Pupil Damage After Periorbital Laser Treatment of a Port-wine Stain

Stefan Hammes, MD, DALM; Albert Augustin, MD, PhD; Christian Raulin, MD, PhD, DALM; Hans-Michael Ockenfels, MD; Edda Fischer, MD

Background: The increase in the number of laser treatments has led to an increase in the number of therapy-related adverse effects. Herein we report a case in which long-term adverse effects occurred after periorbital laser treatment of a treatment-resistant port-wine stain using a long-pulsed alexandrite laser without protective eyewear.

Observations: A 33-year-old woman with a therapy-resistant port-wine stain was treated periorbitally with a 755-nm long-pulsed alexandrite laser after several treatment sessions with the pulsed-dye laser; she was not given protective eye shields. Within a few days of the session, she reported disorders in the motility of her left pupil and a painful sensitivity to light, which was not completely resolved after 12 months of follow-up.

Conclusions: We recommend that both patients and operators use protective eyewear with every laser procedure. When treatment is administered near the eye, eye shields should be placed behind the eyelid or a safe distance should be maintained between the laser and the eyeball by treating up to the orbital rim only.

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Pupil was still irregular (oval) and more dilated than that of the other eye but responded to light (Figure 2).

Eleven months after laser treatment, there was a significant increase in pupil motility because of constant topical treatment with diclofenac sodium (Voltaren). However, the increased sensitivity to light persisted and the patient’s vision distorted whenever she moved. The pupil remained irregularly, slightly dilated (9 vs 6 mm) and responded to light only nasally and in the superior segment of the eye. The patient was advised to continue topical treatment.

COMMENT

Lasers of different wavelengths are used in treating portwine stains, depending on the thickness and depth of the vessels in the tissue. The therapeutic principle at work is selective photothermolysis. The currently preferred method of treatment for portwine stains is the flashlamp-pumped pulsed-dye laser at wavelengths of 585 to 595 nm and pulse durations of 0.5 to 40 milliseconds. Other strategies include the use of the long-pulsed KTP–Nd:YAG laser (532 nm), intense pulsed-light technology, and the long-pulsed alexandrite laser (755 nm). The alexandrite laser is most commonly used for epilation and treatment of broken vessels in the legs; it is also a useful alternative in cases of bulky malformations and mature port-wine stains. No et al reported that the alexandrite laser achieved significant lightening in 3 patients with hypertrophic port-wine stains.

Compared with the pulsed-dye laser (585-595 nm), the alexandrite laser has a wavelength of 755 nm and penetrates the tissue more deeply, regardless of the beam diameter.

In our patient, the light of the laser caused scleritic and episcleritic inflammation and involvement of intraocular structures. In general, the human iris absorbs between 53% and 98% of the infrared light within a spectrum of 750 to 900 nm; the extents of absorption and of any subsequent damage are largely related to the degree of pigmentation. Our patient’s iris was green with a narrow inner rim of brown. Because she did not undergo spectroscopy, we cannot determine the exact extent of absorption; however, even an absorption of about 50% is rather high. In this case, absorption of the laser light by the pupillary sphincter caused hyperthermia and led to temporal atrophy. This induced an inhibited reaction to light and thus a greater sensitivity to light. Furthermore, small atrophies developed in the lower to temporal regions of the iris, resulting in the typical “church window phenomenon.”

Posterior synechia developed as a result of posttraumatic intraocular inflammation. In such cases, the risk of a secondary cataract developing is increased. Despite the fact that the ocular treatment given to our patient resulted in clear improvement from a subjective and an objective perspective, it must be assumed that there will not be complete resolution in the long run. The patient will probably grow accustomed to the increased sensitivity to light over time.

We have found only 2 published reports of intraocular side effects of laser epilation after using diode lasers (800 nm). In both cases, the patient underwent epilation of the upper eyelid region without protective eye shields, with subsequent uveitis and pupillary distortion in one case and iris atrophy and nuclear cataract in the other. Other laser-induced adverse effects involving the eyes occurred for the most part when trained operators failed to protect their eyes adequately. Most of these were retinal injuries due to accidental exposure to various kinds of lasers. The laser caused bleeding in the retina, the subretinal area, or the vitreous. A macular hole can develop during resorption, which may lead to formation of epiretinal gliosis. Lin et al reported a case in which laser treatment with a short-pulsed alexandrite laser at a distance of 25 cm caused a macular hole with a central scotoma. The consequent loss of vision persisted throughout the 7-month follow-up. Ours is the first case, to our knowledge, of an ocular injury involving the alexandrite laser and related damage in the frontal region of the eye.

A study by Pham et al demonstrated the effectiveness of protective eyewear. In that study, the eyes of the
5 patients undergoing treatment with a long-pulsed diode laser (810 nm) for periorbital hypertrichosis were effectively protected by metal eye shields that were placed behind the eyelids. After treatment, no vision changes were detected by electroretinography, slitlamp examination, and fundoscopy.

In their assessment of 29 cases of laser-induced eye injuries, Liu et al13 concluded that most of the accidents were preventable. Of 12 medical laser accidents examined by Moseley14 in 2004, 67% were caused by operator error. Biesman and Zachary17 criticized the lack of specific standards for the safe use of newer devices in the periorbital region and called for a systematic approach to reporting laser- and light-induced ocular injury.

When performing laser treatments near the eye, we consider the use of protective eyewear and the rigorous observance of general safety measures18 indispensable. When treatment is administered near the eyes while the patient is wearing external eye shields only, a safe distance should be maintained between the laser and the eye-ball by treating up to the orbital rim only, and the laser should be pointed away from the eyeball. Whenever laser energy is used in the immediate vicinity of the eye (eg, when treating eyelids), a stainless steel or lead eye shield should be positioned on the surface of the orbit after the application of a topical ophthalmic local anesthetic. Plastic patient eye shields cannot be expected to withstand the thermal and mechanical effects of pulsed lasers and should never be used.19,20

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Correspondence: Stefan Hammes, MD, DALM, Laserklinik Karlsruhe, Kaiserstrasse 104, D-76133 Karlsruhe, Germany (info@raulin.de).

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