

# Endodontic radiography: Are handheld X-ray devices safer than wall-mounted machines?

Sir,

Radiographs are essential during diagnosis and treatment in endodontics. Dental radiographs although use minimum radiation still there is a risk of radiation exposure which cannot be overlooked.<sup>[1]</sup> Traditionally, radiographs are taken with wall-mounted X-ray machines. In the last few decades, handheld intraoral dental X-ray devices (HIDXDs) are widely used for intraoral radiography. The proximity of the dentist to these machines raises concerns about radiation safety.

The HIDXDs were initially invented for military purposes.<sup>[2]</sup> However, these devices are now routinely used in dental clinics as they are convenient to carry in clinics having multiple operatories or in small dental clinics having limited space. There are two types of HIDXDs available in the market, one of which resembles a photographic camera and the other is a pistol type.<sup>[3]</sup> These HIDXDs usually use direct current, 60KvP, 2–2.5 mA, 0.4 mm focal spot area with 20 cm source to skin distance.<sup>[2,4]</sup> An important concern with these devices is radiation hazard for the dentist as well as for the patient as the “as low as reasonably achievable” (ALARA) principle is not followed. ALARA is based on three factors: time, distance, and shielding.<sup>[5]</sup>

## TIME

The operator should spend minimum time near the X-ray machine and leave the area immediately.

Most of these HIDXDs operate on 2 mA compared to wall-mounted X-ray devices which operate on 8 mA. The energy of the X-rays is proportional to the amount of mA. These devices therefore generate only one-quarter of the powerful X-ray beam as compared to wall-mounted units. However, this is usually compensated by increasing the exposure time for HIDXDs. Moreover, due to longer exposure time, there are chances of image blurring and repeat exposure as it is difficult to maintain the steady motion of the patient, operator, and device.<sup>[4]</sup> This makes the operator stand for a longer time near the radiation source. The exposure time can be reduced using E or F speed films or digital image techniques (sensors or phosphor Plates); however, it should be never more than 1 s.<sup>[6]</sup>

## DISTANCE

For protection from radiation, it is recommended that the operator stands 6 ft away and at 90°–135° angulation from

the central beam, which is not possible with these devices. These HIDXDs increase exposure to radiation as the inverse square law tells us that radiation at 1-foot distance from the tube is 100 times > at 10 feet distance.<sup>[7]</sup> However, the distance between the operator and the device can be increased by fully extending the arms during the exposure, using a tripod, and powered with a remote control device. The holding of film/sensor by the dentist should be avoided. The dental assistant should stay a minimum of 2 m away from the patient and the central beam.<sup>[8]</sup>

## SHIELDING

The shielding of the dentist from radiation due to backscatter and leakage from the tube can be reduced using a backscatter shield of 0.5 mm thickness and 15.2 cm diameter, personal protective equipment including lead apron of minimum 0.25 mm thickness, lead gloves, and a thyroid collar.<sup>[2,7,8]</sup> Radiation leakage can be further reduced by surrounding the X-ray tube with heavy metal compounds.<sup>[2]</sup>

Makdissi *et al.* have shown that HIDXD devices do not result in greater radiation risk to the patient or to the operator compared to wall-mounted X-ray units.<sup>[9]</sup> The estimated annual effective dose to the whole body and to the hands with these devices is much lower than 0.25 mSv and 10 mSv, respectively.<sup>[2]</sup>

We should must consider the linear nonthreshold theory which states, a linear relationship between the radiation dose and the risk of inducing stochastic effects. According to this theory, there is no safe dose limit and risk is proportional to the radiation dose. Smith *et al.* found that HIDXDs can put operator at a greater risk of exposure from scattered radiations as compared to wall-mounted X-ray machines.<sup>[10]</sup> The dentists using HIDXDs daily are at the highest risk for long-term low-dose exposure. This long-term exposure to low radiation can damage the brain, neck, thyroid, and other vital organs of the body and more importantly carries carcinogenic potential.<sup>[11]</sup> Hence, an exposure limit should be established for persons undergoing diagnostic or occupational exposure.

The radioprotective measures will only decrease the effective radiation dose to the dentist while using HIDXDs. The best way of safeguarding from secondary radiation is by maintaining a distance between the X-ray tube and the dentist. In operation theaters and dental clinics having

multiple operatories, a semi-mobile X-ray unit should be preferred than HIDXD.

These HIDXD are technologically advanced dental equipment in dental office still it is crucial to maintain protection from radiation exposure. The dentist should avoid using these portable X-ray machines during routine practices. These HIDXD should be strictly utilized only when conventional X-ray machines cannot be used to minimize occupational exposure to dentists ALARA.

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