

Protection from Radiation Hazard for Operator, Patients and Environment in Dental Hospital/Clinic Setup

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Abstract

This article is to create awareness among dentist to provide safety from radiation hazard. Data proves that in entire India there is lack of awareness among dentist in terms of providing safety from radiation hazard for operator, patient, and environment.

Keywords: Radiation hazard, Radiation protection, Radiation safety.

Introduction

Our dental ancestors taught us how to give best dental services even with the basic setup and equipments. The new generation upgraded us with the modern setup and advanced equipments including our dental hospitals and clinic in terms of providing lavish dental care, while planning the layout of this lavish dental setup certain things are always taken care like safety from fire hazard, electrical hazard and bio medical waste hazard but there is one thing which is always lacking behind that is safety from radiation hazard. The represented data proves that from north to south or in entire India there is lack of awareness among dentist in terms of providing safety from radiation hazard. Harleen et al in 2018 conducted a study on awareness and

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attitude towards radiation protection and safety among dental community of north India and it states that 79% dentists are unaware of radiation protection guidelines [1].

Javali et al in 2020 conducted a study on awareness and attitude towards radiation protection and safety among dental surgeons of north Karnataka and it states that around 50% of the dentist in north Karnataka are unaware of principles of radiation protection [2]. Kaur et al 2019 conducted a survey on awareness of radiation protection measures in dental clinic 76% of the dentists behavior

regarding oral radiology safety standards are not satisfactory [3].

This article is to create awareness among dentist to provide safety from radiation hazard. There are four questions to be answered what, why, whom, how. From what protection is needed, why protection is required, for whom need protection, and how to protect. So, the question is, from what protection is needed, and the answer is radiation.

What is radiation?

Radiation is energy travelling in space as waves or particles. The international derived unit for radiation is sieverts. There are two types of radiation ionizing and non-ionizing radiation. In our daily life, people get expose to some amount of radiation that is nonionizing radiation which is emitted by UV rays, infrared rays, microwaves, mobile phones even by foods like banana and in dentistry lasers and light cures are used, but that emission is in micro sieverts. Whereas ionizing radiation is a form of energy that acts by removing electrons from atoms and molecules of materials that include air, water, and living tissue. Ionizing radiation can travel unseen and pass through these materials. Example of ionizing radiation is gamma rays, radioactive elements, x rays, etc. Main uses of ionizing radiation in medicine are sterilization, treatment, diagnosis. In dentistry ionizing radiation is used for investigation and diagnosis in the form of CBCT, extra oral radiography, intra oral radiography, CT scan.

Now after knowing from what protection is needed, the question arises why protection. Hao et al in 2020 published a report case report on occupation radiation disease, skin injury, leukemia after accidental radiation exposure. Prof. Memon in the year of 2019

conducted research and stated that repeated exposure to dental X-rays may increase the risk of thyroid cancer. Hwang et al 2018 conducted a study on health effects from exposure to dental diagnostic X-ray and also concluded that dental X-rays may increase the risk of thyroid cancer.

Common occupational radiation hazards are skin burn, infertility, cancer later on. Effect on patients due to high doses of accidental radiation exposure nausea, vomiting, diarrhea, malaise, CNS effect basically they are slow killers. After the discovery of X-rays in December 1895 by W.C. Röntgen, nearly 14 days after the announcement of the discovery of roentgen rays Dr. Otto Walkhoff took the first dental X-ray that was took an ordinary photographic glass plate, wrapped it in a rubber dam, held it in his mouth between his teeth and tongue and then lay on the floor for a 25 min exposure and reported burns as well as the loss of hair from the exposed site.

Even sir Nikola tesla purposely placed his hands under the x-rays just to report that these x-rays are harmful and can cause skin burns and harmful effects. no one took them seriously. by 1911 more than 50 cases of x-ray induced cancer reported. Even the father of dental radiology Edmund Kells died because of occupational radiation hazard. Then Sir William Rollins came as an angel also known as father of radiation protection, who introduced the hazards of radiation and given guidelines for the patients, operators and environment. that is the answer of my third question that is for whom protection is needed.

Now the last question is how to protect them i.e operator, patient, environment. Before that one should know the principles of radiation protection which is given by

ICRP regulatory body (international commission for radiation protection). In India it is regulated by AERB (atomic energy regulatory board) [4].

Principles of radiation protection: There are 3 principles of radiation protection.

1. Principle of justification – it states that you have a proper reason to advice radiograph or why are you increasing or decreasing the parameters, it's for patient benefit or for your research work. radiograph does better than harm.
2. Principle of optimization - acc. to ICRP dentist should utilize every opportunity to reduce the unnecessary exposure to their patient and themselves. ICRP concept for optimization is alara and alada. Alara is as low as reasonably achievable and alada is as low as diagnostically acceptable.
3. Principle of dose limitation – annual dose limit for patient is 1 milli sieverts and for operator is 50 milli sieverts.

In India millions of dental x rays are performed every year without using protection and no. of operators and public are unaware of health risk hazards so how to protect them i.e operator, patient, environment.

1. **Protection for operator**-Before starting any radiology investigation there are 6 steps of operator protection while using IOPAR, OPG and CBCT.
 - Operator should wear protective gears like lead apron and thyroid collar, use lead gloves and lead eye wears.

- Operator should stand behind lead barrier /metal shield if separate chamber for operator is not available.
 - Operator should follow position distance rule it states that operator should stand 6ft. away from the patient at an angulation of 90 to 135 degrees.
 - Operator should not hold IOPAR film or RVG while shooting intra oral radiograph.
 - Operator should not hold tube head while shooting intra oral radiograph.
 - Operator should always use personal monitoring device tld batch (thermos-luminescent dosimeter) and it should be wear at chest level under lead apron.
2. **Protection for patients**-There are 3 steps of patient protection which should be taken care of by the operator or doctor.
 - Before the exposure-Its operator or doctor responsibility that he/she must educate patient about the procedure of the intraoral, extraoral radiograph, and should ask the patients to remove all the ornaments before shooting the radiograph to avoid any shadows. as well as operator should educate how to hold handrails of OPG and CBCT. And there should be no movement while shooting the radiograph of patient.
 - During the exposure-Use of protective gears for patients and in case of pedo patient parents should also wear lead apron and thyroid collar. Radiation exposure can be reduced by 75% as compared to d-speed films. Radiation exposure can

be reduced by 70% as compared to e-speed films. Patient should not hold film or RVG while shooting intra oral radiograph use snap a ray film holder. For gag reflex use mind diverting technique and use of local anesthesia.

- After the exposure-Proper film handling and processing and proper reading and interpretation of the radiograph.

There are few Guidelines for pediatric patients:

- Only perform imaging when there is a clear dental benefit to the child and use the lowest amount of radiation.
- Always use the thyroid collar while shooting x ray.
- Avoid multiple unnecessary images.
- Allow parents to hold the child (with lead apron) to avoid movement.
- Use alternative diagnostic such as ultrasound.

Guidelines for pregnant dental patients:

- Primary beam is in the area of head and neck, so, it's not contraindicated.
- Although developing fetus is most susceptible to the ionizing radiation
- Radiograph should be taken with lead apron and thyroid collar.
- absolutely in necessary condition.
- use the lowest amount of radiation.
- avoid taking vertex occlusal radiograph.

3. **Protection for environment-** Steps of environment protection while using IOPAR, OPG, CBCT.

a) Layout of the working area

- **For OPG and CBCT**

Rule 1. Avoid crowded areas.

Rule 2. There should be a minimum area of 150squarefeet for CBCT and 80squarefeet for OPG. Thickness of the wall should be 9 inch and in dental hospitals it should be away from the pediatric wards. There should be separate section for control room in CBCT and lead coated viewing window with lead coated entry gate.

• **Layout for Intra oral radiography machine**

For wall mounted IOPAR machines in colleges the room dimensions should be 54squarefeet. If using stand mounted in clinics there should be partition between the dental chairs with lead coating. Waiting areas should be outside the x-ray room. Radiation hazard warning sign for intra oral and extra oral.

b) Developer and Fixer disposal

- lead foils should be stored in a container and then sent for recycling.
- plastic cover should be disposed of in red bin (bmw).
- the developer should be drained off after the proper treatment.
- the fixer should be recycled in silver recovery units.

c) Quality assurance

Quality assurance plays an important role in reducing the radiation dose exposure to the patient. There are few steps which can be done on daily, monthly and yearly basis for the better quality of the radiograph and to avoid repetitions [5,6].

- Daily-compare the quality of the radiographs.

- Monthly-check the exposure parameters.
- Yearly-calibrate the x-ray machines.

Conclusion

To avoid radiation hazard Time, Distance, Shielding are the three factors which plays a

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vital role in protection from the harmful effects of radiation. Time means spend as much less as possible time in radiation exposure. Distance means follow position distance rule. Shielding means always stand behind the lead barrier or metal shield.