Editorial

Are ophthalmologists exposing their patients to dangerous light levels?

There appears in this issue an article by Calkins and Hochheimer (p. 1009) which presents evidence that light exposures from ophthalmoscopes, slit lamps, and overhead surgical lamps can present a hazard to the retinas of patients. Other studies have appeared recently which also indicate that ophthalmological diagnostic and treatment devices may be hazardous, on the basis of animal exposure evaluated against light safety standards. The growing concern over ophthalmological devices has led in the past year (1) to the formation of a working group of the National Research Council Vision Committee to look into these hazards (Myron Wolbarsht discusses it in a Letter to the Editor, p. 1124), (2) to a session on ophthalmic exposures in a conference on applied vision sponsored by the National Academy of Sciences, and (3) to a special conference sponsored by the National Eye Institute, which I organized. Held in Houston, the conference was attended by about 50 clinicians and basic scientists who discussed intense-light effects on the retina under five headings: (1) potential hazards from specific ophthalmic devices; (2) quantitative dimensions of intense-light damage obtained from animal studies; (3) radiation measurements, and the development of standards; (4) basic research on the role of light in receptor renewal and metabolism; and (5) degenerative retinal disorders and intense-light exposure. An extensive discussion session was also held. The proceedings of the conference will be published as a special issue of Vision Research, which I hope will appear before the end of the year.

Among the ophthalmological procedures or devices which either exceed the existing safety standards or are on the borderline are intraocular fiberoptic illuminators used in vitreous surgery, photocoagulators (to nonfocal regions), fluorescein angiography, fundus photography, and indirect ophthalmoscopy.

The safety evaluations are not straightforward because the standards were developed primarily for coherent light sources and have only begun to be adapted to extended, incoherent light sources such as used in ophthalmic devices. The standards are also cumbersome and difficult to use, although recently the American Congress of Government Industrial Hygienists has published simplified versions which can be applied more easily. The experiments on animals which have directly applied the diagnostic and treatment devices have assumed steady fixation of the light on the retina, which is probably unrealistic, and have often chosen the highest intensities, which may not always be used in practice. So the results to date on the specific devices are still debatable.

The research on animals which serves as
the basis for the safety standards demonstrates three kinds of lesions. Thermal lesions, which were extensively studied because of concern over viewing atomic explosions, involve a focal lesion which is ophthalmoscopically visible and is largely produced by infrared radiation. Second, the photochemical lesion, which has been fairly thoroughly studied, is produced by a continuous exposure of upwards of several minutes to as long as 2 hr in some of the experiments. It has its primary effect on the pigment epithelium, with only secondary damage to photoreceptors. It is clear that radiation from the near-ultraviolet and blue part of the visible spectrum is most effective in producing this lesion. Finally, the "colorblinding" lesion results from cumulative exposure to intense narrow-band spectral light applied intermittently a few seconds at a time, repeated for up to an hour per day for a number of days. It is unique in affecting (depending upon its wavelength) one class of cones; that is, blue light damages blue-sensitive cones and green light damages green-sensitive cones. Red light is relatively ineffective. Also, the blue-sensitive cones are irreversibly destroyed, but the green sensitive recover in a matter of weeks. It is clear from the animal studies that the greatest practical concern should be with short wavelength light and the thermal band of infrared radiation.

Two topics which were also discussed at Houston are the protection of dystrophic retinas from intense lights and the quite involved question of whether the protection of degenerative retinas from normal light levels has any effect in prolonging useful vision.

Recommendations which grew out of the Houston conference and, in part, the working group of the NRC, which can and should be implemented without further research, are (1) to encourage instrument designers and manufacturers to minimize the blue region of the spectrum in these devices and to filter out burning infrared rays; (2) to encourage the Bureau of Radiological Health of the Food and Drug Administration to consider ophthalmological devices among those requiring their consideration; and (3) for both the Food and Drug Administration and the American National Safety Institute (an industrial association) to consider more fully safety standards for extended, incoherent light sources such as used in these devices. On the basic research side, the most useful research from a long-term standpoint would be to determine the action spectra of the three kinds of lesions, so that the absorbing pigment responsible for each lesion can be identified and the chemical nature of the damage studied.

Finally, and perhaps most important from a practical standpoint, the diagnostician or therapist should be encouraged by every means available to use the minimum amount of light which will accomplish his particular task. Although the evidence does not definitely point to a patient hazard, ophthalmologists and patient researchers should be widely alerted to the possible hazards and should be aware of them in planning their diagnostic treatment and research activities.

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