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necessary which was statistically significant($p<0.05$). From this study we could infer that students are well aware of the adverse effects of radiation but in terms of safety practices being followed in Dental clinics, there are some pitfalls noticeable.

Keywords: Radiation safety; precautions; radiation protection; awareness.

1. INTRODUCTION

X-rays were discovered by Wilhelm Conrad Roentgen in 1895, and it has been a very important diagnostic method in modern dentistry [1,2]. Radiation is the transmission of energy through space and matter. It may occur in particulate or in electromagnetic radiation. Electromagnetic radiation is the movement of energy through space as a combination of electric and magnetic fields. This is generated when the velocity of an electrically charged particle is altered. Examples of electromagnetic radiations include X-rays, Y-rays, UV rays, infrared radiation, radio waves and microwaves [3].

The ability of the ionizing radiation to penetrate the soft tissues to reflect an image that cannot be seen by naked eye but on a sensor /film it becomes visible making it a great importance in dentistry. Its usage varies from diagnosing minor caries lesions to diagnosing periapical and maxillofacial lesions. However, ionizing radiation causes damages to the cells biologically [4]. It may directly damage the DNA or indirectly by creating free radicals [5]. These free radicals are unstable and reactive uncharged molecules tend to stabilize by rebinding and they produce new toxic substances, such as hydrogen peroxide which can lead to cellular alterations [6].

Biological effects of radiation are classified into deterministic and stochastic effects. Deterministic effects are dose dependent, above which the biological damage appears in the body and severity of the response is directly proportional to dose, whereas stochastic effect causes sublethal damage to DNA [6,7]. So radiographs should be prescribed only for a patient when it is required to diagnose and treat the pathology. Schauer and Linton reported that in the past 2 decades there was significant increase in demands for radiologic imaging procedures in health care services to help in medical decision making [8]. Recognizing the harmful effects of radiation and the risks involved with its use led the National Council on Radiation Protection and Measurements (NCRP) and the International Commission on Radiological Protection (ICRP)

to create guidelines for restrictions on the amount of radiation received by both doctors and patients [7].

There are three guiding principles in radiation protection; The first is the principle of justification. In making dental radiographs this principle obligates the dentist to do more good than harm. The second guiding rule is the principle of optimization. This principle olds that dentists should use every means to reduce unnecessary exposure to their patient and themselves. This philosophy of radiation protection is often referred to as the principle of ALARA (As low as reasonably achievable).The third principle is that of dose limitation. Dose limits are used for occupational and public exposures to ensure that no individuals are exposed to unacceptably high doses [7].

Radiation protection is the science and art of protecting people and the environment from the harmful effects of ionizing radiation. It is also described as all activities directed towards minimizing radiation exposure of patients and personnel during x-ray exposure [8,9]. The amount of exposure received by a patient or operator from dental radiography depends on the film speed, exposure parameters of collimation, technique, and protecting barriers used. This demands the operator to have detailed knowledge towards radiation hazards and its protection procedures.

Previous literature documented insufficient knowledge among medical students, doctors, paramedics and dentists about their understanding of ionizing radiation or the use of equipment involved in the imaging [9] Thus a need arises to assess the knowledge, attitude and practice (KAP) of dental imaging and appropriate radiographic protection among dental students.

Our recent research has features as numerous articles in reputed journals [10–14]. Based on this experience we planned to pursue a study to evaluate the awareness of knowledge dental radiography in the interns.

2. MATERIALS AND METHODS

The survey consisted of using a close ended questionnaire. A set of 10 questions were prepared by the authors and were pre validated by three senior faculties in the Department. Based on the feedback received from three senior faculties the options for some of the questions were modified and pilot tested on a small group of 10 students whose responses were also included in the final results of the study.

A total of 100 dental students were selected based on the purposive random sampling from a private Dental Institution in Chennai. The questionnaire was circulated online using Survey Monkey. The inclusion criteria of the study were interns from a Dental College and the expression of consent to participate in the survey. The exclusion criteria were students from other years of study in the BDS program and expression of unwillingness to participate in the survey.

Though the name, age and gender of the participants were collected during the survey, the name and age were not used for any discriminatory purpose in the survey and a strict confidentiality of the names of the students were maintained during the study. The responses received were extracted in the form of an excel worksheet. In this worksheet data encoding was done and was imported into SPSS ver 21. Here the basic descriptive statistics was worked out for each question and the final inferential statistics looking for an association between the gender and the nature of responses was done using Chi-square analysis.

3. RESULTS AND DISCUSSION

The survey questions were circulated to 100 dental students and the resultant samples had 72 females and 28 males. Fig. 1. The first question asked in the questionnaire is do dental x-rays cause harm to the humans, 95% of the respondents (68- females and 27 males) answered they do cause harm in the form of stochastic and deterministic radiation. Fig. 2. There was no statistically significant difference in the response between the genders ($p>0.05$). It is a common myth that radiation causes free radical formation which remains suspended in the air and the same was asked as a question. Interestingly 72% (54-females and 18 males) said that ionized radiation remains suspended in the air. Fig. 3. There was no statistically

significant difference in the response between the genders ($p>0.05$). The next question was to check the awareness of the respondents to the regulations and guidelines issued by NCRP and ICRP. A total of 89% (61- females and 28 males) said that they were aware of the guidelines and 11% were not aware of the guidelines. There was a statistically significant difference in the responses from both the genders ($p<0.05$). Fig. 4. The next question assessed the principal of justification, wherein the respondent were asked if they performed a clinical examination before the radiological examination and a total of 93% (65 females and 28 males) said that they do it before advising a radiograph. There was a statistically significant difference in the responses from both the genders ($p<0.05$). Fig. 5. The next question was on the relevance of dental radiography for a pregnant mother. Analysing the responses it was found that 58% (42 females, 16 males) felt radiographs are absolutely contraindicated, 23%(16 females ,7 males) depending on the clinical scenario it can be done following safety guidelines and 19%(15 females, 4 males) felt it is relatively contraindicated. Fig. 6. The next question was to assess the students if they were aware of the methods to reduce radiation. For this questions there were 37% (24 females,13 males)of participants felt collimator was the main option of reducing radiation, 34% (27 females, 7 males) felt filtration was the option to reduce radiation and 29%(21 females,8 males) felth reducing the KvP was the option to reduce radiation dose. Fig. 7. There was no statistically significant difference in the response between the genders($p>0.05$). The next question was to assess the position -distance rule and 65%(46 females,19 males) opted for the correct choice of 6 feet at an angulation of 90-135 degrees from the primary beam. Fig. 8. There was no statistically significant difference in the response between the genders($p>0.05$).The next question was on the most common technique for taking intra oral radiographs for which 40% mentioned as paralleling technique and 60% as bisecting angle technique. Fig. 9. There was no statistically significant difference in the response between the genders($p>0.05$). The next question was on the trefoil symbol used in dental operatories, for which 79%(56 females,23 males) responded by saying that it was a symbol of radiation safety. Fig. 10. There was no statistically significant difference in the response between the genders($p>0.05$). For the next question on who holds the film or sensor during exposure, a surprising 83% (60 females,23 males) responded saying they hold the sensors during exposure.

Fig. 11. There was no statistically significant difference in the response between the genders ($p > 0.05$).

Knowledge imparted during student life shapes attitude and practice regarding clinical behaviour among the dental professionals. The use of radiography for dental diagnosis is growing very significantly. Two factors are responsible for this; advancing imaging technology and over reliance on imaging for establishing diagnosis. This had led to improved accuracy of diagnosis and better treatment. But, at the same time this had exposed the dental practitioners and the patients to the harmful effects of radiation hazard.

A study conducted by Swapna et al [15] in 2016, Rela et al [16] in 2018, in which majority of the study population were females. This is in

accordance with our results. Whereas the study conducted by Basheer et al [4] among dentists, dental students and dental staff, most of the study population were males. This is contradictory to our results.

In a previous study conducted by Swapna et al [15] and Basheer et al [17], most of the study population was aware that x-rays cause harmful effects to humans. This is in accordance to our study. In the present study, majority of the study population (89%) were aware of ICRP and NCRP. Prabhat et al [5] reported 96-100% awareness was reported among the dental interns which is almost similar to our study. In contrast to the study conducted by Swapna et al [15], only 35% of study population were aware of ICRP and NCRP and Amal et al [16], only 34% of study population were aware of ICRP and NCRP recommendations.

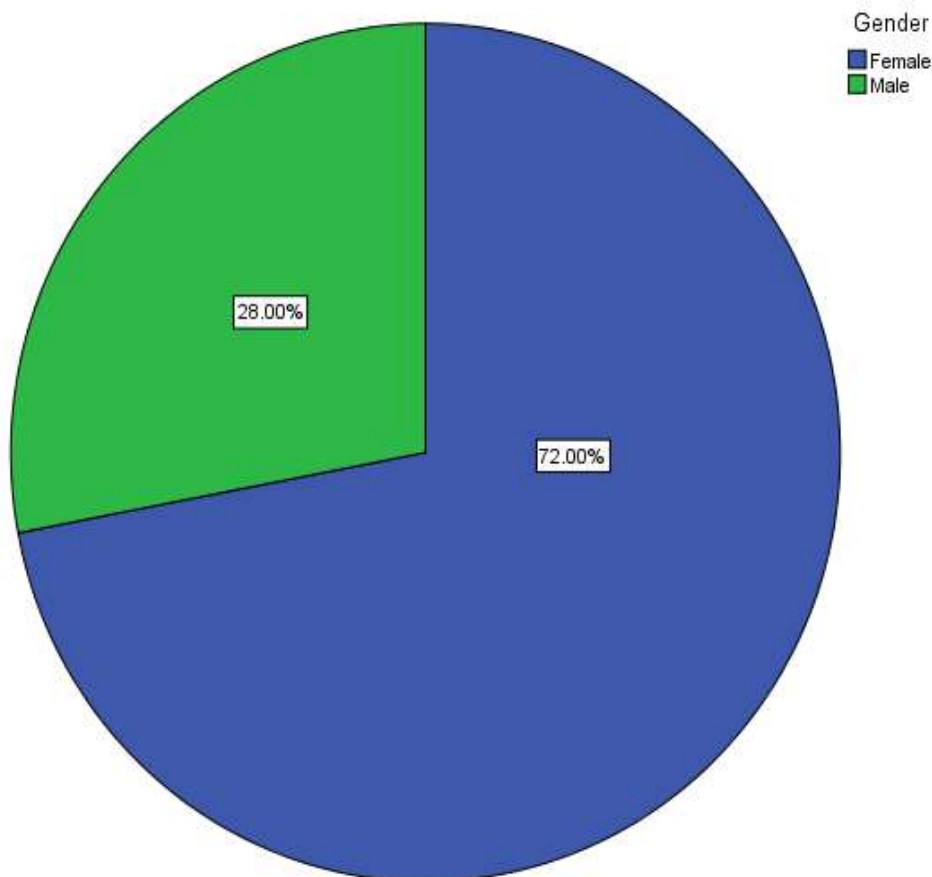


Fig. 1. Pie chart showing the gender distribution of the respondent. Majority (72%) were females

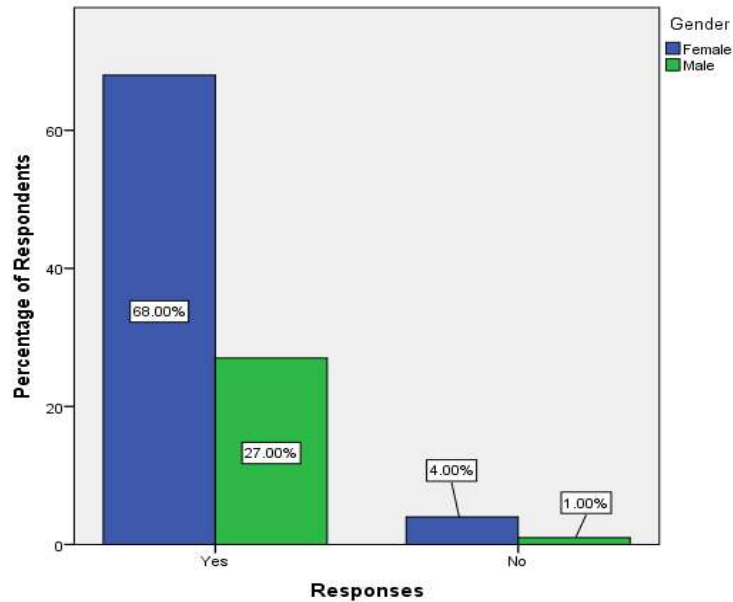


Fig. 2. Bar graph showing the association between the responses to the question whether the respondents were aware of the harm caused by dental X-rays and gender. X axis represents the responses and Y axis represents the percentage of respondents. The majority were aware that X-rays do cause harm to the humans. A chi square association test (chi square - 0.167 p-0.583 ($p > 0.05$)) statistically not significant implying no association between the gender and the responses

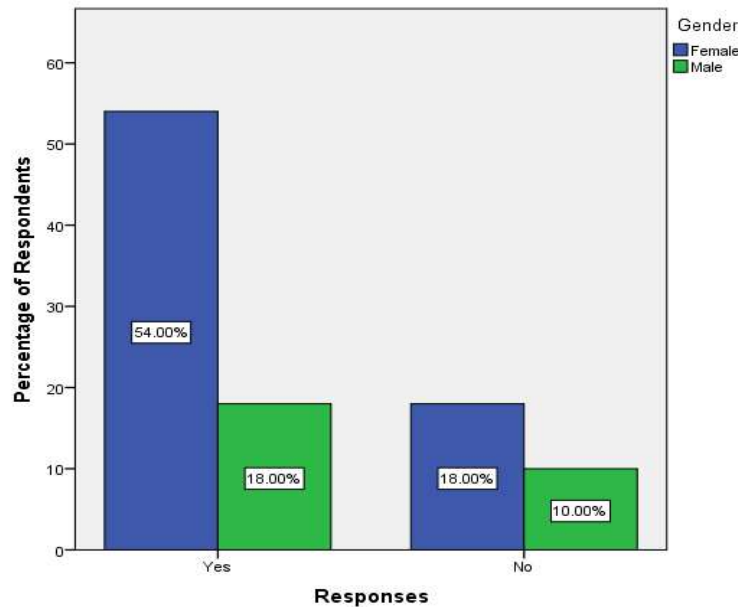


Fig. 3. Bar graph showing the association between the responses to the question whether the respondents believed that ionizing radiation remains suspended in the air and gender. X axis represents the responses and Y axis represents the percentage of respondents. The majority felt that radiation is suspended in the air. A chi square association test (chi square - 1.148 p-0.243 ($p > 0.05$)) statistically not significant implying no association between the gender and the responses

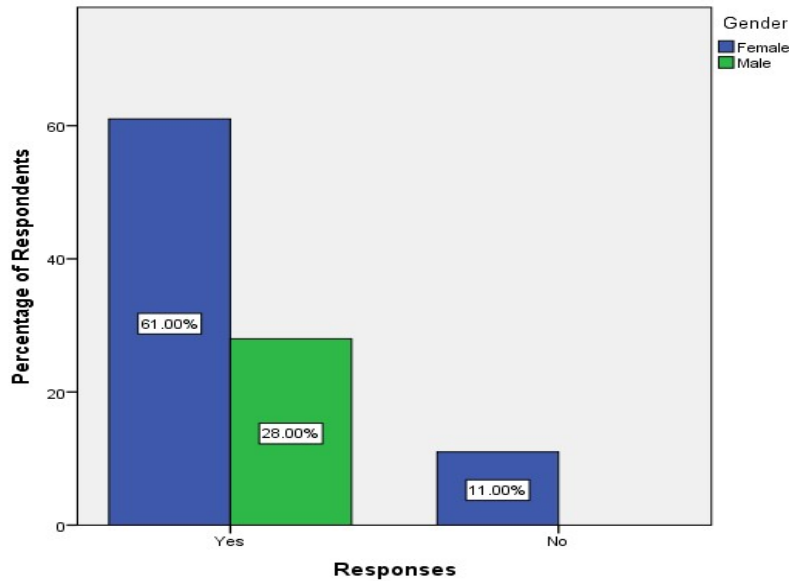


Fig. 4. Bar graph showing the association between the responses to the question whether the respondents were aware of the ICRP & NCRP regulations and gender. X axis represents the responses and Y axis represents the percentage of respondents. The majority were aware of the regulations. A chi square association test (chi square - 4.806 p-0.02 (p<0.05)) statistically significant implying an association between the gender and the responses

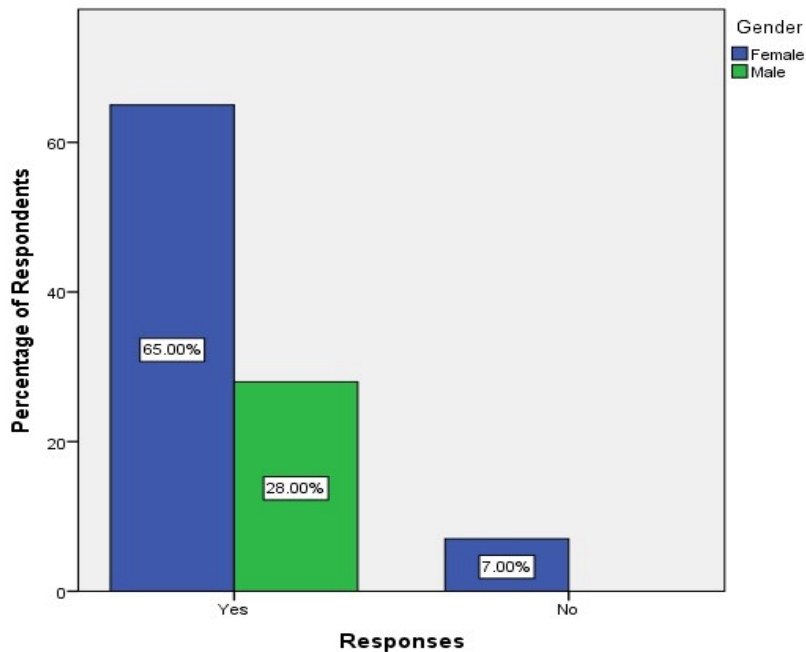


Fig. 5. Bar graph showing the association between the responses to the question whether the respondents performed a clinical examination before radiography and gender. X axis represents the responses and Y axis represents the percentage of respondents. The majority performed a clinical examination before radiography. A chi square association test (chi square - 1.927 p-0.08 (p<0.05)) statistically significant implying an association between the gender and the responses

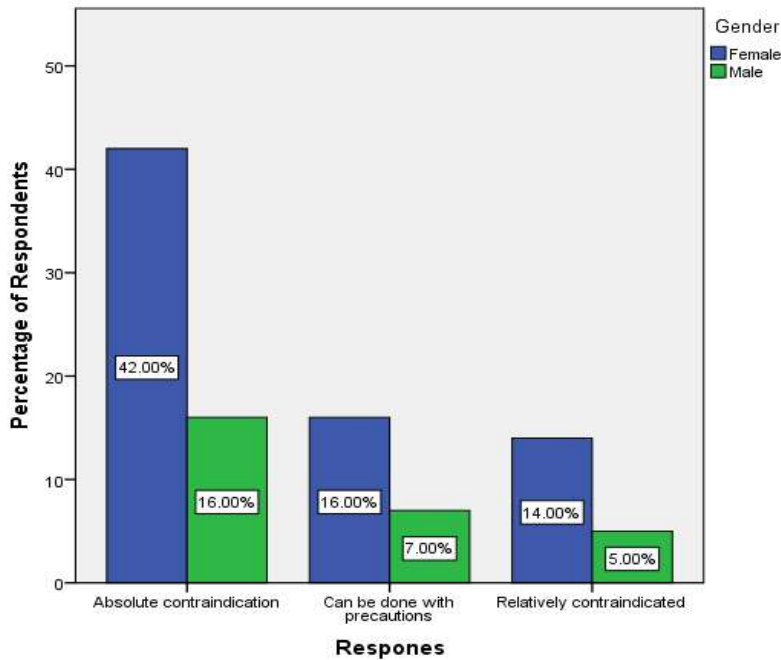


Fig. 6. Bar graph showing the association between the responses to the question if radiography can be performed during pregnancy and gender. X axis represents the responses and Y axis represents the percentage of respondents. The majority felt it is an absolute contraindication. A chi square association test (chi square - 0.099 p-0.8 ($p > 0.05$)) statistically not significant implying no association between the gender and the responses

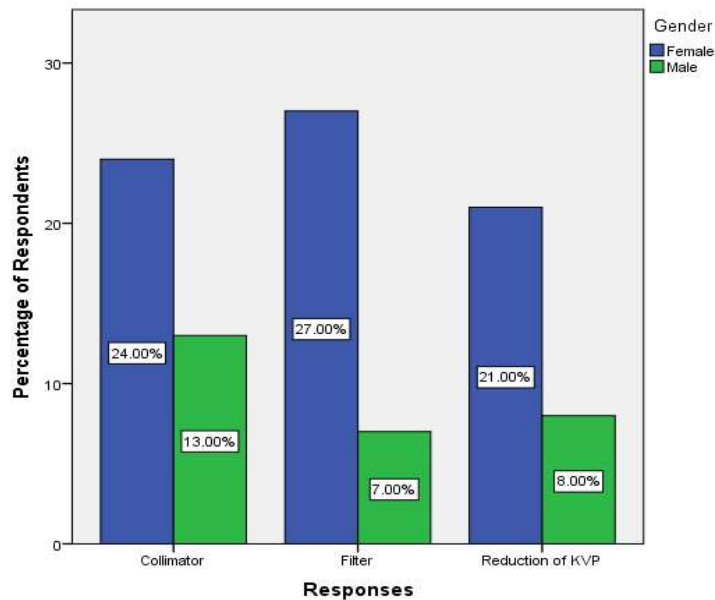


Fig. 7. Bar graph showing the association between the responses to the question on the methods to reduce radiation exposure and gender. X axis represents the responses and Y axis represents the percentage of respondents. There was a mixed response with nearly equal distribution. A chi square association test (chi square - 1.463 p-0.4 ($p > 0.05$)) statistically not significant implying no association between the gender and the responses

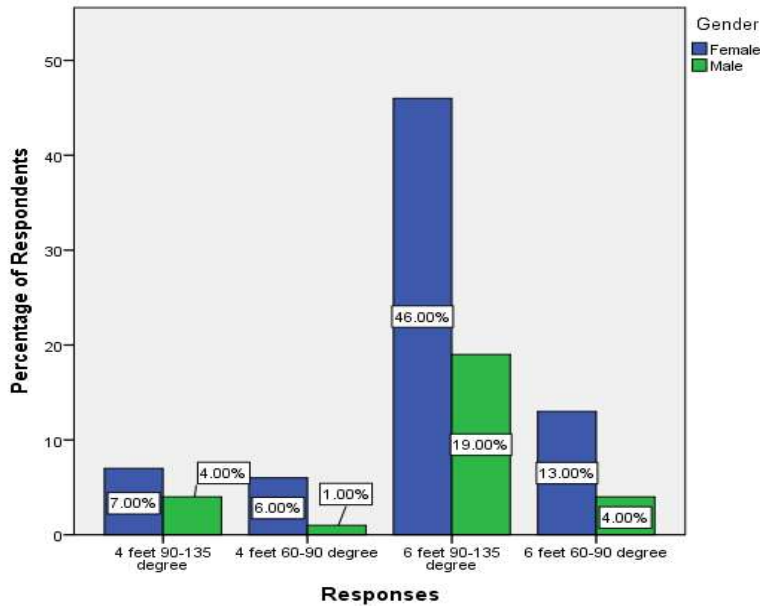


Fig. 8. Bar graph showing the association between the responses to the question on the position and distance rule and gender. X axis represents the responses and Y axis represents the percentage of respondents. The great majority said they adopted 6 feet 90-135 degree angulation. A chi square association test (chi square - 1.252 p-0.7 ($p > 0.05$)) statistically not significant implying no association between the gender and the responses

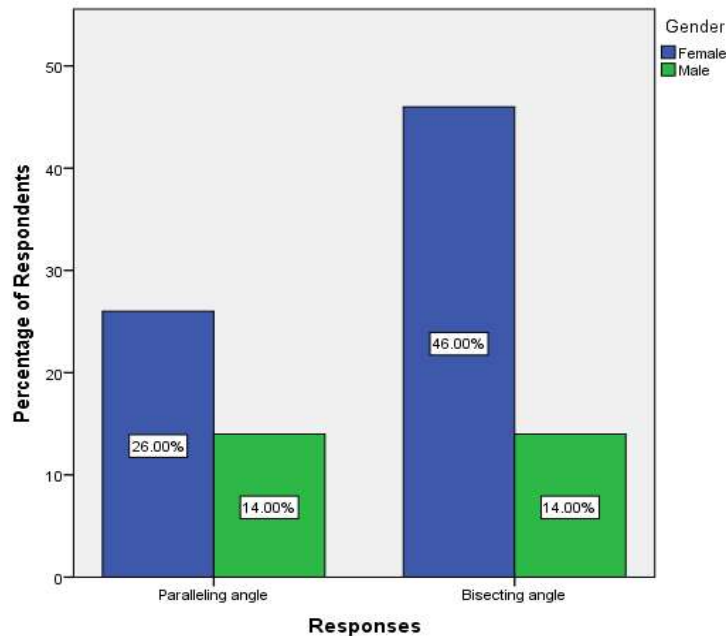


Fig. 9. Bar graph showing the association between the responses to the question on the technique of radiography and gender. X axis represents the responses and Y axis represents the percentage of respondents. The majority had used paralleling technique. A chi square association test (chi square - 1.620 p-0.23 ($p > 0.05$)) statistically not significant implying no association between the gender and the responses

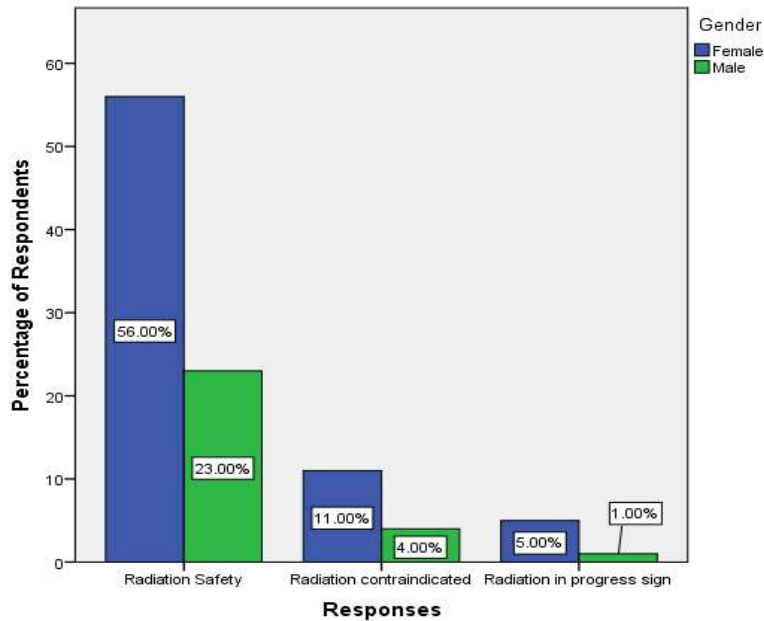


Fig. 10. Bar graph showing the association between the responses to the question of the meaning of trefoil symbol and gender. X axis represents the responses and Y axis represents the percentage of respondents. The majority responded saying it is a radiation safety symbol. A chi square association test (chi square - 0.444 p-0.68 ($p > 0.05$)) statistically not significant implying no association between the gender and the responses

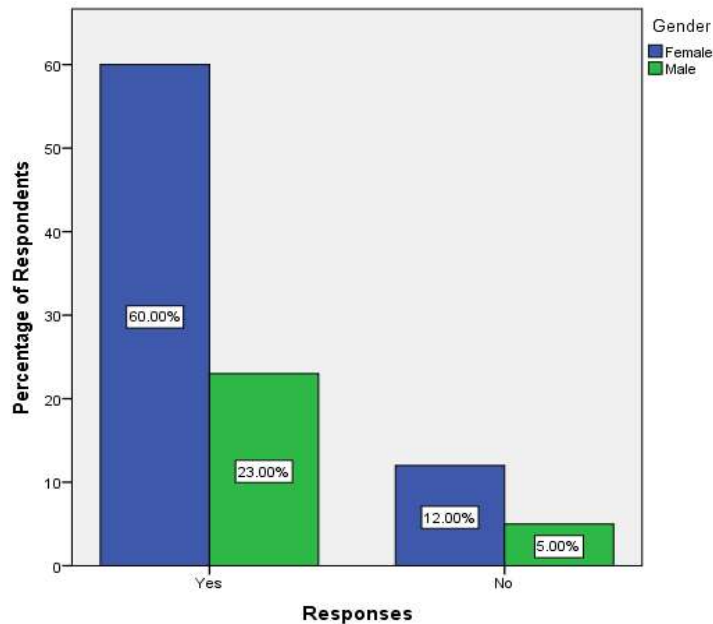


Fig. 11. Bar graph showing the association between the responses to the question if the students hold the sensor/film and gender. X axis represents the responses and Y axis represents the percentage of respondents. The majority held the sensor by themselves. A chi square association test (chi square - 0.020 p-0.87 ($p > 0.05$)) statistically not significant implying no association between the gender and the responses

In the present study, the majority of the study population (58%) reported that dental radiography is absolutely contraindicated in pregnant women. Previous study conducted by Swapna et al [15] reported 42% of the study population, Rela et al [2] reported that 64% of study population and Rela et al [16] reported that 46% of the study population assume that it is an absolute contraindication for pregnant patients to be radiographed. This is almost similar to our study.

In the present study, most of the study participants (65%) agreed that the ideal distance of operator (Position Distance Rule) when exposed to dental radiation is 6feet, 90°–135°. Rela et al [16] reported that 52% of the study population agreed that ideal position distance rule and Amal et al [15] reported that 72.3% of the study population agreed the ideal distance of the operator when exposed to dental radiation is 6 feet and 90°- 135°.

In the present study, the majority of the study population (60%) preferred using bisecting angle technique whereas 40% of the study population preferred parallel angle technique for taking intraoral radiography. In contrast to our study, Basheer [17] reported that most of the study population (77.3%) preferred parallel angle technique than bisecting angle technique. This is contradictory to our results.

In the present study, the majority of the study population (79%) were known about the trefoil symbol which is the radiation safety sign. In the previous study conducted by Swapna et al [15], 67.5% were knowledgeable about the trefoil symbol. This is almost similar to our study.

In the present study, majority of the study population (83%) reported that they prefer to hold the x-ray film/sensor during the exposure. The study conducted by Swapna et al [15] reported that only 16% of the study population preferred to hold the film or sensor during the exposure and Basheer et al [17] reported that only 30.7% of the study population preferred to hold the film or sensor during the exposure.

4. CONCLUSION

Within the limitations of the study we find that the majority of dental students were aware about the recommendations of ICRP and NCRP recommendation, ideal distance to stand while exposing the radiograph, when to order

radiograph for pregnant women, harmful effects of radiation and knowledge about symbols of radiation protection was found to be high among majority of students. But most of the students were aware that holding film or sensors causes harmful effects but they were difficult to apply in clinical practice. The knowledge imparted during the student life shapes the attitude and practice regarding clinical behaviour among dental professionals.

CONSENT

As per international standard or university standard, respondents' written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the author(s).

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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