

## Hand-held dental X-ray device: Attention to correct use

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Dear Editors,

Since the early 20th century, protection from the deleterious effects of ionizing radiation in diagnostic imaging examinations has been a much-discussed topic. At present, there is a consensus among safety agencies about the need to try, whenever possible, to reduce the levels of radiation to which professionals and patients are exposed, based on the ALARA (as low as reasonably achievable), ALADA (as low as diagnostically acceptable) and ALADAIP (as low as diagnostically acceptable being indication-oriented and patient-specific) principles.<sup>1-3</sup>

The last decade has been marked by growth in the sale and use of portable hand-held X-ray devices in dental offices and universities. Since the use of these devices makes it difficult for the operator to maintain a distance of 2 meters between the radiation source and patient, it is necessary to clarify the radioprotection norms. Given the lack of clear, concise, and direct information on this topic, this Letter to the Editor is extremely relevant.

The development of the portable hand-held dental X-ray device has led to several advantages, including a reduction in size and weight, which allows for easy transportation to any required location. This makes it an appealing option for use in a surgical center during operations, in forensic dentistry, community work, and home care.<sup>4</sup> However, the use of portable hand-held X-ray devices in routine dental care is not recommended due to the secondary radiation dose that the operator may receive during radiographic examinations.<sup>4,14</sup>

Studies have been conducted to develop protocols that ensure excellent operator safety, reducing or avoiding exposure to radiation. Protective measures have proven effective in reducing the radiation dose to the operator, thereby enhancing protection against secondary radiation during radiographic exams conducted with portable hand-held dental X-ray devices. These measures include 1) operating the portable device with arms fully extended to maintain distance from the body, 2) using a backscatter shield on the cylinder, 3) employing a longer cylinder, 4) wearing protective aprons, 5) using lead gloves, and 6) utilizing a rectangular collimator. These precautions are particularly crucial when the operator is in close proximity to both the radiation source and the patient.<sup>4,15</sup> Additionally, staff members and the public should maintain a distance of 2 meters from both the patient and the radiation source, and avoid standing in the path of the central X-ray beam.

It is important to emphasize that radioprotection measures will only minimize the effective dose received by the professional if the operator holds the device during the examination. Only when portable hand-held dental X-ray devices are used on a stand and operated from a protected area (either 2 meters away or behind a barrier), similar to the usage of conventional radiographic devices, can operators be fully safeguarded against secondary radiation. Consequently, manufacturers should endeavor to create supports for portable devices that enable the operator to emit radiation from a safe distance.

Even if the equivalent dose in the head and extremity regions of the portable device operator does not exceed 0.6 mSv/year and 20 mSv/year respectively, which are within the limits deemed acceptable by the International Commission on Radiological Protection (ICRP),<sup>4,14</sup> it is necessary to consider the linear non-threshold (LNT) theory. The LNT theory posits a linear relationship between the dose and

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the risk of inducing stochastic effects, even at low doses, implying that there is no safe dose limit. Despite the dose intensities falling within the low range, there are several reasons to apply the LNT theory. First, a policy is required to establish exposure limits for individuals in the low-dose range, including those undergoing diagnostic imaging procedures and occupational exposure. Second, current epidemiological evidence neither confirms nor rules out the existence of a safe dose in oral radiology. Therefore, the LNT theory, which is scientifically plausible, should be considered even at low radiation doses. Most radiation protection organizations concur that it is prudent to assume the risk is proportional to the dose, even in the case of diagnostic exposure.<sup>16</sup>

In conclusion, it is essential to use protective measures to nullify or reduce the secondary radiation exposure received by the operator of the portable hand-held dental X-ray device. Adhering to the principles of optimization (ALARA) and dose limitation, the portable hand-held dental X-ray device should only be utilized under the circumstances outlined in the third paragraph of this letter, when the use of a conventional device is not feasible. Specifically, a safe scenario where the operator is positioned 2 meters away from the patient, at an angle of 90°-135° from the central X-ray beam. Companies that distribute these devices bear the responsibility for disseminating this information and instructing professionals on radioprotection measures for the operator, staff, and the public.

**Conflicts of Interest:** None

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