



Awareness and Practice of Radiation Protection Protocols Followed in Dental Clinics-A Survey

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ABSTRACT

The radiographic examination is one of the principal diagnostic methods used in all fields of medical services and contributes to the promotion of the health. Accordingly, a certain amount of radiation is inevitably delivered to patients during normal radiographic procedures. Repeated radiation doses utilized in dental treatment might be harmful to the patients and thus a thorough knowledge on radiation protection protocols are mandatory for dental clinicians. The aim of this study was to investigate the knowledge, awareness and practice of general dentists practicing in the Chennai regarding radiation prevention protocols undertaken in their area of work. The study was a questionnaire based cross-sectional study. A total of 200 dentists were contacted to participate in the study. The target population entailed were general dentists practicing in Chennai. A Pretested questionnaire was mailed to the respondents following informed consent. The data were extracted from the responses and analyzed. The total response rate recovered was 75 % and the respondents comprised of 54 males & 96 females respectively. Only 49% of the general dentists followed the position & distance rule for radiographic procedures appropriately. The results showed that the knowledge, awareness of the general dentists regarding radiation prevention protocols in Chennai were satisfactory. However, the practice regarding radiation protection protocols were inadequate. To ensure the implementation of radiation prevention protocols, strict protocols must be followed by the licensing and monitoring authorities about the use of the equipment emitting radiation and rigorous health education programs should be initiated to sensitize the clinicians.



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INTRODUCTION

Radiation is in the form of ionizing and non ionizing radiation transmitted through space and matter. X-rays are the ionising radiation extensively used in the dental profession. Radiographs have a number of uses but they still have harmful effects in the surrounding. In dentistry, it is mainly used for diagnostic purposes. The dentist and the patient and employees, are prone for radiation exposure in the dental set-up. It is very important to keep this exposure to the minimal. Even though the exposure is less, the operator and patient must follow appropriate guidelines for their protection to radiation. There are various radiation protection mea-

asures being undertaken. A survey conducted in Bengaluru amongst the dentists suggested that the radiation protection protocols carried out by the dentists were very minimal and not according to the standards set by the authorities.

According to the UNSCEAR (United Nations Scientific Committee on Effects of Atomic Radiation) as reported in the year 2008, approximately 480 million of diagnostic radiographic examinations in dentistry are done worldwide annually and these dental radiographic examinations comprise of 15% of all diagnostic X-ray examinations in health care (United Nations Scientific Committee on the Effects of Atomic Radiation, 2008; Kumar *et al.*, 2018).

Radiation has countless uses in the field of dentistry. Radiographic examinations are one of the principle diagnostic tools. Radiographs can be intra-oral or extra-oral. Most of the dental clinics have a X-ray machine or an RVG. There are continuous low doses of radiation emitted after every radiograph taken. X-ray radiations are ionizing radiations, thus it is necessary for the radiation exposure prevention protocols to be followed strictly. The ALARA principle is a guideline stating that the radiation exposure should be As Low As Reasonably Achievable (Nisha *et al.*, 2014).

Currently there is limited information about the protocol for radiation safety followed by dentists in their dental clinics. Most of these clinics do not follow the advised protocol set by the AERB thus leading to radiation leakage and exposure to the doctors, patients as well as other employees.

Radiation exposure even though in low doses over a prolonged period of time create harmful effects on the human body. Specially, the dentists and the employees in the dental clinic must be protected from these harmful radiations over a prolonged period of time (Okano and Sur, 2010). Hence this study was initiated to investigate the knowledge, awareness and practice of general dentists practicing in the Chennai regarding radiation prevention protocols undertaken in their area of work. This survey will help in establishing the percentage of dental clinics following the required protocol and further helps us in understanding the requirement of creating awareness amongst dentists.

MATERIALS AND METHODS

A cross-sectional study was conducted to assess the knowledge, awareness and practice of radiation exposure prevention protocols amongst dental practitioners in Chennai, Tamil Nadu, India. A questionnaire comprising of 15 questions in clinical and

radiographic practice was formulated. After obtaining clearance from the institutional research and ethical committee, a mailed questionnaire was distributed among general dentists and compiled after their responses.

The questionnaire included 3 descriptive questions and the rest were multiple choice questions. The results were compiled in the form of percentages and presented.

RESULTS

A total of 200 general practitioners in Chennai were included in the study, out of which the response rate was 75% (Table 1). Out of the total of 150 dentists who responded, 54 were males and 96 were females. These were general practitioners who were practicing in Chennai and had a X-ray machine set up in their dental office.

95% of the practitioners were aware of the ALARA (as Low As Reasonably Achievable) which states that the radiation exposure per radiograph taken must be kept as minimal as possible to achieve the best results with no or least harmful effects.

40 % of the participants did not use radiation badges in the dental clinic, neither for the dentist nor the employees (Figure 1). They did not get their radiation exposure levels checked periodically.

34% of the dentists did not have a protective lead barrier around their dental X ray machine (Figure 2). This lead to the scattering of the radiation around the dental clinic during exposure. Thus the people in the vicinity also got exposed to the radiation let out by the radiographic machine.

Only 49% of the dentists followed the 6 feet position distance rule in their dental clinic (Figure 3). This lead to being in the path of radiation exposure most of the time. 5% of the dental practitioners said they would make a full mouth IOPA series for the patient when they enter the dental clinic for their first diagnostic impression (Figure 4).

24 % of the dentists prefer to send the patient for OPG instead of taking a full mouth IOPA series. Most of the general practitioners stated the adverse effects of radiation to carcinogenic changes in the body. Most of the general practitioners suggested to avoid taking radiographs in pregnant patients. But in emergency conditions they advised the use of protective barriers like lead apron and thyroid collar before taking the radiograph. Radiographs must be avoided during the 1st and 3rd trimesters of pregnancy (Figure 5).

25% of the dentists did not have x ray machines

which were registered with the AERB and 75% of the dentists did not get their x ray machines regularly serviced (Figure 6). Only 35% of the dentists used Thyroid collar for the patients during radiation exposure and 25% of dentists used thyroid collar for the operator (Figure 7). 54 % of the dentists did not use Lead aprons for the patients and only 50% dentists used lead apron for the protection of the operator (Figure 8). 75.5% used Digital Processing techniques for Dental X-rays. This reduced the re-exposure to radiation due to reduction in the processing errors.

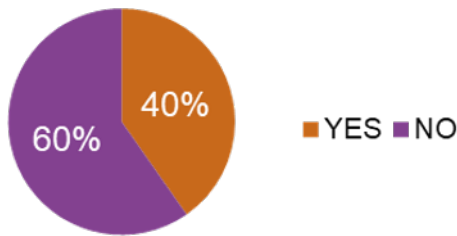


Figure 1: Presence of radiation badges

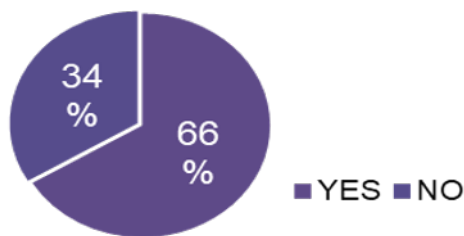


Figure 2: Protective barriers around X-rays machines

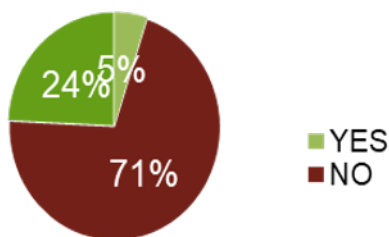


Figure 3: Distance from the patient during exposure

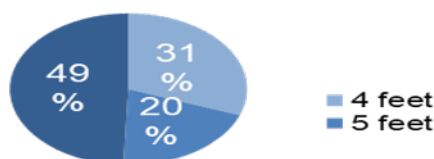


Figure 4: Full mouth IOPA series

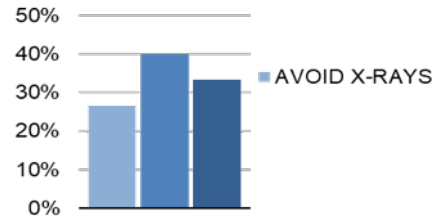


Figure 5: Management of radiographs of pregnant patients

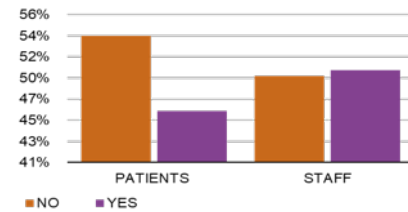


Figure 6: Servicing of X-ray machine



Figure 7: Use of Thyroid collar

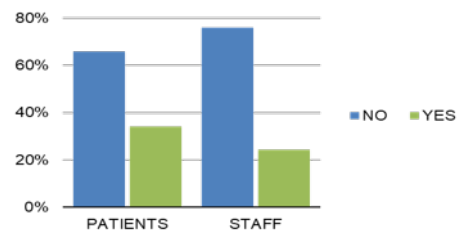


Figure 8: Use of Lead apron

DISCUSSION

Radiographs should only be prescribed when the benefit outweighs the risk. Thus, it is important for the dentist to provide justification for the dental radiograph taken. The exposure dosage must be as minimal as possible.

The dentists must have adequate knowledge about the radiation protection protocols to be followed when using a dental x ray unit in the clinic. The safety of the patients and the staff must also be considered of utmost importance. To assess the knowledge on radiation protection it is important to create awareness about radiobiology. The dental practitioners had an adequate amount of knowledge about the radiobiology. They also knew the various harmful effects due to over exposure to radiation. Radiation causes cell damage by ionization with the con-

Table 1: Responses of the Participants

Survey Domains	Positive responses	Negative responses	
Awareness of the ALARA principle	95%- Aware	5%- Unaware	
Use of radiation badges in the dental clinic	40%-Used badges	60%-did not use	
Following the Position distance rule	6 feet-49%	5 feet-20%	4 feet-31%
Full mouth IOPA series	For all patients- 5%	No-24%	Sent for OPG-71%
Management of radiographs in pregnant patients	Avoid X-rays-40%	Safe in 2 nd trimester-35%	Use protective barrier-25%
Servicing of X-ray machine	78%-serviced	22%- did not service the machine	-
Use of thyroid collar	35%-used	65%-did not use	-
Use of Lead apron	50%-used	50%-did not use	-

sequent formation of ions that can produce free radicals, break chemical bonds, creates cross-linkage between macromolecules or damage molecules and genes. Undifferentiated cells or rapidly proliferating cells are more prone being affected by radiation. Such mesenchymal cells or stem cells are found in fetuses. Thus the developing fetus is extremely sensitive to radiation effects specially in the 1st and the 3rd trimesters of pregnancy. In the 1st trimester of pregnancy organogenesis starts to occur (Steffler, 1995).

Only 49% of the dentists followed the position rule of standing minimum 6 feet away from the x-ray exposure. The most effective method is to reduce the radiation exposure is the use of fast films, thyroid collar and lead apron. The use of faster film speed can also reduce radiation exposure to about 50% while maintaining the diagnostic quality (Rohlin and White, 1992).

95% of the dentists had the knowledge of the ALARA principle. But most of the dental clinics did not follow the appropriate protocol to reduce the radiation exposure to the minimum. Consequently, patients may receive unnecessary radiation dose if the ALARA principle is not put into practice. Most of the dental practitioners did not know the maximum permissible annual dose of ionizing radiation for health care workers is 50 milli sieverts (mSv) and the maximum permissible life time dose is 10 mSv multiplied by a person's age.

The knowledge of radiation protection was poor amongst the majority (65%) of the general dentists did not use lead apron. Thyroid gland is sensitive to radiation. Sikorski et al. documented that radiation exposure reduction by using a thyroid shield. In

addition, their study showed that thyroid skin exposures measured on adults lower in offices in which thyroid shield was used as compared (Sikorski and Taylor, 1984).

It is recommended that leaded thyroid shields should be used in children (Cacchillo *et al.*, 1993; Hujoel *et al.*, 2004).

Almost 40% of the dentists did not have a thermoluminescent dosimeter (TLD) badge despite taking more 40-50 dental radiographs per month. Although 49% of them kept a distance of at least 3 meters to the radiation beam, but some radiation gets absorbed due to the scatter. The dose of direct and scatter radiation to the patient is considerably low (Hallquist *et al.*, 1994; Horn-Ross *et al.*, 1997).

It is crucial to reduce the radiation exposure by other means. Collimation reduces the primary and secondary radiation scattering (Longstreth *et al.*, 1993; Preston-Martin and White, 1990). They act as an aperture of the camera and allow the beam to only follow a parallel or straight path using a rectangular or conical collimator (Wingren *et al.*, 1997). Compared to conical collimators, rectangular collimators are 5 times more effective at reducing the dose of radiation scattered (Freeman and Brand, 1994; Gibbs, 2000).

A collimator must be provided in every dental X-ray unit set up mostly the rectangular type (Pharoah and White, 2009). The use of dosimeter must be regulated and checked every few months (Shah *et al.*, 2014). In this study, knowledge of radiation protection positively affected the dentist's practice of taking radiographs in their dental clinics (İlgüy *et al.*, 2005).

Education, implementation of radiation protection program and usage of barrier shielding are important tools for the protection of the health care workers. Radiation protection program must include the train of the dentists in the use of the dosimeter badges settings go the x ray machine etc. This training must be done regularly and be a continuous process due to the loss of relevant information academically within 6-12 months of the course (Absi *et al.*, 2011; Bornstein *et al.*, 2014).

CONCLUSION

The general practitioners in this study did have good knowledge on radiation biology but showed relatively poorer knowledge on radiation protection. Despite their poor radiation protection knowledge their practice was better. We recommend that the dental authorities keep a check on these use of these X-ray machines as well as the amount of radiation protection barriers applied to the practice to reduce the amount of radiation. Quality control practice and correct practice of the concept of ALARA must be followed.

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Conflict of Interest

The authors declare that there is no conflict of interest.

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