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ORIGINAL ARTICLE

Assessment awareness and perception of dental practitioner toward radiation protection protocols

Smita R Priyadarshini[1], Satya Ranjan Misra[2], Swati Patnaik[3] K Laxmi Sushmita[4], Rupsa Das[4]
[1]Associate Professor, [2]Prof & Head, [4]Post Graduate Trainee Department of Oral Medicine & Radiology,
[3]Associate Professor, Department of Public Health Dentistry
Institute of Dental Sciences, Siksha O Anusandhan (Deemed to be University) Bhubaneswar 751003
Corresponding author: Dr K Laxmi Sushmita; Email: sushmitakoduru@gmail.com

ABSTRACT

Radiation has a pivotal role in therapeutic and diagnostic radiography. Acknowledgement of the positive and negative effects of radiation as well as the hazards involved must be addressed with the improvement of radiation protection practices and guidelines. To determine the awareness about radiation protection in daily practice and the protection of the operator & patient while exposing radiographs. This preliminary survey was conducted among dental practitioners. A modified 20 item questionnaire was prepared, distributed and 144 validated entries were collected. Data were entered into Microsoft Excel 2007 and analyzed in SPSS V20. Associations between categorical variables were determined using Levene's test. **P** *< 0.05 was considered statistically significant. The majority of the participants were aware of the cumulative effects of radiation (95.8%) & sufficient awareness about radiation protection but when radiation protection of the operator was evaluated it was comparatively less to the protection of the patient. Thus, regular training about radiation effects and protection should be provided to the practitioners. Improved awareness of the radiation protection of the operator should be emphasized.*

Keywords*: Ionising Radiation, Radiation Protection, Risk assessment, ALARA, TLDs*

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INTRODUCTION

X rays are invisible to our naked eye but their detrimental effects are experienced. Radiological investigations are the prime necessity in the diagnosis and treatment of the disease in the oral maxillofacial region, nonetheless, the harmful effects cannot be ignored. [1]

There are certain principles of radiation protection like:

- Principle of justification: This emphasizes that one should only go for the radiological investigation of a patient only when the benefit outweighs the harmful effects.
- Principle of optimization: ALARA (as low as reasonably achievable) which is changed to ALADA (As low as diagnostically achievable) should be practised.
- Principle of dose limitation: One must not exceed the limits recommended by ICRP (international commission on radiological presentation) and NCRP (national council on radiation protection and measurement).

Radiation protection is pivotal as any radiographic examination will lead to exposure of the patient to millions of radiations. These have the potential to damage any molecule of the body by ionization, leading to irreversible DNA mutations. [2]

All specialities like Endodontics, Implantology, Oral surgery frequently require intraoral, extra-oral radiographs to carry out any procedure. Lack of quality assurance programs as far as the radiographs are concerned leads to the implementation of necessary radiation protection protocols while practising radiologic examination. In a deterministic effect, the symptoms are seen in a patient when the exposure that is made is above the threshold level. Different cells and tissues have varied sensitivity whose features

appear in a similar process. Highly sensitive cells are spermatogonia and erythroblasts as they are rapidly dividing, and the least sensitive is nerve cells and muscle fibres.[3]
Radiation hazard like cancer is considered as stochastic effects which don't have a threshold level contrary to the deterministic effects. According to International Agency for Research on Cancer (IARC), average cumulative doses were 19.4 mSv, and less than 5% of workers received cumulative doses exceeding 100 mSv [4]. This study aims to determine the awareness of the principles of radiation protection in daily practice and knowledge of the proper protective actions to protect the operator & the patient during radiographic procedures

MATERIAL AND METHODS

This is a cross-sectional questionnaire-based survey that was executed among dental practitioners with valid registration to the dental council of India in Odisha. A 23-item anonymous questionnaire was developed by meticulously reviewing the literature that was peer-reviewed amongst the investigators. The questionnaire was modified to 20 items that were self-distributed among the study participants and filled 144 entries were collected after 1 week to the investigators. The sample size was selected based on the previous studies & keeping the power of the study as 80%. The Cronbach's alpha value for the questionnaire was found to be 0.8 and later modified accordingly to identify the lacunae. The questionnaire was categorized into four sections. Demographic details, general awareness, protection of the operator & protection of the patient. All procedures followed were following the ethical standards of the responsible committee on human experimentation and with the Helsinki Declaration of 1964 and later versions. The study was conducted in agreement with the ethical committee guidelines under Siksha O Anusandhan Deemed to be University (Ref.No/OMR/IMS.SH/SOA/180302).

Statistical analysis

Data were entered into Microsoft Excel 2007 and analyzed in SPSS version 18.0 (SPSS Inc., Chicago, USA). All the categorical variables were expressed in terms of numbers and percentages. Associations between categorical variables were determined using Chi-square or Fisher's exact test. $P < 0.05$ was considered statistically significant.

RESULT

Demographic Data

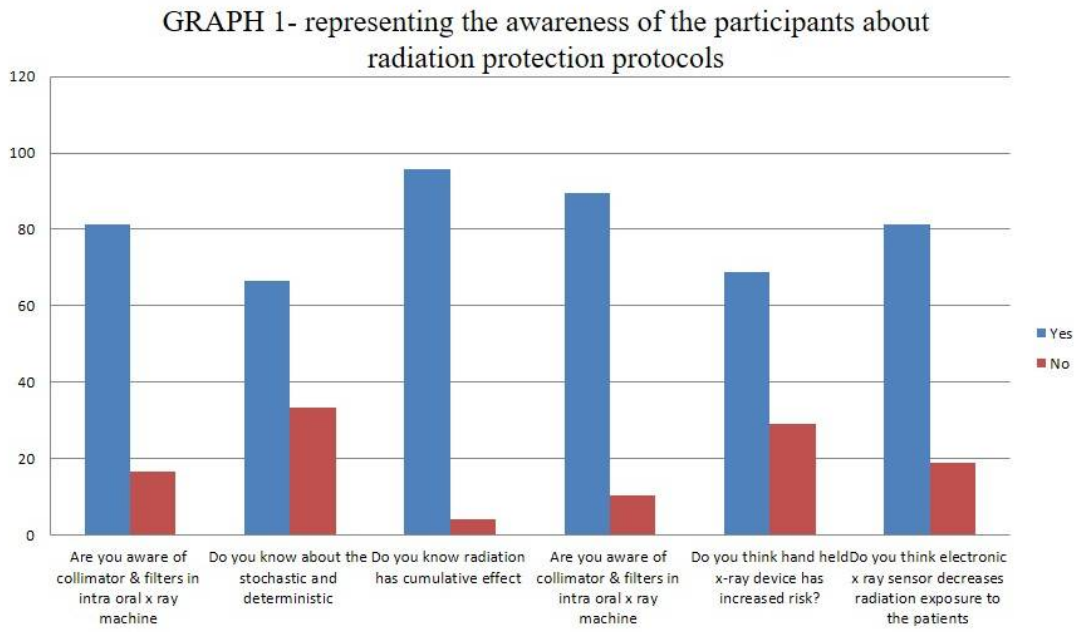
The participants included in the study were 144 of which the majority of the participants were under 40 years of age with the mean age being 32 years. More than 1/3rd of the participants were females (72.91%) with 70.8% with a bachelor's degree and the rest had a master's degree. The time passed since graduation and the work experience of the participants was similar &the majority had less than 5 years of experience (68.75%). [Table 1]

Table 1. Demographic data

Gender	Male	36(25%)
	Female	105(72.91%)
Educational Qualification	MDS	45 (31.25%)
	BDS	99(68.75%)
Time since graduation	Less than 5 years	96 (66.67%)
	More than 5 years	48 (33.3%)
Work Experience	Less than 5 years	99 (68.75%)
	More than 5 years	45(31.25%)

General awareness amongst dentists about radiation protection

Participants with the awareness about ALARA were 81.25% .66.6% of participants were aware of the stochastic and deterministic effects of radiation. 72.7% BDS and 27.2% MDS were aware of the harmful effects of radiation. The difference between the responses in the two groups was statistically significant (with $p<0.05$).
95.83% were aware of the cumulative effect of radiation and 89.53 % of the participants were familiar with the use of collimators and filters in the x-ray machine.
The majority of the participants thought handheld x-ray device has increased risk (68.8%) than the wall-mounted or portable x-ray machine & 81.25% responded digital electronic x-ray sensor decreases radiation exposure to the patients. [Graph 1]

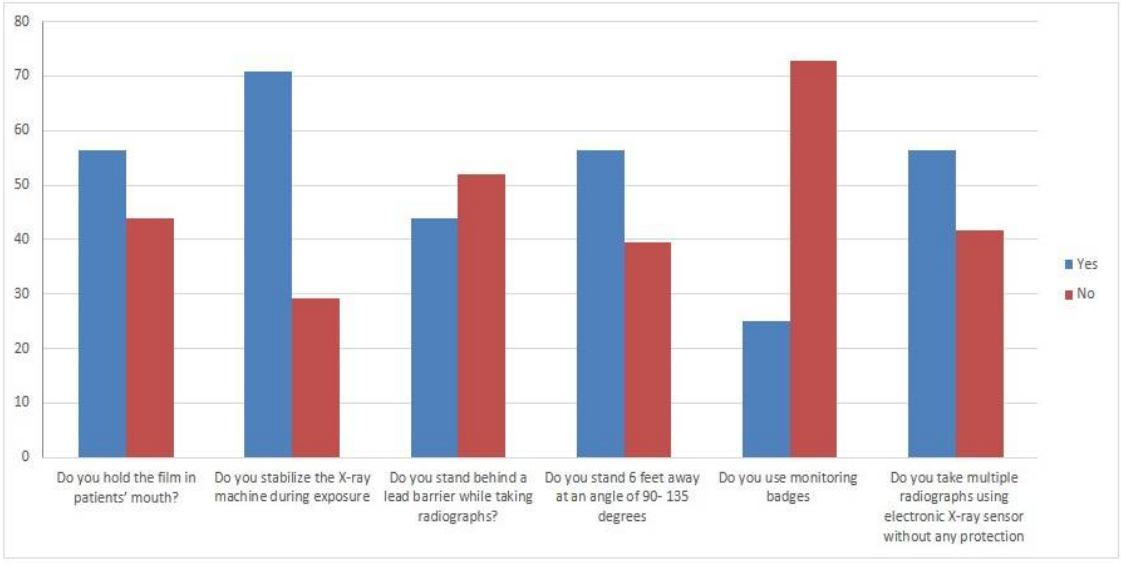


Graph 1: representing the awareness of the participants about radiation protection protocols.

Protection of operator

While exposing a radiograph participant who stabilized the film in patients' mouths were 56.3% and 70.8% stabilized the X-ray machine during exposure. Only 43.8% stood behind a lead barrier while taking radiographs with 56.3 % who abided by the 6 feet away at an angle of 90- 135 degrees rule. Monitoring badges were not used widely & 25.1% of participant agreed to usethem. 56.3% took multiple radiographs while using an electronic X-ray sensor without any protection. [Graph 2]

Graph 2-representing the practice of radiation protection protocols followed by the participants.



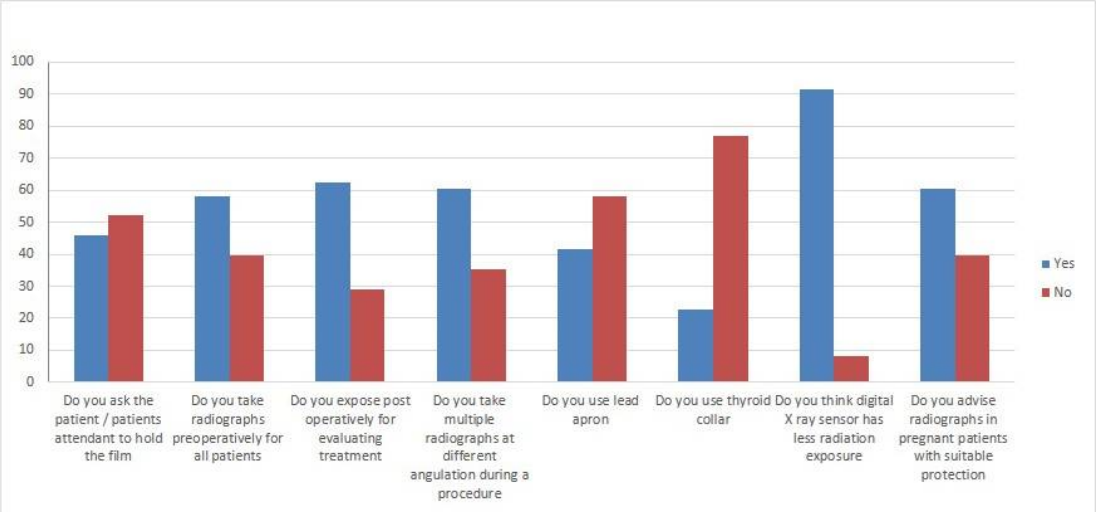
Graph2: Representing the practice of radiation protection protocols followed by the participants.

Protection of Patient

While taking a radiograph 45.8% asked the patient/patient attendant to hold the film. Maximum participants were advised for a pre-operative radiograph (58.3%) as well as a post-operative radiograph (62.5%). Multiple radiographs at varied angulation during a procedure (60.4%) were advised during a

procedure. Lead apron (41.7%) & thyroid collar (22.9%) was used minimally amongst the practitioners. [Graph 3]

Graph 3- representing the practice of radiation protection protocols followed by the participants.



Graph 3: Representing the practice of radiation protection protocols followed by the participants.

Protection of Patient

When the years of experience, as well as time since graduation was compared, in the years of experience section statistically significant value, was obtained for awareness on the cumulative effect, about whether they hold the film in patient's mouth, about use of collimators & filters in an intraoral x-ray machine. Even the operator holding an x-ray device along with the patient's attendant holding film had increased risk. The operator stabilizing x-ray machine, use of post-operative radiograph for evaluating treatment, & use of thyroid collars for patients had significant values in case of years of experience whereas in the time since graduation the statistically significant value is shown in [Table- 2].

Table 2: Significant values comparing time since education and years of experience

	Education				Time since graduation			
		Sign	Standard D	STAN. ERROR	time	Sig.	SD	SE
Do you tell patients regarding the possible harmful effects of diagnostic radiography?	MDS	0.001	0.505	0.075	<5years	0.003	0.452	0.046
	BDS		0.448	0.045	>5years		0.501	0.072
Do you know radiation has a cumulative effect?	MDS	0.00	0.344	0.051	<5years	0.00	0.243	0.025
	BDS		0.00	0.00	>5years		0.00	0.00
Are you aware of collimator & filters in an intraoral x-ray machine?	MDS	0.00	0.447	0.067		Not significant		
	BDS		0.172	0.017				
Do you think electronic x-ray sensor decreases radiation exposure to the patients?	MDS	0.002	0.447	0.067	<5years	0.004	0.416	0.042
	BDS		0.360	0.036	>5years		0.334	0.048
Do you hold the film in the patient's mouth?	MDS	0.001	0.477	0.071	<5years	0.00	0.503	0.051
	BDS		0.502	0.050	>5years		0.468	0.068
Do you stabilize the X-ray machine during exposure?	MDS	0.00	0.344	0.051		Not significant		
	BDS		0.483	0.049				
Do you ask the patient/patient attendant to hold the film?	MDS	0.001	0.447	0.067		Not significant		
	BDS		0.550	0.055				
Do you expose postoperatively for evaluating treatment?	MDS	0.002	0.688	0.102		Not significant		
	BDS		0.522	0.052				
					>5years		0.438	0.063
Do you use a thyroid collar?	MDS	0.000	0.252	0.038	<5years	0.002	0.392	0.040
	BDS		0.462	0.046	>5years		0.468	0.068
Do you think the digital X-ray sensor has less radiation exposure?	MDS	0.000	0.367	0.055	<5years	0.00	0.201	0.021
	BDS		0.240	0.024	>5years		0.394	0.057

DISCUSSION

This survey highlights the lack of knowledge about the principles of radiation protection among dentists. Protection methods are not meticulously practised among them. Assuming risk from dental radiography is minimal, however, it cannot be stated as non-existent. A radiograph should be exposed only when it justifies dental management and radiographic screening before the clinical examination is unreasonable. [3,4]The primary tissue of concern while using dental radiographs is the thyroid gland, as it is highly radiosensitive & anatomical location makes it susceptible to exposure. [5]

A knowledge, attitude, and practices conducted in a dental professional study group by Swedish dental practitioners concluded that there was greater awareness among 5 -25 years of experience as compared to those with fewer years of experience[5]. Also, professionals were more informed than graduates. Although professionals were aware of radiation protection protocols it was not followed properly in their dental practice. This was comparable to this study.

ICRP has implemented the hazard/profit concept &the ALARA principle must be followed.[6]Here 81.25% were aware of the ALARA principle which is the same asShah *et al*. who have reported a high of 98.6% and Prabhat *et al*. reported 84% know about ALARA.[7,8]

In comparison to Arnout and Jafar & Enabulele and Igbinedion reported a very low of 40% &17.9% awareness regarding the same similarly Wali et al. Monica P et al have reported 41.3% & 56.8% respectively[9,10, 12,13]

Sheikh et al reported that radiation protection practices in Indian dentists were substandard.[19] In our study, 56.25% of individuals followed the position and distance rule, 43.75%used lead aprons. 22.9% of participants have agreed that they use thyroid collar in their practice as compared to a study done by Math et al where none of the dental practitioners used thyroid collars,60% followed the distance rule position with 48% standing at a distance of 6 feet, 88% of dental practitioners did not use a lead apron.[15] When we properly use the radiation protective equipment on our daily basis, we not only protect the patient but also, protect the radiographer from irrelevant radiation.Lead apron shielding in dental imaging is controversial.As no overall research in different populations is done towards protection by lead apron shielding.[15]

The X-ray beam has a divergence nature so with the increase in the distance the divergence reduces the volume of the irradiated surface.[16]As per the position distance rule, the operator has to be at least 6 feet from the source at an angulation of 90 to 135 degrees to the central ray of the X-ray beam. Noohiet al concluded that in their study have recorded usage of protective shields by a patient as well as the radiographers to be 0.01% and 15.7% respectively.[19] The present study concludes that 77.1% of participants failed to provide any safety measures for their patients.

The paralleling technique and use of XCP film holders enhance the diagnostic quality of radiographs thereby reducing the number of films and the amount of radiation exposure to patients. Even the practice of the dentist holding a film in the patient's mouth was uncommon; 60 percent of Australian dentists never do this but 25 percent will do so less than once every month and 1.5 percent might do so more than 10 times a month.[16] Similar to practice here where the film was held by the dentists or patient (56.25%).

A study among Iranian dentists by Shahab *et al*. inferred that a maximum of the dental practitioners was not following the correct method, material, and equipment for decreased exposure of radiation to the patient.[17] Film holders provide better positioning of the film & avoid unnecessary exposure to the fingers. Our study reveals that 45.83% of participants are directing their patients to place the IOPA films with their finger which increases the exposure to the radiation.

Dosimeters are effective in detecting the amount of radiation exposure. In India Monitoring badges or TLD, badges are used which are made of lithium fluoride, lithium borate, calcium fluoride, and calcium sulfate that emits light by stimulation. Our study revealed 25% only use the TLD badges in their practice. Dosimetry data of faculties shows no more than 1.50 mSv per year but varies between 3.70 mSv-3.90 mSv. Personal monitoring services (TLD Badges) for dental practitioners could be made compulsory for oral radiologists who are regularly getting exposed. [16,17]

CONCLUSION

The results specify that for lessening any redundant radiation, efforts should be made to increase the dentist's understanding of radiation dose reducing procedures. Although awareness is present, dental practitioners should use radiation protection protocols to decrease cumulative radiation exposure. Similarly, care should be taken to prevent unnecessary exposures to patients.

LIMITATIONS

The current study is limited to dental colleges. However, it can be extended to all private practitioners as well. Thorough knowledge, radiation protection awareness programs can be conducted to increase awareness among the technicians/ clinicians.

DECLARATION

Study participants are informed about the nature of the study and all possible measures were taken to maintain the confidentiality of all the participants with proper informed consent.

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