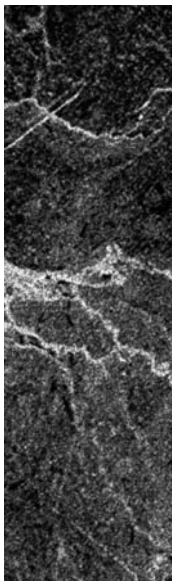

Ask the Experts

VISIBLE LIGHT CURING

Guest Expert
Ellen M. Bruzell, DSc*

QUESTION: Are there any potential health hazards related to the use of dental curing lights?

ANSWER: To cause health hazards, a dental curing lamp must emit radiation within certain wavelengths and at an adequate dose, and biologic targets must be close enough for the radiation to be absorbed in sufficient amounts. Most dental curing lamps emit visible light and some ultraviolet (UV) radiation. Besides the teeth, the eyes, skin, and oral mucosa are the main targets. Visible and UV radiation do not strike only the material to be polymerized but can be absorbed by the patient's oral tissues and the lamp operator's skin and eyes through direct irradiation and reflection. It is estimated that reflected light from the oral cavity to the lamp operator is 10 to 30% of the incoming light.[1] The reflection is increased by the use of mirrors and other reflective materials and decreased by the use of a dark rubber dam. The small protective shield found on some light guides may not be adequate to absorb the light flux.

Dental curing lamps also produce electromagnetic fields, and implanted devices such as pacemakers are possible targets. This event is not regarded as a common threat, although some lamp manufacturers warn about the possibility in their instructions for use. Dental curing lamps are one of many sources of electromagnetic fields in the dental office and should be considered within the context of other risk factors present in the environment (eg, various chemicals, x-rays).

Detrimental effects on the eyes caused by visible blue light occur mainly in the retina.[2] Despite the existence of physiologic repair mechanisms against blue light damage, the intensity of the light emitted from dental curing lamps is relatively high, and most of the emitted light spectrum overlaps the wavelengths that cause retinal damage. Our research group has estimated that the use of a regular halogen lamp, with an intensity of 1,000 mW/cm^2 at a distance of 30 cm and 30% light reflection, would reach the threshold limit value of blue light irradiation exposure for workers (based on an 8 h workday; American Conference of Governmental and Industrial Hygienists) within 1 to 2 minutes.[3] For a lamp of this type, threshold limit values for UV are not reached within such short times, but higher-intensity lamps emitting partly in the UV range may cause higher UV doses. A detrimental effect of UV light on the eye is the potential promotion of cataracts.[2] The probability for occurrence of ocular damage increases with increasing age owing to age-related changes in the lens and retina, including the loss of natural antioxidants.

Skin effects of UV exposures are well known, but these effects hardly manifest themselves in the skin of the lamp operators. Little is known about UV effects on the patient's oral tissues, although, theoretically, UV radiation can be absorbed in these tissues, resulting in biologic reactions.

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Another point to consider is the phenomenon of photosensitization, related to both skin and eye. If the patient or the operator has a photosensitizing disease (eg, porphyria) or is taking photosensitizing drugs (for an extensive list of drugs, please see DeLeo[4]), toxic reactions may occur in the skin or eyes. Light-curable dental materials contain UV- and visible light–absorbing chemicals, not necessarily declared by the manufacturer, that might be potent photosensitizers.

To my knowledge, no epidemiologic data related to eye damage in dental personnel are available. A precautionary attitude should be applied as the intensity of curing lamps has increased over the past few years, as well as the frequency of the use of such lamps. As the protective shields on the light guides are small, protective eyewear filtering out UV and blue light should be worn by lamp operators. Special attention should be given to photosensitizing drugs and diseases. Dental curing lamps are not the only visible/UV light source in the dental office. Bleaching lamps also emit these wavelengths, and for some lamps, the irradiated area is generally larger and the exposure times longer.

REFERENCES

1. Moseley H, Strang R, MacDonald I. Evaluation of the risk associated with the use of blue light polymerizing sources. J Dent 1987; 15:12–15.
2. Diffey H, Hart G. Ultraviolet and blue-light phototherapy—principles, sources, dosimetry and safety. IPEM Rep 1997; 76:35–39.
3. Bruzell Roll E, Jacobsen N, Hensten-Pettersen A. Health hazards associated with curing light in the dental clinic. Clin Oral Investig 2004; 8:113–117.
4. DeLeo V. Occupational phototoxicity and photoallergy. In: Kanerva L, Elsner P, Wahlberg JE, Maibach HI, eds. Handbook of occupational dermatology. New York: Springer Verlag, 2000:314–324.

Editor's Note: If you have a question on any aspect of esthetic dentistry, please direct it to the associate editor, Edward J. Swift Jr, DMD, MS. We will forward questions to appropriate experts and print the answers in this regular feature.

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