To Shield or Not to Shield?

by STEPHANIE PATRICK, BS,RT(R)(M)(QM)

For decades, patients have been comforted with a traditional thick lead apron blanketed over them as their dental x-rays were performed. Knowing that harmful ionizing radiation was being blocked from their body gave them a sense of protection. But is it still necessary? New recommendations from the American Academy of Oral and Maxillofacial Radiology (AAOMR) have changed the way dental professionals can think about shielding.

RADIATION INTERACTIONS

When x-rays are emitted from the dental x-ray tube, there are a number of interactions that will occur. Some x-rays will be absorbed by the tube housing, which is lead-lined. Additionally, there are x-rays that will be absorbed in the patient's body part being imaged contributing to their radiation dose, which is necessary for anatomy to be visualized. X-rays will also pass through the body and reach the image receptor (sensor). Finally, some x-rays change direction inside the body after interacting with tissue and may leave the body or interact again with other atoms. These x-ray photons that have changed direction are called scattered radiation and do not contribute to the useful image.

The cone on the dental unit limits the beam size where x-rays photons are being emitted from the tube. Using rectangular collimators in addition to the cone will further reduce patient dose, improve image quality, and reduce scattered radiation. Filtration is also built into the system to absorb lower energy beams that do not produce useful diagnostic information and will reduce radiation dose to the patient.

NEW RECOMMENDATIONS

Research has now shown that due to the very small area allowed by the dental imaging

equipment for primary radiation to enter the maxilla or mandibular areas, x-rays emitted from the tube do not reach the thyroid or gonadal areas at any significance;[1] these areas are more radiosensitive compared to other parts of the body. The AAOMR has found the risk to thyroid carcinoma is negligible. Decades of studying radiation exposure show that radiation does not produce heritable effects.[1,5] Modern x-ray dental equipment and sensors allow for significantly lower radiation doses along with increased beam filtration.

Scattered radiation from the patient will also travel in all directions inside the patient's body, and external lead placed on the patient in dental imaging does not assist in protecting the patient from their internal radiation dose received or reduce the amount of scatter produced in the body.[1,2]

It is now recommended by the AAOMR that no lead shielding is required for patient imaging, which includes lead aprons and thyroid shields. This new recommendation is applicable to all dental imaging including intraoral radiographs, panoramic, cephalometric and cone beam CT imaging. It is also not required to shield pediatric or pregnant patients for dental imaging.[1] The American Dental Association supports this recommendation and will be publishing an article in early 2024.

At the time of this writing, the National Council on Radiation Protection and Measurements (NCRP) has not officially updated its stance and is in the stages of preparing a commentary about the recent AAOMR recommendations. The most recent NCRP publication on radiation safety during dental imaging, NCRP Report No. 177, states that aprons are to be discontinued, but thyroid shields are to be utilized. The Missouri Radiation Control Program (MRCP) adheres to the recommendations of the NCRP.

SCATTERED RADIATION & DENTAL PERSONNEL

Scattered radiation is a concern for the operator of the x-ray equipment as it travels in all directions from the patient. Having the exposure switch outside the operatory or the use of a coiled switch allows dental personnel to maintain distance safely.

Regarding handheld units, the NCRP does not mandate that operators of these devices wear a lead apron. Backscatter shields are installed on the units to protect the operator of these devices. The MRCP and handheld manufacturers do recommend the use of a lead apron for the operator, but this practice is not widely utilized.[3] It is also recommended that all pregnant dental workers wear a lead apron when using handheld x-ray units.

RADIATION DOSIMETRY BADGES

Most dental practices in Missouri do not utilize a radiation dosimetry program where the dental staff is provided with badges to monitor the radiation dose received since it is usually minimal.[6] The NCRP recommends dental personnel utilize monitoring in the following circumstances:

- When new equipment is installed or substantially different practices are implemented;
- When a worker declares pregnancy to the dental employer;
- Personnel who are likely to receive an annual dose in excess of 100 mrem (1 mSv);
- Personnel who are likely to receive a weekly dose in excess of 25 mrem (.25 mSv); and/or,
- When handheld x-ray units are utilized at a practice for the first year to monitor exposure.

The majority of dental x-ray operators will not be exposed to the levels stated above due to maintaining a minimum of six feet from the x-ray source and utilizing barriers (standing outside the room during the exposure) where dosimetry monitoring is needed.[2,4] However, a dosimetry program can help determine a baseline for dental personnel's radiation exposure; if no exposure for a year is noted, the dosimetry can be discontinued. The NCRP states "All occupational exposures have been declining over recent decades for workers in all healing arts including dentistry."[2]

All equipment producing radiation must be surveyed at varying intervals by a qualified expert to determine output and safety. Scatter surveys are routinely performed when testing panoramic and cone beam CT units as well to ensure the safety of the dental staff.

In summary, the AAOMR and ADA recommend discontinuing the use of any shielding for patients moving forward. The NCRP and MRCP have not updated any recommendations for dental shielding at this time, and thyroid shielding for patients is the current published recommendation as of December 2023. All dental x-ray operators should still be prudent when making exposures by maintaining appropriate distance and using barriers.

Stephanie Patrick, BS, RT (R)(M)(QM) is a Qualified Expert with Heldebrandt Consulting and travels throughout Missouri performing radiation safety inspections for sites including dental settings. She has been in the radiologic sciences with experience in radiation physics and safety for more than 30 years and enjoys providing educational radiology information to facilities. Heldebrandt Consulting is an MDA Solutions Center Allied Business Participant. Find information about their services at solutions.modental.org/company/heldebrandt-consulting.

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