Research Article

JRAD Journal of Research and Advancement in Dentistry

J Res Adv Dent 2018;9:1:32-42.

Awareness and Attitude Towards Radiation Protection and Safety among Dental Community of North India

Bali Harleen[1*] Mishra Neha[2] Kaur Prabhpreet[3] Sharma Sheetal[4] Rajavelu Muthunagai[5] Saini Shraddha[6]

[1]Assistant Professor, Department of Oral Medicine and Radiology, Universal College of Medical Sciences and Teaching Hospital, Bhairahawa, Nepal.
[2]Assistant Professor, Department of Oral Pathology and Microbiology, Chitwan Medical College and Teaching Hospital, Chitwan, Nepal.
[3]Reader, Department of Oral Pathology and Microbiology, Shaheed Kartar Singh Sarabha Dental College and Hospital, Ludhiana, Punjab, India.
[4]Senior Resident, Department of Oral Medicine and Radiology, All India Institute of Medical Sciences, Delhi, India.
[5]Reader, Department of Oral and Maxillofacial Surgery, Seema Dental College and Hospital, Rishikesh, Uttarakhand, India.
[6]Private Consultant, Centre for Smile and Implants, Gurgaon, Haryana, India.

ABSTRACT

Aim: The aim and objective is to evaluate the level of awareness and attitude towards radiation hazards and safety practices among dental community in North India.

Materials and Methods: A questionnaire-based cross-sectional study was conducted among 150 dental practitioners in North India using online Google forms and by hand questionnaire distribution. Questions which were included, based on demographic data, the use of intraoral radiographic equipment, patient and operator protection measures; as well as general awareness regarding dental radiology.

Results: Result showed out of 150 filled forms (online and by hand) received, 84 were female (56%) and 66 were males (44%). Majority i.e. 98 (65.3%) of the participants, belonged to the age group of 25-29 years. Post graduates dominated our study group. Our study had 74 out of 140 dentist license holders working as specialists in their filed while 69 did general practice. When asked about prescription of radiograph to a new adult patient 76 (50.7%) answered advising periapical radiographs only. The results were similar in case of their advising of periapical radiographs to paediatric patients. Of the 146 who filled the answer to maintenance of X ray equipment in their work place, 58 (39.7%) marked if required as the criteria for equipment maintenance.(out of 144), 74 (51.4%) didn't know the kilo voltage of their intra-oral X-ray unit. Similar pattern for 146 participants was noticed in question on tube current; where majority were clueless. Position Indicating device (PID) available in the participant's work place was of cylindrical shape as reported by 140 (93.3%) participants. Variation in exposure time was not known by 40 (26.7%), Of all participants, positioning device for X-ray image receptor placement was used by only 34 (23%) of the 148 that answered. Digital CCD sensor for image receptor is used by majority of participants i.e 82 (54.7%). Out of 150 participant 80 (53.3%) said they stood behind a protective wall during exposure. 102 (68%) had thyroid collar or lead apron at their work place. Dosimetry for self X-ray exposure evaluation was employed by 100 (67.6%) of 148 participants only. Majority, 81 (54%) answered thyroid as the most important organ in radiation protection in dental radiology. 123 (82%) know that full-mouth causes more radiation exposure than one Panoramic radiograph. 105 (70%) are against X-ray exposure of a pregnant woman for a periapical radiograph, while 45 (30%) say it is not harmful. For question where it stated that the average exposure during an Intra oral periapical radiograph was less as compared to daily background radiation, 65 (43.3%) agreed. 96 (64%) of all participants agreed that radiation exposure following an Intra oral periapical radiograph (IOPAR) was harmless.

Received: Sept. 19, 2018**: Accepted**: Oct. 26, 2018
*Correspondence Dr. Harleen Bali.
Department of Oral Medicine and Radiology, Universal College of Medical Sciences and Teaching Hospital, Bhairahawa, Nepal.
Email: harleen_bali@yahoo.com

pISSN 2278-0076
eISSN 2321-9270

Conclusions: The implementation of standards of quality care for radiography and radiation protection could be improved among North Indian dentists. An elaborate educational programme in dental radiography is a prerequisite. Furthermore, a need to make the knowledge of basic radiography equipment a must before installation, in order to make the most out of it.

Keywords: Awareness, radiation protection, dentistry.

INTRODUCTION

After the invention of X-rays by Wilhem Roentgen in Germany, way back in 1895; radiology has become a vital branch of medicine and dentistry, thereby leading to advancement in dental radiography equipments.[1] With each passing year the use of these ionizing radiations for diagnosis, treatment planning, and follow up is seen to increase dramatically.[1,2]

Because of the known fact regarding the adverse effects of the radiations it becomes important to assess its potential benefits over the detrimental effects it has on professionals performing the radiographic examinations as well as on the patients.[3] Numerous protection guidelines have been set by different organizations worldwide and clinical trainings are given to dental students as a part of their academic curriculum for educating them towards the radiation hazards and the risks-reduction methods.[4] Throughout the world, studies are being conducted on regular basis to evaluate the risk/benefit equation of these ionizing radiations.

Though with the developing techniques considerable reduction in radiation doses has been achieved, despite this, there is negligence seen on part of the professionals when it comes to application of their knowledge and following the policies to keep a check and reduce the adverse health effects from the radiations.[5]

With an aim to investigate the dental health professionals of north India regarding their knowledge about the various radiation dose reduction techniques, radiographic equipments and their quality maintenance, safety measures employed for patient as well as radiographer and general awareness of dental X- ray exposure level; we conducted this survey.

MATERIALS AND METHODS

An online questionnaire (English) (Annexure 1) adapted from Jacob et al[15], Shahab et al[7] and Furmaniak et al[3] was distributed among 450 dental community members via Google forms online/social media platforms and in person. The subjects were randomly selected to obtain an even geographical distribution throughout the North Indian Subcontinent. It was an anonymous questionnaire survey comprising 30 questions (Figure 1). To prepare the questionnaire, a review of the literature was performed and the variables were determined. The dentists' were informed about the anonymous processing of the questionnaires. A total of 150 dentists responded to this survey in 2018. This was done to evaluate their primary knowledge about the radiation protection, selection criteria for advising radiographs to patients, radiographic equipment and techniques best suited for patient's safety and reduced exposure along with method of patient and personnel protection.

Present survey's questionnaire included questions based on education in the field, experience in the field, years of using/advising radiograph, their knowledge and the use of intraoral radiography (equipment, technique, frequency of use and radiation protection). Information was obtained on the type of image receptor (analogue or digital), exposure settings, presence and composition of shielding wall and distance from the radiation source that they maintained. The data was compiled using excel sheet and analyzed.

RESULT

The result thus obtained was divided into the following categories:

Demographic

Result showed out of 150 filled forms (online and by hand) received, 84 were female (56%) and 66 were males (44%). Majority i.e. 98 (65.3%) of the participants, belonged to the age group of 25-29 years, 44 (29.3%) belonged to 30-35 years age group and very few (8) were above the age of

35(graph 1). Post graduates dominated the study group with 57.3% i.e 86, followed by graduates at 22.7% (34) and undergraduates at 17.3% (26). Rest (4) were PhD. Less than two years of work experience was held by 42 (28%) participants in dental practice, 40 (26.7%) had an experience of 2-5 years, 14 (9.3%) had 5-10 years experience, 18(12%) and 16 (10.7%) were postgraduate and undergraduate respectively(graph 2). Our study had 74 out of 140 dentist license holders working as specialists in their filed while 69 did general practice (graph 3). 76 (50.7%) professionals participating in the study had clinic, 16 (10.7%) worked in some institute while 16 (10.7%) worked at both places while 28 (18.7%) were still studying (graph 4).

Clinical Attitude toward radiation reduction

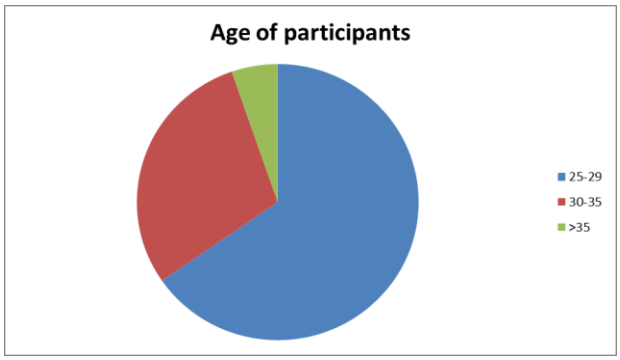
When asked about prescription of radiograph to a new adult patient 76 (50.7%) answered advising periapical radiographs only and 12 (8%) prescribed panoramic only. 48 (32%) used both panoramic and periapical at first visit while 14 (9.3%) do not rely on radiographs for diagnosis. The results were similar in case of their advising of periapical radiographs to paediatric patients, i.e. 80 (53.3%), while double number of participants comparatively advised panoramic or none in children i.e. 24 (16%) and 28 (18.7%) respectively. Here very few i.e. 18 (12%) advised both (graph 5). When asked how many radiographs were advised by them approximately on a monthly basis, 48 (32%) answered in the range of 40-80, 30 (20%) said 40, while 32 (21.3%) were advising below 40, 26 (17.3%) were in the range of 80-160.

Knowledge of equipment and accessories

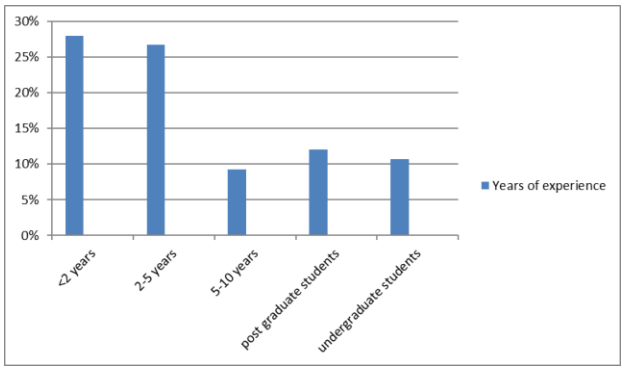
Of the 146 who filled the answer to maintenance of X ray equipment in their work place, 58 (39.7%) marked if required as the criteria for equipment maintenance, while 32 (21.9%) reported no check up at all (graph 6). 40 (27.4%) and 16 (11%) said to have check up of X-ray equipment once and twice a year respectively. Majority (out of 144), 74 (51.4%) didn't know the kilo voltage of their intra-oral X-ray unit. 31(21.5%) marked 65-70 kVp. Similar pattern for 146 participants was noticed in question on tube current; where majority were clueless i.e. 70 (47.9%). 46 (31.5%) said their work place intra-oral X-ray equipment used 10 mA, 24 (16.4%) said 10-12 mA. Position Indicating device (PID) available in the participant's work place was of cylindrical shape as reported by 140 (93.3%) participants. Only 4 used rectangular PID (graph 7). On the question where the exposure time of their work place intraoral radiography was asked, only 120 participated and a variety in answers was seen, indicating that it was not clear to the participant whether exposure time was asked in seconds or as mAs (current in milli amperes * second) was asked. Despite the confusion majority of who answered were clueless and wrote between 1-15 second range. Variation in exposure time was not known by 40 (26.7%), rest (110) knew one could change the exposure time of intra- oral X-ray unit. Among those 110, 31 (28%) said exposure time is altered depending on the place of interest for X-ray exposure, film speed, patient type and kVp of the equipment, while 29 (26.4%) believed it depended upon only the place of interest, 28 (25.5%) gave kVp of the machine credit. Of all participants, positioning device for X-ray image receptor placement was used by only 34 (23%) of the 148 that answered, 62 (41.3%) made patient hold the radiograph in place themselves, while 52 (34.7%) did it themselves (graph 8). Digital CCD sensor for image receptor is used by majority of participants i.e 82 (54.7%) out of 150. 52 (34.7 %) still use conventional film and rest use digital phosphor plate (graph 9).

Other radiation protection measures

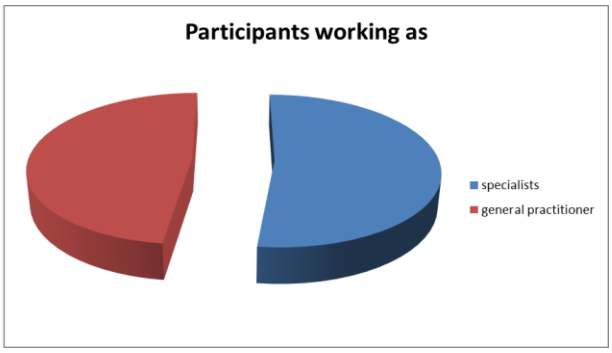
48 (32%) stood in B,C,G,H position as per figure (question 20, annexure 1) in questionnaire wherein 42 (28%) preferred E position when taking radiograph of the patient. Out of 150 participant 80 (53.3%) said they stood behind a protective wall during exposure, rest did not do so. Out of 144, 50 (34.7%) maintained a safe distance of at least 6 feet from the patient, 48 (33.3%) wear lead apron, 30 (20.8%) use lower exposure setting, 4 (2.8%) did nothing to avoid direct exposure (graph 10). 102 (68%) had thyroid collar or lead apron at their work place, while 48 (32%) didn't (graph 11). The X-ray room at work place of 100 (66.7%) did not have a protective layer of lead paint to prevent stop X-rays, only 50 (33.3%) had it. Dosimetry for self X-ray exposure evaluation was employed by 100 (67.6%) of 148 participants only (graph 12).



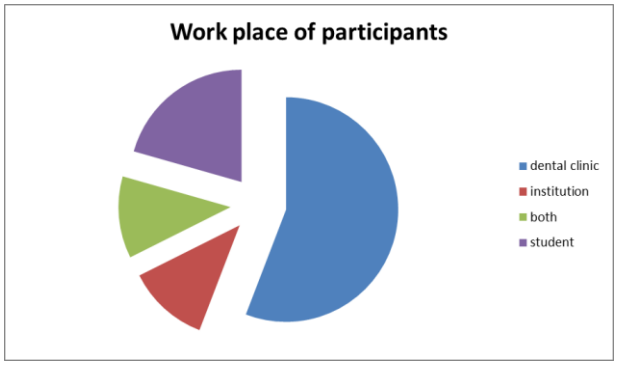
Graph 1: Age of participants in the study.



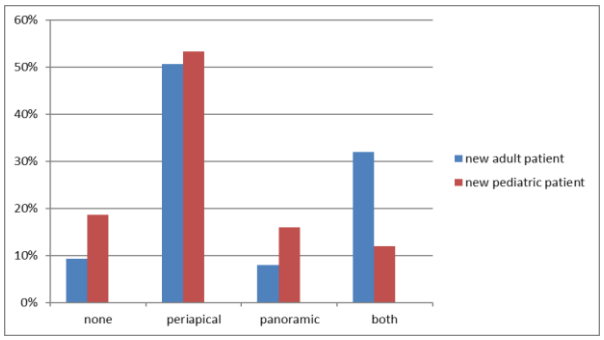
Graph 2: Years of experience in dental practice.



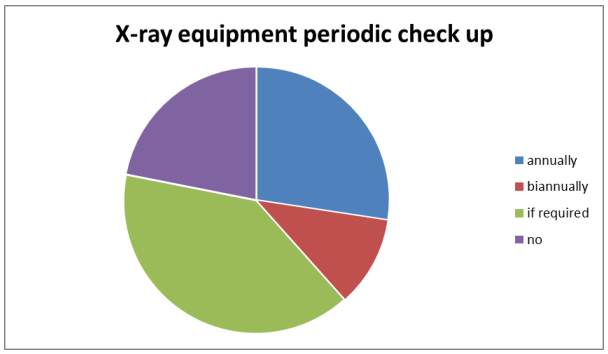
Graph 3: Percentage of participants in the study who worked as.



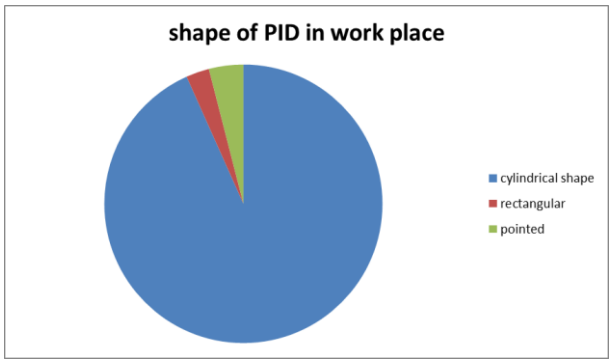
Graph 4: Percentage of participants in the study who worked in.



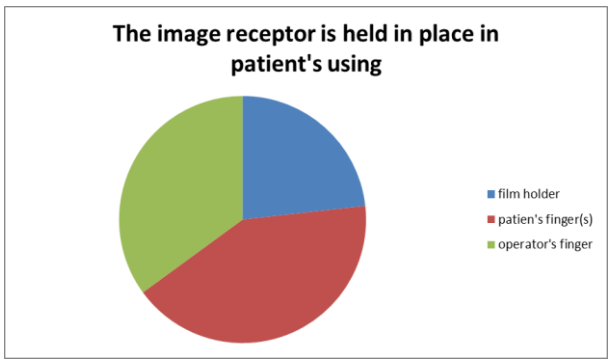
Graph 5: Radiograph prescribed at adult/pediatric patient`s first visit.



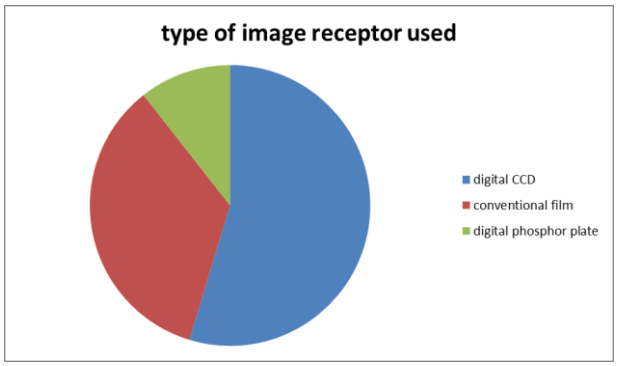
Graph 6: Periodic check of the x-ray equipment.



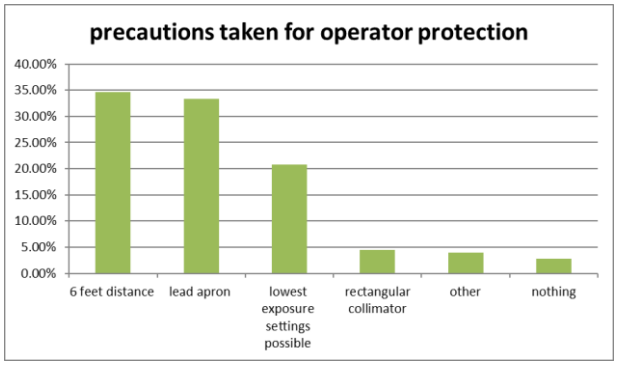
Graph 7: Shape of position indicating device.



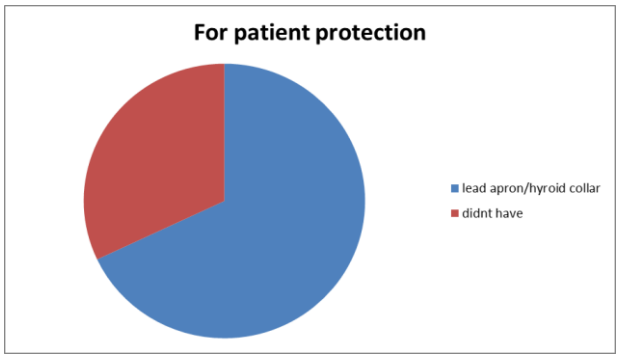
Graph 8: how is image receptor held in patient's mouth.



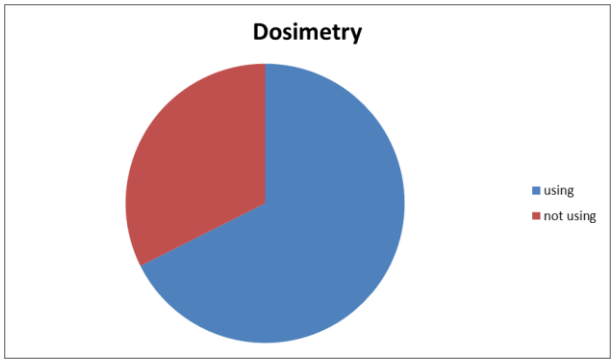
Graph 9: Type of image receptor used/advised radiograph on.



Graph 10: Precautions taken for operator protection.



Graph 11: Lead apron or thyroid collar use.



Graph 12: Use of dosimetry.

General X-ray awareness

Majority, 81 (54%) answered thyroid as the most important organ in radiation protection in dental radiology. 36 (24%) said it was Gonads, while 28 (18.7%) marked Bone marrow in questionnaire. 123 (82%) know that full-mouth causes more radiation exposure than one Panoramic radiograph. 105(70%) are against X-ray exposure of a pregnant woman for a periapical radiograph, while 45 (30%) say it is not harmful. For question where it stated that the average exposure during an Intra oral periapical radiograph was less as compared to daily background radiation, 65(43.3%) agreed, 85(57%) did not. 96(64%) of all participants agreed that radiation exposure following an Intra oral periapical radiograph (IOPAR) was harmless (graph 13).

DISCUSSION

Practitioners who administer ionizing radiation must become familiar with the magnitude of radiation exposure encountered in medicine and dentistry, the possible risk that such exposure entails, and the methods used to affect exposure and dose reduction. This information provides the necessary background for explaining to the concerned patients regarding the benefits and possible hazards involved with the use of x rays.[6]

Hence, the present study was conducted to the explore various issues related to radiation protection in Indian dental practice comprehensively and simultaneously in the dental practitioners. It assessed Indian dental practitioners' knowledge, attitudes, practices, perception about radiation hazards and protection. The study also aimed at evaluating the effects of the aforementioned variables and the influence of socio-demographic factors.

To effectively control and prevent radiation-induced hazards, it is essential to understand the effects of ionizing radiation on the health of an individual. These questions represent the knowledge domain of radiation protection, and studies which address the same have been reported in the literature. Various researchers [5,7,8,9,10,11,12] have reported a lack of knowledge of dental practitioners towards radiation hazards and protection. [1]

Questionnaire

1. Gender
a) Male
b) Female
2. Age
a) 25-29 years
b) 30-35 years
c) >35 years
3. Level of education in the dental field
a) undergraduate
b) graduate
c) post graduate
d) Ph.D
4. Years of experience in dental practice
a) <2 y
b) 2–5 y
c) undergraduate student
d) postgraduate student
e) 5-10 years
f) > 10 years
g) other

5. Do you work as a:
a) general practitioner
b) specialist
6. Do you work in a
a) clinic
b) dental school as a faculty member
c) both
d) student
e) Other
7. Which radiograph do you prescribe to a new adult patient?
a) None
b) Periapical
c) Panoramic
d) Both
8. Which radiograph do you prescribe to a new pediatric patient?
a) None
b) Periapical
c) Panoramic
d) Both
9. How many intraoral radiographs do you advise / take monthly?
a) 40
b) 40–80
c) 80–160
d) 160–240
e) >240
f) < 40
10. Do you have periodic check up for your X-ray equipment?
a) annually
b) biannually
c) if required
d) no
11.What is the kilovoltage of your intraoral radiographic equipment?
a) Don't Know
b) 45–55 kVp
c) 56–64 kVp
d) 65–70 kVp
e) 71–80 kVp
f) >81 kVp
12.What is the tube current of your intraoral radiographic equipment?
a) Don't Know
b) 10 mA
c) 10–12 mA
d) >12 mA
e) Don't have
13.What shape does the Position Indicating Device of your intraoral radiographic equipment have?
a) cylindrical
b) pointed
c) rectangular
14. What is the average exposure time for intraoral radiographs that u use in your work place ?

_____

15. Does the exposure time vary?
a) No
b) Yes
16. If Yes
a) depending on place of interest
b) film speed
c) patient type
d) kV of equipment
e) all of the above
17. How is the radiographic film/sensor positioned during exposure?
a) film holder
b) Patient's finger(s)
c)Operators's finger(s)
18. Which type of radiographic receptor do you use/ advice radiograph on ?
a) Conventional film
b) digital storage phosphor plate
c) digital CCD-sensor
19. Where do you stand during intra-oral exposure ?
a) varying position according to direction of radiation tube
b) fixed position

20) Which position (your position as per the diagram below) is recommended

a) A
b) B
c) C
d) D
e) E
f) F
g) G
h) H
21. Do you stand behind the protective wall during exposure?
a) yes
b) no
22. Do you take other precautions to protect yourself from radiation during exposure ?
a) I keep a 6 feet distance from the patient
b) I wear a lead apron
c) I use the lowest exposure settings possible
d) I use a rectangular collimator
e) other
23. Is there a lead apron or thyroid collar in your work place
a) yes
b) no
24. Are the walls of x-ray room covered with lead
a) yes
b) no
25. Do use TLD Badge or dosimetry ?
a) yes
b) no
26. What in your knowledge is the most important organ in radiation protection in dental radiography?
a) gonads
b) bone marrow
c) thyroid
d) skin
27. In your opinion , which of the following radiographic techniques delivers more radiation to the patient
a) panoramic
b) full mouth
28. One can take any periapical radiograph of a pregnant woman ?
a) true
b) false
29. The average dose from periapical radiography is lower or comparable with daily background radiation dose
a) true
b) false
30. Radiation dose associated with one periapical radiograph is absolutely safe and has no impact on health
a) true
b) false

Svenson et al [10,14] reported an association of knowledge with educational status, and duration and type of practice. Ezoddini Ardakani and Sarayesh[13] concluded that specialist dentists were more knowledgeable than general dentists. Our study had 74 out of 140 dentist license holders working as specialists in their field while 69 did general practice.

Razi et al[9] reported an inverse correlation of knowledge with the age of their study subjects, but found no association between knowledge and duration of practice. In our study majority i.e. 98 (65.3%) of the participants, belonged to the age group of 25-29 years. Less than two years of work experience was held by 42 (28%) participants in dental practice, 40 (26.7%) had an experience of 2-5 years. Further studies are essential to explore the role of socio-demographic variables on various aspects of radiation protection.[1]

When analyzing the exposure parameters of the intraoral radiographic equipment, it was found that most dentists used kV/kVp settings between 65 kV/kVp and 70 kV/kVp, which is in accordance with the guidelines.[1] Jacobs R et al[15] found a significantly negative correlation between age and kV/kVp setting. This might be related to the general evolution in dental radiographic equipment, striving for higher kV/kVp equipment to obtain a balance between image contrast and radiation protection. In contrast, older dentists still seemed to use their original old radiographic equipment.[15]

In our study 48 (32%) advised 40-80 radiographs approximately on a monthly basis, 30 (20%) said 40. While 32 (21.3%) were advising below 40, 26 (17.3%) were in the range of 80-160. To adhere to ALARA principles (as low as reasonably achievable) it is very important to avoid ordering unnecessary radiographs. The Dental Patient Selection Criteria Panel, established by the Center for Devices and Radiological Health of the Food and Drug Administration, was assigned the responsibility of formulating selection criteria for oral radiography. When used in ordering radiographs for caries detection, these guidelines have been found to result in 43% fewer radiographs being made while missing what was felt to be an insignificant number of lesions (3.3%). Additionally, when these guidelines were used, the number of missed intraosseous and other dental conditions was considered inconsequential, given the range of variability among clinicians in diagnosis and treatment. In spite of these findings, only a little more than a third of dentists chose to prescribe selectively according to the patient's needs.[6]

Our study showed that the selected periapical radiographs were the dominant initial radiographs taken or ordered by the dentists. This may be beneficial for the patients exposed to radiation, but many incipient and occult conditions of the teeth and jawbones might thus remain undetected. Our findings were contrary to the study done by Tugnait et al[16], who reported that 61% of general dental practicioners used panoramic equipment routinely in England and Wales. Kaugars et al[17] in their study determined that at least 60% of the respondents had panoramic machines in Virginia and Florida. [5]

To ensure the optimum exposure conditions, quality assurance of the radiographic system should be performed. One of the basic steps of quality assurance is X-ray machine maintenance, and regular check-ups of the equipment are a necessity.[6] Regulations in the AERB (Atomic Energy Regulatory Board),Govt. of India, for dental X-ray equipment requires periodic quality assurance to be carried out at least once in 2 years and after any repairs having radiation safety implications to maintain their license to practice. Despite this fact, our study showed that 58 (39.7%) of the 146 Indian dentists perform check-ups of their X-ray machines only if required, while 32 (21.9%) reported no check up at all.

Knowledge of any equipment or instrument is necessary in order to be able to put it into better use and at the same time be mindful of consequences. However in the present study majority (out of 144), 74 (51.4%) didn't know the kilo voltage of their intra-oral X-ray unit, while out of 146 participants 70 (47.9%) were clueless regarding the tube current.

Although rectangular collimation of the radiation beam to limit the exposure area is recommended only 4 used rectangular PID as reported by our study. Position Indicating Device (PID) available in the majority participant's work place was of cylindrical shape as reported by 140 (93.3%) participants. Even the Damascus survey[18] showed a

total absence of the use of rectangular collimation among their responders.[15] Restricting the X-ray beam to the receptor area can prevent unnecessary patient exposure.[5,6,15] Rectangular collimation ensures that the emitted X-ray is slightly larger than the receptor area. By replacing the round collimation with rectangular collimation, the effective dose will be reduced by almost 60%. The results of our study are similar to the findings in Belgium (6%),[15] Turkey (5.5%)[15] and Canada (8%).[19]

Higher use of round collimation were reported in Sweden (36%).[20] The low rate of rectangular collimation use may be attributed to the low rate of film positioning devices used (23% in our research) as well as the concern of cone cutting.

Of the three technical conditions (tube voltage, filtration, and exposure time), exposure time has been shown to be the most crucial factor in influencing diagnostic quality. In terms of exposure, the optimal image quality means that the radiograph is of diagnostic density, neither overexposed (too dark) nor underexposed (too light). Both overexposed and underexposed radiographs result in repeat exposures, thereby leading to needless additional patient exposure. Image density is controlled by the quantity of x-rays produced, which in turn is best controlled by the combination of milliamperage and exposure time, termed milliampere-second (mAs).[6] Selecting an appropriate exposure time is very important in minimizing patients' radiation exposure. In our study despite the confusion majority who answered were unaware regarding the correct parameters for an intra oral radiograph X-ray machine.

Variation in exposure time was not known by 40 (26.7%), rest (110) knew one could change the exposure time of intra- oral X-ray unit. Among 110, only 31 (28%) said exposure time is altered depending on place of interest for X-ray exposure, film speed, patient type and kVp of the equipment. These results show that the dentists in the present study do not consider the optimum exposure time for periapical radiographs. Shahab S et al[7] observed this may be owing to several factors such as using old and exhausted processing solutions and compensatory overexposure, underdevelopment of overexposed film, factory pre-setting of some X-ray timers that are based on slower film speeds, dentists' own experience with slower films and not upgrading to new faster film exposure settings.

Of all participants, positioning device for X-ray image receptor placement was used by only 34 (23%) of the 148 that answered. The fact that aiming devices were never used by 77% (114) of the dentists deserves some attention. This number is comparable with the results of recent surveys among dentists in England and Wales[16] and Syria,[18] where, respectively, 37% and 43% of the responders used film holders. Even more important was the relatively large percentage (34.7%) of dentists who hold the film inside the patient's mouth while exposing, thereby not standing at a safe distance, subjecting oneself to unnecessary secondary radiation. This directs to a general underestimation of the potential risks of radiation exposure.

Digital CCD sensor for image receptor is used by majority of participants i.e 82 (54.7%) out of 150. The difference in exposure time between analogue (0.4 s) and digital receptors (0.22 s) was comparable with a Norwegian questionnaire, where a reduction in exposure time of 55% was found.[21]

Dental operatories should be designed and constructed to meet the minimal shielding requirement of the NCRP (National Council on Radiation Protection and Measurements, USA.). This recommendation states that walls must be of sufficient density or thickness that the exposure to non-occupationally exposed individuals (e.g., someone occupying an adjacent office) is no greater than 100 J/Gy per week. In most instances, it is not necessary to line the walls with lead to meet this requirement.[6] As noticed in our study, the X-ray room in participant's work place did not have protective layer of lead paint to prevent/stop X-rays in case of 100 (66.7%) participants.

Walls constructed of gypsum wallboard (drywall or sheet rock) have been found to be adequate for the average dental office. In our study, out of 150 participant 80 (53.3%) said they stood behind a protective wall during exposure. Unless protective shielding is provided for the operator, the installation (operatory) should be so arranged so that the operator can stand at least six feet from the patient and in a location that is not in the path of the

x-ray beam during exposure.[6] We found out of 144, 50 (34.7%) maintained a safe distance of at least 6 feet from the patient, 48 (33.3%) wear lead apron, 30 (20.8%) use lower exposure setting, 4 (2.8%) did nothing to avoid direct exposure.

The position of the practitioner to the radiation tube and the patient is in most cases determined by physical constraints of the design of the dental office. If leaving the room or making use of some other barrier is impossible, strict adherence to what has been termed the position-and-distance rule is required: The operator should stand at least 6 feet from the patient, at an angle of 90 to 135 degrees to the central ray of the x-ray beam.[6] In our study 48 (32%) followed 90 to 135 degree position when taking radiograph of the patient. When applied, this rule not only takes advantage of the inverse square law to reduce x-ray intensity but also considers that in this position most scatter radiation is absorbed by the patient's head.[6]

Radiosensitive target organs commonly reported include bone marrow, thyroid gland, and gonads. Current data show that the mean exposure at skin entrance for a single dental periapical film is 217mR. The proximity of the thyroid gland to the x-ray beam is of crucial importance as during Intra-oral radiographic examination, the thyroid gland is almost directly in the center of the radiation field. The ADA strongly recommends Leaded thyroid collars.[6] In our study, 102 (68%) had thyroid collar or lead apron at their work place, while 48 (32%) didn't. Majority of participants in our study i.e. 81 (54%) answered thyroid as the most important organ in radiation protection in dental radiology. 36 (24%) said it was Gonads, while 28 (18.7%) marked Bone marrow in questionnaire. One should know, that though thyroid is in the direct line of exposure still the dose to the thyroid from oral radiography is fairly low. A 21-film complete mouth examination results in a thyroid dose of 0.94mGy, one sixth of that resulting from a radiographic examination of the cervical spine. Likewise, the thyroid dose from panoramic radiography is about 0.074mGy, 1% that from a cervical spinal examination.[6]

Although scatter radiation to the patient's abdomen is extremely low, leaded aprons should be used to minimize patient's exposure to radiation. The gonad dose resulting from oral radiography is minimal. Leaded aprons are useful because they attenuate as much as 98% of the scatter radiation to the gonads. Similarly, thyroid shields reduce the exposure of this gland by as much as 92%. No difficulty, great expense, or inconvenience is encountered with their use; instead, using them demonstrates a real concern for the welfare of the patient. However, use of fast film and rectangular collimation are far more important means of protecting the patient.[6]

The best way to ensure that personnel are following office safety rules such as those described previously is with personnel-monitoring devices. Commonly referred to as film badges, these devices provide a useful record of occupational exposure. Their use is not only recommended but also required by law in certain states. For a reasonable charge, these services provide badges that contain either a piece of sensitive film or a radiosensitive crystal (thermoluminescent dosimeter) and a printed report of accumulated exposure at regular intervals. These reports indicate any undesirable change in work habits and help remove any apprehension office staff members may have about the possibility of exposure to x rays.[6] Dosimetry for self X-ray exposure evaluation was employed by 100 (67.6%) of 148 participants in our study.

123 (82%) participants in our study know that full-mouth cause more radiation exposure than one Panoramic radiograph. Effective dose from panoramic radiography is 9-24μSv; while full mouth using CCD sensor with round collimation is 85μSv.[6]

Although a fetus is sensitive to ionizing radiation, the amount of exposure received by an embryo or fetus during dental radiography (esp. single IOPA radiograph) is extremely low. No incidences have been reported of damage to a fetus from dental radiography. Regardless, prudence suggests that such radiographic examinations be kept to a minimum consistent with the mother's dental needs. As with any patient, radiographic examination is limited during pregnancy to cases with a specific diagnostic indication. With the low patient dose afforded by use of optimal radiation safety techniques, an intraoral or extraoral examination can be performed whenever a reasonable diagnostic requirement exists.[6] This awareness is not shown by the present study results wherein 105(70%) are against X-ray exposure of a

pregnant woman for a periapical radiograph, while only 45 (30%) said it is not harmful. The possible negative consequences of this include abandoning radiological diagnostics for patients who are pregnant, even when the benefits outweigh the risk. Another much less likely but possible consequence is denial of performing prescribed examinations for patients who are pregnant by radiographers.[3]

For question where it stated that the average exposure during an Intra oral periapical radiograph was less as compared to daily background radiation, 65(43.3%) agreed, 85(57%) did not, though 96(64%) of all participants agreed that radiation exposure following on Intra oral periapical radiograph was harmless.Though one IOPA radiograph causes radiation exposure less than daily background radiation. Disregard for radiation risk may lead to excessive number of unnecessarily prescribed or repeated periapical radiographs.[3]

CONCLUSION

Our study had majority of Dental Personnel working as specialists and postgraduates in their field, still the practice concerning radiation protection and safety lacked in places, the improvement of which can better the usage of radiation equipment, accessories to reduce radiation exposure. The study suggests that practicing dentists need to be enticed and encouraged to conform to the rules of protection from X-rays. Protection of one's self and patient from all kinds of health hazards is the hallmark of concerned doctors. An elaborate undergraduate radiation education programme may strive towards a future generation of “radiation protection minded” dentists. The AERB recommendations should reach out through the dentists’ platform (e.g., IDA) and radiography equipment installing companies to the dental practitioner. Continuous Professional Development Programs (CPD) should be held and attended in this regard.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

REFRENCES

1) Binnal A, Rajesh G, Denny C, ahmed J, Nayak N. Insights into the state of radiation protection among a subpopulation of Indian dental practitioners. Imaging Science dentistry. 2013;43:253-9.

2) Gibbs SJ. Biological effects of radiation from dental radiography. Council on Dental materials, Instruments, and Equipment. J AM Den Assoc 1982;105:275-81.

3) Furmainak KZ, Kelodziejska MA, Szopinski KT. Radiation awareness among dentists, radiographers and students. Dentomaxillofac Radiol 2016;45:1-5.

4) Garg D, Kapoor D. Awareness level of Radiation protection among dental students. J Nepal Med Assoc. 2018;56(212):800-3.

5) Iiguy D, Iiguuy D, Dincer D and Bayirli D. Survey of dental radiological practice in Turkey. Dentomaxillofacial Radiology. 2005;34:222-227.

6) White SC, Pharoah MJ. Oral radiology principles and interpretation (6th edn). St Louis, MO: Mosby 2009.

7) Shahab S, Kavosi A, Nazarinia H, Mehralizadeh S, Mohammadpour M, Emami M. Compliance of Iranian dentists with safety standards of oral radiology. Dentomaxillofac Radiol. 2012; 41: 159-64.

8) Aps JK. Flemish general dental practitioners’ knowledge of dental radiology. Dentomaxillofac Radiol. 2010; 39: 113-8.

9) 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.

10) Svenson B, Söderfeldt B, Gröndahl H. Knowledge of oral radiology among Swedish dentists. Dentomaxillofac Radiol. 1997; 26: 219-24.

11) Mutyabule TK, Whaites EJ. Survey of radiography and radiation protection in general dental practice in Uganda. Dentomaxillofac Radiol 2002; 31: 164-9.

12) De Melo Mde F, Melo SL. Radioprotection in dentistry offices. Cien Saude Colet. 2008; 13 Suppl 2: 2163-70.

13) Ezoddini Ardakani F, Sarayesh V. Knowledge of correct prescription of radiographs among dentists in Yazd, Iran. J Dent Res Dent Clin Dent Prospects. 2008; 2: 95-8.

14) Svenson B, Gröndahl HG, Söderfeldt B. A logistic regression model for analyzing the relation between dentists' attitudes, behavior, and knowledge in oral radiology. Acta Odontol Scand. 1998; 56: 215-9.

15) Jacobs R, Vanderstappen M, Bogaerts R, Gijbels F. Attitude of the Belgian dentist population towards radiation protection. Dentomaxillofac Radiol. 2004; 33: 334–339.

16) Tugnait A, Clerehugh DV, Hirschmann PN. Radiographic equipment and techniques used in general dental practice. A survey of general dental practitioners in England and Wales. J Dent. 2003; 31: 197–203.

17) Kaugars GE, Broga DW, Collett WK. Dental radiologic survey of Virginia and Florida. Oral Surg Oral Med Oral Pathol. 1985; 60:225–229.

18) Salti L, Whaites EJ. Survey of dental radiographic services in private dental clinics in Damascus, Syria. Dentomaxillofac Radiol. 2002; 31:100–105.

19) Bohay RN, Kogon SL, Stephens RG. A survey of radiographic techniques and equipment used by a sample of general dental practitioners. Oral Surg Oral Med Oral Pathol Oral Radiol Endod.1994; 78: 806–810.

20) Svenson B, Petersson A. Questionnaire survey on the use of dental X-ray film and equipment among general practitioners in the Swedish Public Dental Health Service. Acta Odontol Scand.1995; 53: 230–235.

21) Wenzel A, Møystad A. Experience of Norwegian general dental practitioners with solid state and storage phosphor detectors. Dentomaxillofac Radiol. 2001; 30: 203–208.