REVIEW ARTICLE

Endodontic Practice and Radiation Safety – A Review

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ABSTRACT

Sources of radiation can be categorized as natural and artificial. Natural radiation from external and internal sources yields the largest contribution to radiation exposure. External sources, cosmic and terrestrial, contribute 35% of world's natural radiation. Sources of internal radiation are radionuclides that are taken up by inhalation and ingestion. Contribution from the artificial (manmade) radiation has increased and originates mainly from medical field, consumer and industrial products, and other minor sources. At present, the medical uses of radiation constitute more than 99.9% of radiation exposure to the world's population from man-made sources. Endodontics has been defined as the aspect of dentistry which involves the treatment or precautions taken to maintain the vital tooth, the moribund tooth, or the non-vital tooth in the dental arch. Most structures of concern during endodontic therapy are not visible to the naked eyes; hence, they cannot be directly observed. It is imperative, therefore, that an imaging process be employed to aid in visualization, leading to a considerable dependence on radiographs. There should be a reasonable expectation of gaining information from the radiograph that is not available from any other reasonably available safer method, which is applicable in endodontics. Endodontists should be aware of the ill effects of radiation and methods to protect the operator as well as the patient from its harmful effects.

Keywords: Endodontic practice, Ionizing radiation, Radiation protection, Radiation safety, X-ray exposure.

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INTRODUCTION

Radiation protection is the science and art of protecting people and the environment from the harmful effects of ionizing radiation. It is also described as all activities directed toward minimizing radiation exposure of patients and personnel during X-ray exposure.[1] The amount of exposure received by a patient or operator from dental radiography depends on the film speed, exposure parameters of collimation, technique, and protecting barriers used. This demands the operator to have detailed knowledge toward radiation hazards and its protection procedures. Sources of radiation can be categorized as natural and artificial.[2] Natural radiation from external and internal sources yields the largest contribution to radiation exposure.[3] External sources, cosmic and terrestrial, contribute 35% of world's natural radiation. Sources of internal radiation are radionuclides that are taken up by inhalation and ingestion. Radon (inhalation) is the largest single contributor to natural radiation (52%). Contribution from the artificial (manmade) radiation has increased and originates mainly from medical field, consumer and industrial products, and other minor sources. At present, the medical uses of radiation constitute more than 99.9% of radiation exposure to the world's population from man-made sources.[4-6] Endodontics has been defined as the aspect of dentistry which involves the treatment or precautions taken to maintain the vital tooth, the moribund tooth, or the non-vital tooth in the dental arch.[7] Most structures of concern during endodontic therapy are not visible to the naked eyes; hence, they cannot be directly observed. It is imperative, therefore, that an imaging process be employed to aid in visualization, leading to a considerable dependence on radiographs. Although radiation doses in dental radiography are low and may not present any risks, exposure to radiation should be minimized where practicable. There should be a reasonable expectation of gaining information from the radiograph that is not available from any other reasonably available safer method,[8] which is applicable in endodontics.

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SOURCES OF RADIATION

Sources of radiation can be categorized as natural and artificial. Natural radiation from external and internal sources yields the largest contribution to radiation exposure. External sources, cosmic and terrestrial, contribute 35% of world's natural radiation. Sources of internal radiation are radionuclides that are taken up by inhalation and ingestion. Radon (inhalation) is the largest single contributor to natural radiation (52%). Contribution from the artificial (manmade) radiation has increased and originates mainly from medical field, consumer and industrial products,

and other minor sources. At present, the medical uses of radiation constitute more than 99.9% of radiation exposure to the world's population from man-made sources. Computed tomography scanning accounts for 42% of collective effective dose arising from medical diagnostic radiology. Everyday around the world, 10 million diagnostic radiology procedures and 1 lakh diagnostic nuclear medicine procedures are being conducted.[9]

PROTECTION FROM RADIATION

People who work with radiation are also entitled to protection from radiation. There are exposure limits for occupationally exposed radiation workers. The maximum permissible dose (MPD) is the dose of radiation to the whole body that produces very little chance of somatic or genetic injury. The MPD for whole-body exposure per year for occupationally exposed personnel is 0.05 Sv (5 rem). An age-based formula has also been developed as a guideline for any accumulated dose (N in years).[10]

$$MPD = (N - 18)\ 0.05Sv/yr$$

PLANNING AND DESIGNING OF A SAFE RADIOLOGY DEPARTMENT

- Radiation area should be at one corner in the building such that at least two walls open to the environment
- One extra thickness of brick with barium plaster is a must for the walls
- Warning board and light should be seen when the machines are operating, at the entry
- The barriers should have 2 mm or more of lead and it should go at least 12 inches below the ground
- All the timers, control consoles should be kept behind the lead barriers.

Conch Shell Design

The operatory that contains the X-ray unit should be constructed in such a manner that it protects people in surrounding areas from radiation.

Film Badge Service

It is a good way to keep track of occupational exposure. Badges are worn by personnel at all times while at work and are regularly sent to the company providing the service. Written reports of the exposure recorded on the badges are provided. If proper safety precautions are followed, no one in a dental office should receive radiation doses close to their MPD.[11]

Lead Barrier

It is preferable that the operator stands behind lead barrier while exposing films. The barrier should have a window or other means of monitoring the patient during the exposure.[12] If no barrier is available, the operator should stand at least 6 feet away from the patient and in an area that lies between 90° and 135° to the primary beam. These are areas of minimum scatter radiation.

Never Hold the Film or Tube

Dental personnel should never hold films for patients. If assistance is necessary, ask a family member or guardian to help. Be sure to protect the helper with lead apron as well. Dental personnel should also never hold the tube head for stability.[12-15]

CONCLUSION

Justification and optimization of a procedure along with dose limitations are absolutely essential in clinical practice. In addition, dentists should remain informed about safety updates and availability of new equipment, supplies, and techniques that would further improve the diagnostic ability of radiographs and decrease exposure to patients. Endodontists should be aware of the ill effects of radiation and methods to protect the operator as well as the patient from its harmful effects.

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