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Awareness on Radiation Protection Devices Among Dental Students

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Abstract: Radiation protection refers to the implementation of practices to reduce radiation exposure to patients, workers and the public. The fundamental aim of radiation protection is to reduce risk of harm by ensuring that any dose received is justified and 'as low as reasonably practicable' (ALARP). Exposure to Radiation has become common in Dentistry, patients are exposed to radiation by various radiation emitting devices such as OPG, CBCT,CT and IOPA. Apart from patients, dental surgeons and dental assistants are being exposed to radiations on a regular basis. Radiation effects on human cells cause various problems, increased risk of brain cancers, tumors of parotid gland and various problems in the head and neck region. Thus knowing about Radiation protection is important for both patients and Dentists.The Aim of this study is to create awareness and determine the understanding of radiation protection devices and its role in dentistry among dental students.Radiographic examination plays an important part of diagnosis in dental practice.Majority of the dental students within the study were aware of the radiation protection devices and its usage.

Keywords: Radiation; ALARA; device; protection; dentistry

INTRODUCTION

Radiations are defined as the transmission of energy through space and matter. It is transmitted in particulate or in electromagnetic radiation(Ramanathan and Ryan, 2015). Electromagnetic radiation is known as the kinetic energy through space, from electric and magnetic fields which is a combination. Generation of electromagnetic radiation initiated when the velocity of an electricity charges the particle is altered. ϒ-rays, X-rays, UV. rays, visible light, infrared radiation, microwaves and radio waves are all examples of electromagnetic radiation. The types of radiation in the electromagnetic spectrum may be ionizing or non-ionizing, depending on their energy response is proportional to the dose(Lee *et al.*, 2012).

Stochastic effect doesn't have a threshold dose that could lead to biological injury, so the probability of occurrence of the change, rather than its severity, is dose dependent. High-dose ionizing radiation (x-ray) causes both deterministic and stochastic effects. Whereas low dose of radiation leads to mainly stochastic effects. Both dentists and patients are at high risk of stochastic effects(Zhou *et al.*, 2010).

Though the exposure is minimal still it is very important to reduce the radiation to avoid the accumulated dose to the dentist and patients in their lifetime. Considering this, dental radiograph should be The fact that ionizing radiation has various biological harmful effects, by the production of free radicals thus affecting the cell directly or indirectly, leading to DNA damage, including single or double-strand breaks, and or DNA cross-links. X-radiations are detrimental to cells of the human body and are adequately powerful and lead to cancer, leukemia and even genetic damage(Soye and Paterson, 2008).

Radiology has become a major field in diagnostic application in both medicine and dentistry. Radiographs play a critical diagnostic role in dentistry(Arslanoglu *et al.*, 2007). This field has grown enormously with the rapidly expanding range of imaging modalities like Cone Beam Computed Tomography (CBCT) Computed Tomography (CT), ortho cubic super-high resolution CT (Ortho-CT) for pathologies, different dental and biological effects of radiation are broadly classified into: Non-stochastic (deterministic) and stochastic effects.

Deterministic effects are dose dependent, above which the biological damage appears in the body and the severity of the taken for a patient only when the benefit outweighs the risk of damage from x-radiation(Briggs-Kamara and Okoye, 2013). Determining the negative effects of radiation and the risks involving its use leads the National Council on Radiation Protection and Measurements and the International Commission on Radiological Protection to issue few globally usable guidelines to control the amount of radiation received by both the patient and professional. The latest occupational hazards lead to a limited exposure of radiation which have been introduced to ensure there are no deterministic effects towards any individual(Langlais and Langland, 1995). They were also introduced to determine the probability for stochastic effects is as low as reasonably and economically feasible(Gibbs, 1982).

In radiation protection, there are three main principles which are started with the principle of justification(Shahab *et al.*, 2012). This principle is obeyed during the making dental radiographs to ensure the dentist does more good than harm. Secondly, the principle of optimization in the guides holds that the dentist should utilize every opportunity to reduce the unnecessary exposure to their patient and themselves. The radiographic examination carried out in all fields of medical services and dental services contributes to the promotion of health, both individually and nationally(Ezoddini Ardakani and Sarayesh, 2008).

However, radiograph plays an essential role in dental practice, as the dentist has to evaluate a diseased tooth through radiographic examination. Certain amount of radiation cannot be omitted from delivering to the patients, therefore it should be as low as reasonably achievable which is known as the ALARA concept. Moreover, in dentistry the radiation exposure has to be done to full-fill their diagnosis sheet. The practicing dentist differs from medical colleagues as he exposes, processes, and interprets the radiograph. Even if the radiation exposure is minimal, yet the importance to reduce the radiation or to avoid the radiation dosage is the responsibility of the dentist because the effect is going to be in their entire lifetime(Jacobs *et al.*, 2004).

International Commission for Radiation Protection is the regulatory body which lays down norms for radiation protection at the international level(Razi, Bazvand and Ghojazadeh, 2011). The Atomic Energy Regulatory Board of India had provided the norms for radiation protection in all related fields. They had recommended norms for permissible doses of radiation from the X-ray tubes, the shielding required for the walls of an X-ray tube room, the lead equivalent shielding apparel to be worn by radiation workers, and also lays down safe dose limits for radiation workers and for the general public(Brent, 1989). Therefore, this study was conducted to determine the awareness of dental students in Chennai regarding the radiation protection devices.Our team has rich experience in research and we have collaborated with numerous authors over various topics in the past decade (Deogade, Gupta and Ariga, 2018; Ezhilarasan, 2018; Ezhilarasan, Sokal and Najimi, 2018; Jeevanandan and Govindaraju, 2018; J *et al.*, 2018; Menon *et al.*, 2018; Prabakar *et al.*, 2018; Rajeshkumar *et al.*, 2018, 2019; Vishnu Prasad *et al.*, 2018; Wahab *et al.*, 2018; Dua *et al.*, 2019; Duraisamy *et al.*, 2019; Ezhilarasan, Apoorva and Ashok Vardhan, 2019; Gheena and Ezhilarasan, 2019; Malli Sureshbabu *et al.*, 2019; Mehta *et al.*, 2019; Panchal, Jeevanandan and Subramanian, 2019; Rajendran *et al.*, 2019; Ramakrishnan, Dhanalakshmi and Subramanian, 2019; Sharma *et al.*, 2019; Varghese, Ramesh and Veeraiyan, 2019; Gomathi *et al.*, 2020; Samuel, Acharya and Rao, 2020)

MATERIAL AND METHODS

A convenient sample size of 100 consecutive dental students who are currently pursuing in Saveetha Dental College, Chennai participated in the study. A cross-sectional observational online based study was conducted. Questionnaire was constructed on the Survey Monkey website with dichotomous responses and multiple choice questions. The questionnaire consists of 10 questions and these questionnaires were shared with all the participants and required them to answer the questions. All the responses were analysed and recorded.

RESULTS AND DISCUSSION

Awareness of dental students related to awareness on harmfulness of dental X-rays was evaluated by assessing the first set of questions; about 92% of the participants agreed that dental X-rays are harmful. Remaining 8% of the participants denied the statement [Figure 1]. However, excessive exposure to X-rays leads to stochastic and deterministic effects of the cells. If the exposure is limited then there will be no defect towards any cells in the human body. As for the second question, about awareness regarding NCRP or ICRP organizations where only 43% of them answered “Yes” and Remaining 57% of them had no clue about these organizations [Figure 2]. The third question gives knowledge of students on the awareness of use of collimators and only 55% of the participants claimed that they are aware of the usefulness of collimators and filters in dental radiograph whereas, remaining 45% of them are not aware of those importance [Figure 3]. Fourth question gives awareness of students on ALARA principle and was only aware by 49% of the participants, the remaining 51% of them were not aware of ALARA principles [Figure 4]. In dental radiography a operator should hold onto this principle to avoid unnecessary radiograph to be taken for their patients. As a dentist they should take radiographs for their patients only if they cannot diagnose the disease clinically.According to question 5 about awareness on high speed films, 62% of the participants claimed that high speed films reduce patient exposure and remaining 38%

of them denied this statement [Figure 5]. The sixth question gives the students knowledge on regular use of Lead Aprons, about 72% of the participants preferred to use lead aprons regularly. Remaining 28% of them do not prefer to use lead aprons regularly [Figure 6]. According to the seventh question, on the awareness of regular use of Lead collars; only 61% of the participants agreed to use lead collars regularly and Remaining 39% does not want to use these collars regularly [Figure 7].The eight question, knowledge of students on the use of rectangular collimators for reduction of exposure, 60% of the participants answered 'yes' and remaining 40% of the participants had no clue [Figure 8]. The ninth question shows the awareness of the students on Radiation shielding, majority which is 59% of the participants were aware of radiation shielding in X-ray rooms. Remaining 41% of them were not aware of this shielding, [Figure 9]. These shielding in the X-ray room helps to prevent the rays from reaching the patients who are waiting outside the room. According to the final question, the knowledge of students on the use of radiographs during pregnancy, 63% of the participants claimed that dental radiographs are absolutely contraindicated in pregnant patients. Remaining 37% of them assumed that dental radiographs are not a contraindication for pregnant patients. Usually, dental radiographs are safe to be taken only in the second trimester. As the development of the fetus occurs in the first trimester, X-ray can interrupt the development of cells. Therefore, it is dangerous to take any scans during the first trimester [Figure 10].

In the study done by Katarzyna et al.,(Furmaniak, Kołodziejska and Szopiński, 2016) dentists who underwent training regarding radiation protection had significantly more knowledge and awareness compared to untrained dentists. Therefore, they concluded that for radiographers the level of education had no connection with the awareness. Within the radiography student group, students in the third year of the study had significantly higher numbers of correct answers than those in the first and second years of the study. Anyhow, in current study all the students are moderately (60%) aware of this topic.

In a study conducted by Svenson et al.,(Svenson, Söderfeldt and Gröndahl, 1997) revealed the knowledge, awareness and practice of the practitioner in dentistry having a higher level of knowledge with 5–25 years of experience than those with lesser years of experience. The study also revealed that specialists have a better knowledge than other general practitioners. However in our study, the students were also shown adequate and satisfying results regarding awareness of radiation protection devices. Tavakkoli et al.,(Tavakkoli, Nikneshan and Varshousaz, 2004) conducted a study based on radiation dosage reduction among general dental practitioners using digital intraoral radiographic systems, where the conclusions were made as radiation exposure is reduced to 40–60% in RVG than using E-speed intraoral films. However, the International recommendation is to use RVG because the radiation exposure can be reduced by 60% as compared to E-speed intraoral films.

In a study by Ilgüy et al.,(Ilgüy *et al.*, 2005) they have assessed dentist's knowledge about radiographic equipment, dose reduction techniques, and quality of dental radiographic service among dental practitioners in Turkey. The result showed that they need to indicate that unnecessary radiation attempts should be made to improve dentist's knowledge about radiation dose reduction techniques. This showed that they lacked knowledge regarding even though they are working after their post graduate.

Sheikh et al.,(Sheikh *et al.*, 2014) had reported a poor radiation protection attitude and knowledge was seen among Indian dental practitioners. When compared to the current study majority of the dental students (61%) were preferred to use lead collar while 72% were preferred using lead aprons and 59% were aware of usage of radiation shielding in X-ray rooms.

According to official organizations, it is believed that 98% reduction in scattered radiation and attenuate dose to 0.04 μR can be achieved using lead aprons. Patients should wear thyroid collar during radiation exposure as it reduces attenuation of scattered radiation to 92%. Proper shielding from radiation and by increasing the distance from source protect radiographers as well as patients for unnecessary exposure to radiation.

A study by Liao et al.,(Du *et al.*, 2012) among radiographers in Kerman (Iran) concluded that the percentage of protective shields used for patients and radiographers is 0.01% and 15.7%, respectively. However, another study reported by Arnout et al.,(Arnout, 2014) revealed that about 30–60% of dental students completely avoid radiography procedures for pregnant patients, without considering the patient's trimester or level of emergency. In current study, the majority (63%) of the students are aware of the protocols regarding radiation towards pregnancy.Our institution is passionate about high quality evidence based research and has excelled in various fields ((Pc, Marimuthu and Devadoss, 2018; Ramesh *et al.*, 2018; Vijayashree Priyadharsini, Smiline Girija and Paramasivam, 2018; Ezhilarasan, Apoorva and Ashok Vardhan, 2019; Ramadurai *et al.*, 2019; Sridharan *et al.*, 2019; Vijayashree Priyadharsini, 2019; Chandrasekar *et al.*, 2020; Mathew *et al.*, 2020; R *et al.*, 2020; Samuel, 2021)

CONCLUSION

Majority of the dental students within the study were aware of the radiation protection devices and its usage. However, this study was limited to one particular district which is Chennai, Tamilnadu and only 100

participants. Further, study should be conducted in a larger scale area and sample size to get a proper overview regarding this topic within the dental students concerning the new advent technologies.

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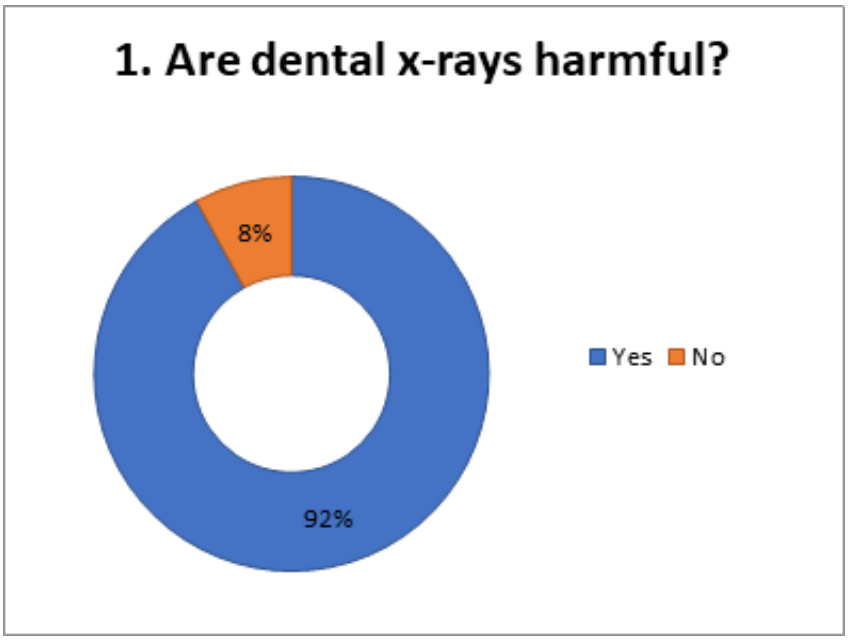

Fig.1: Pie chart representing the knowledge of students on harmfulness of Dental X-rays 92% answered that x-rays are harmful and the remaining 8% answered it is not harmful.

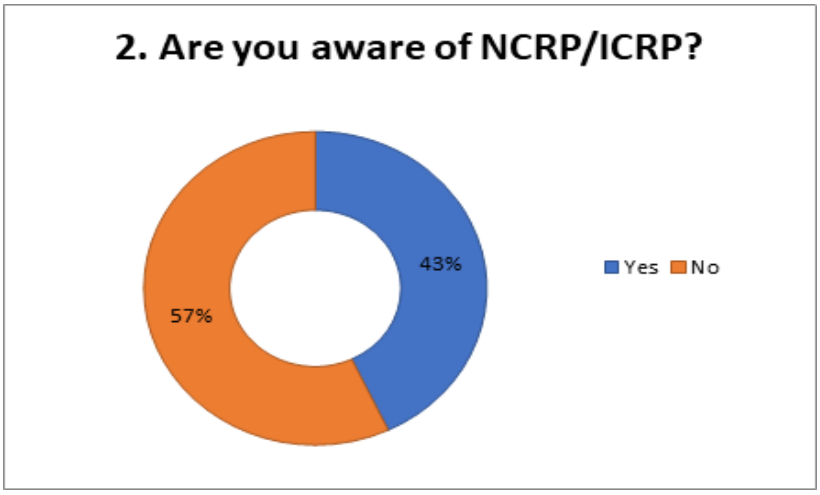

Fig.2: Pie chart representing the knowledge of students on awareness of NCRP/ICRP, 43% of students are aware about NCRP/ICRP and the remaining 57% are not aware of that.

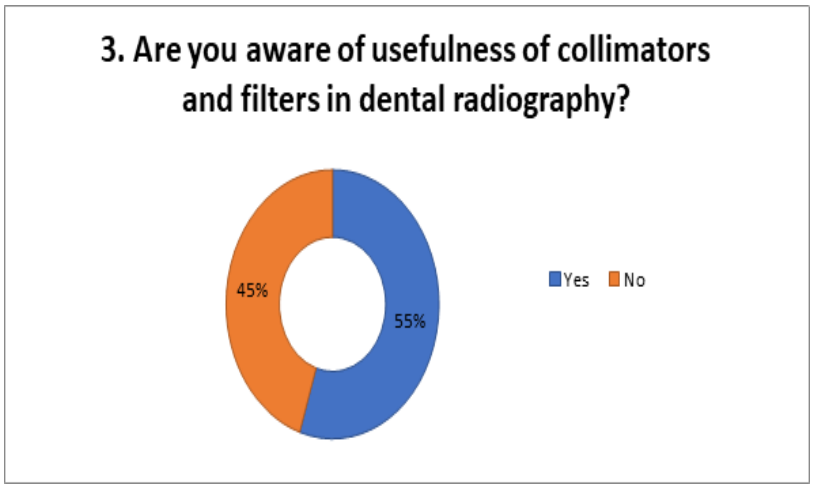

Fig.3: Pie chart representing the knowledge of students on usefulness of Collimators and filters in dental radiography, 55% answered that they are aware of the use of collimators and filters and the remaining 45% are not aware of them.

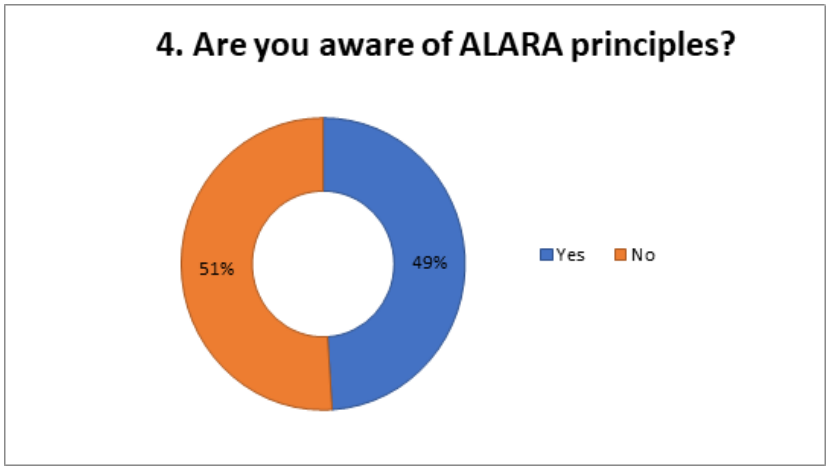

Fig.4: Pie chart representing the knowledge of students about ALARA principles, 49% of the students are aware about ALARA principles and 51% of the students are unaware.

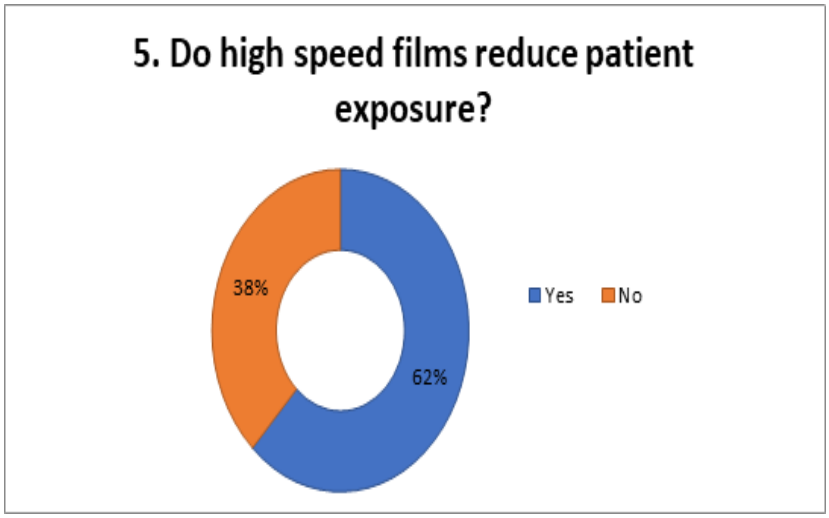

Fig.5: Pie chart representing the knowledge of students on use of high speed films to reduce patient exposure, 62% of the students are aware of use of high speed films and 38% not.

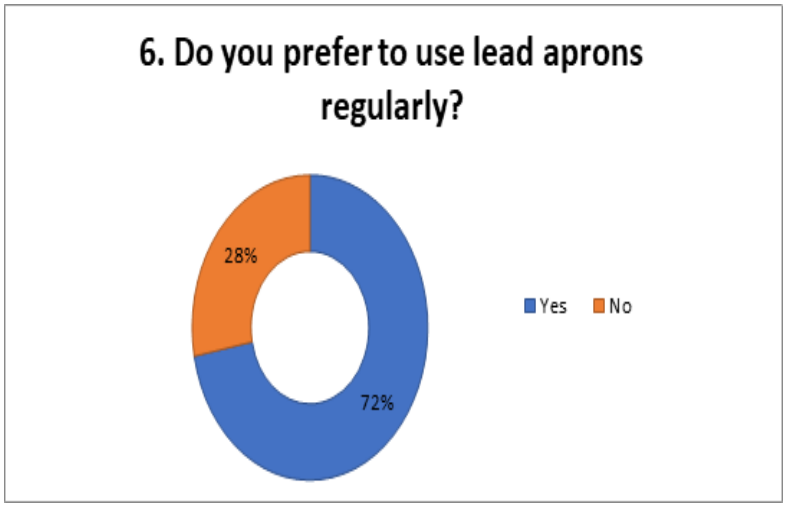

Fig.6: Pie chart representing the knowledge of students on regular use of lead aprons, 72% answered that they prefer to use lead aprons on regular and the remaining 28% do not use lead aprons regularly.

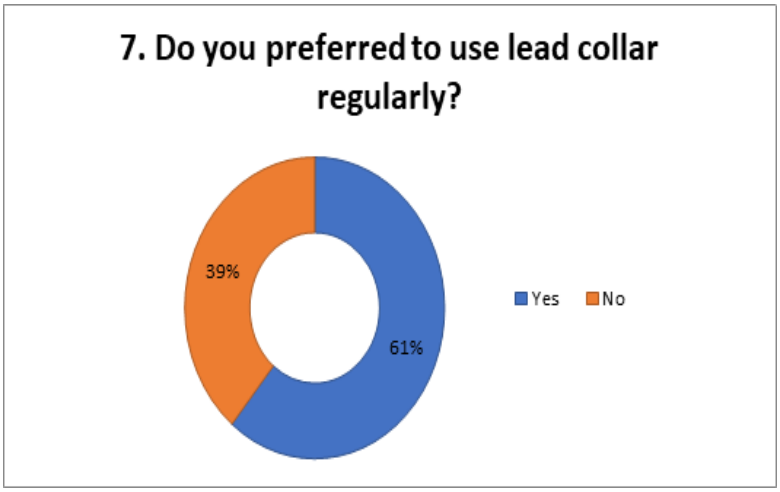

Fig.7: Pie chart representing the knowledge of students on regular use of lead collars, 61% answered that they prefer to use lead collar on regular and the remaining 39% do not use lead collar regularly.

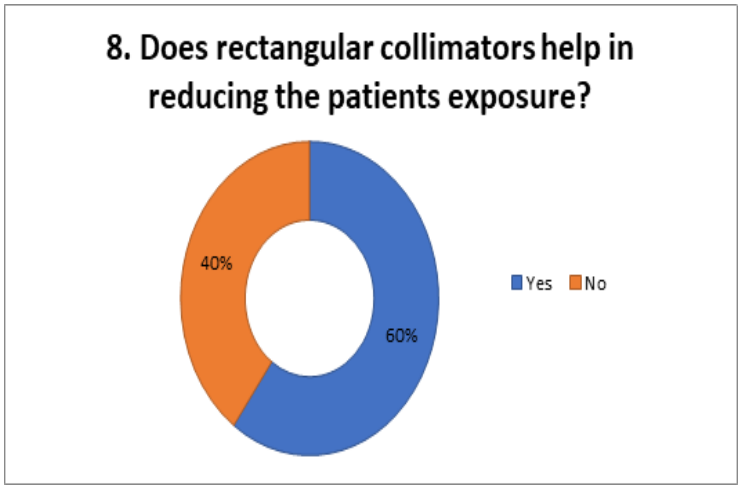

Fig.8: Pie chart representing the knowledge of students on use of rectangular collimators, 60% students are aware of the use of rectangular collimators the remaining 40% are not aware.

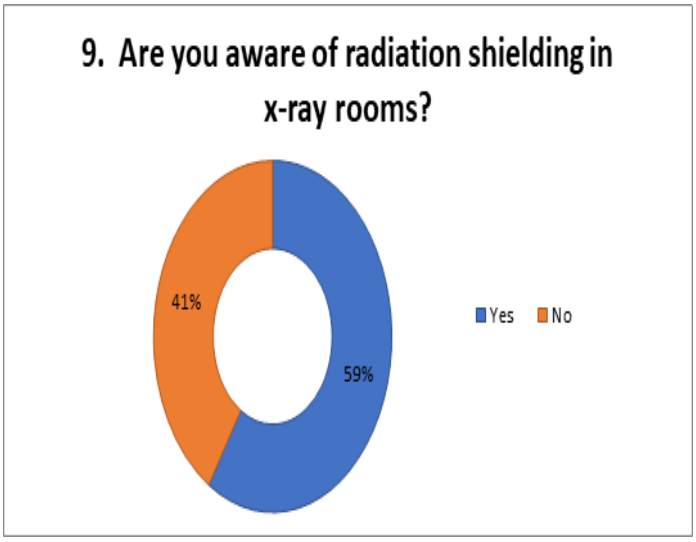

Fig.9: Pie chart representing the knowledge of students on use of radiation shielding in X-ray rooms, 59% students are aware of the radiation shielding and 41% are unaware.

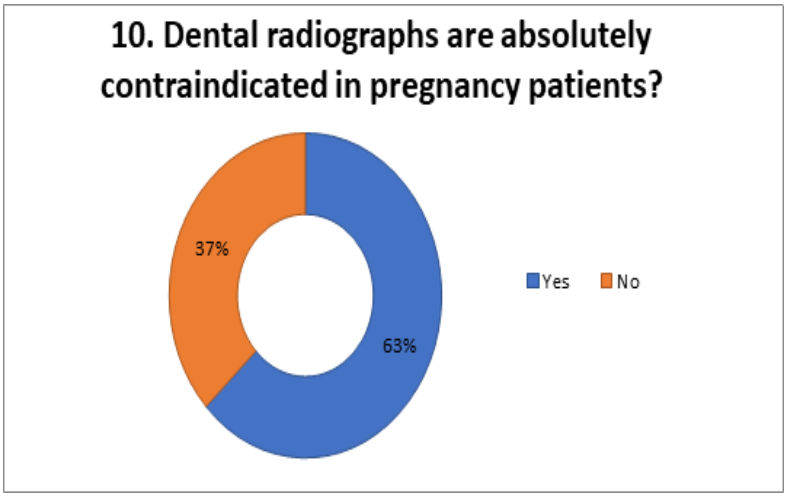

Fig.10: Pie chart representing the knowledge of students on contraindication of radiographs during pregnancy, 63% answered 'yes' and 37% answered 'No'