Detection of retinal laser injury using confocal scanning laser imaging

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The use of laser energy in medical practice requires specific safety measures. Accidental ocular exposure of laser can have vision-threatening consequences. We report a case of accidental laser exposure in a dentist who was working with a diode laser. The patient presented within 24 hours of exposure and the clinical fundus examination and spectral-domain optical coherence tomography (SDOCT) were remarkable at this time. Blue light autofluorescence (BAF) and multicolor images obtained using the Spectralis SDOCT system revealed the laser impact site. The multicolor image showed a larger extent of retinal involvement highlighting its role in imaging.

Key words: Diode, laser damage, multimodal imaging

Laser is used for treatment in various medical disciplines including ophthalmology, dermatology, and dentistry. The use of laser is an established mode of treatment for cancerous and precancerous oral lesions. Diode laser (810 nm) has been used to treat oral leukoplasia and oral lichen planus. CO2 laser has been used in conditions like aphthous ulcers and tissue excesses. Working with a laser requires safety precautions to avoid accidental exposure. The eye in general and retina, in particular, is 100000 times more prone to light damage than skin when working in the range of 400–1400 nm. Detection of retinal laser damage requires detailed clinical examination and imaging as they can be subtle and mimic other retinal diseases. Multicolor imaging (MC) of the retina is a novel imaging modality that is increasingly being used to identify various retinal conditions. We herein report multimodal imaging features of laser-induced accidental retinal injury in a dentist.

Case Report

A 58-year-old dentist presented with a blurring of vision in both eyes following exposure to diode laser a day ago. The best-corrected visual acuity (BCVA) was 6/6 N6 in the right and 6/60 N36 in the left eye. He had a history of central serous chorioretinopathy (CSC) in the left eye few years ago.

Old records revealed the BCVA was same as the current visit in both eyes. Figs. 1 and 2 depict the findings during the last visit one year ago. The right eye [Fig. 1a] had no subretinal fluid (SRF). The left eye had SRF, noted on MC image [Fig. 1b] using Spectralis spectral-domain optical coherence tomography (SDOCT). SDOCT of the right eye [Fig. 1c] was normal whereas the left eye [Fig. 1d] showed fibrin at fovea and SRF. Blue light autofluorescence (BAF) image of the right eye [Fig. 1e] was remarkable during his last visit. The left eye showed hyperfluorescence over SRF [Fig. 1f]. Individual blue reflectance (BR) [Fig. 2a], green reflectance (GR) [Fig. 2c], and infrared reflectance (IR) image [Fig. 2e] of right eye were normal. Compared to BR [Fig. 2b] and GR images [Fig. 2d], the extent of the SRF was best seen on the IR image [Fig. 2f] in the left eye.

Clinical examination with an indirect ophthalmoscope and slit-lamp biomicroscopy at the current visit after exposure to laser was unremarkable in the right eye whereas the left eye showed retinal pigment epithelium (RPE) atrophy and trace subretinal fluid. The color fundus photograph of the right eye [Fig. 3a] was unremarkable whereas the left eye [Fig. 3b] showed RPE alterations. MC image [Fig. 3c] of the right eye showed a circumscribed area of orange-yellow hue involving both arcades, papillomacular bundle, and fovea. There was an optic disc sized circular zone of altered hue near the superior arcade. MC image of the left eye [Fig. 3d] showed a margin of RPE atrophy as a darker hue. SDOCT image of the right eye [Fig. 3e] showed no change in the retinal layers whereas the left eye showed trace SRF and loss of outer retinal layers [Fig. 3f]. BAF image of the right eye [Fig. 3g] showed a circumscribed area of hyperautofluorescence corresponding to the circular zone of altered hue on the MC image. BAF image of the left eye [Fig. 3h] continued to show hyperautofluorescence due to trace SRF. Circumscribed areas of hyperreflectance were noted on BR [Fig. 4a], GR [Fig. 4c], and IR [Fig. 4e] images in the right eye, which corresponded to the orange-yellow hue seen on MC image. The circular zone of altered hue was best seen on IR [Fig. 4e] image. Boundaries of SRF were best seen on GR [Fig. 4b,d and f] image in the left eye. A diagnosis of laser-induced retinal injury in the right eye was made.

Discussion

Retinal injury due to laser can occur both as exposure during work or accidental exposure to laser pointers. The present case highlights the adverse effect of such an exposure as an occupational hazard in a dentist, which is hitherto unreported in literature.

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Cite this article as: Roy R, Saurabh K, Biswas RK, Kochgawoy L, Sinha S, Nandi K, et al. Detection of retinal laser injury using confocal scanning laser imaging. Indian J Ophthalmol 2020;68:1688-91.
Although the patient maintained BCVA in the right eye and clinically did not have any discernible retinal change, the MC image showed the altered retinal reflectivity after exposure. The optic disc sized circular zone of altered hue noted on the MC image [Fig. 3a] corresponded with the circumscribed area of hyperautofluorescence noted on BAF [Fig. 3e], which suggests that this area might be the point of impact of a laser beam. The hyperautofluorescence on BAF may have been caused by increased photoreceptor degradation and increased production of lipofuscin within the area. What MC image further added to the knowledge was the exact and larger extent of retinal involvement due to laser, which extended beyond the area of hyperautofluorescence and involved the entire retina between fovea and optic disc. It is intriguing to note that SDOCT scan of this area did not show any change in the retinal architecture at the present time. The SDOCT changes would probably develop with time.

Individual reflectance images of the right eye showed the same area of hyperreflectance coinciding with the orange-red hue noted on the MC image. The hyperreflectance was most pronounced on the GR image [Fig. 4c] suggesting affection of the inner and middle retinal layers more than outer retinal layers. MC, BAF, and reflectance image of the left eye remained unchanged after laser exposure, which may be because the patient was using the right eye alone while working.

**Conclusion**

The present case highlights the risk associated with accidental exposure to the dental laser to the retina. It also highlights the role of MC imaging to detect the retinal damage, which was not clinically discernible.

**Declaration of patient consent**

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

**Financial support and sponsorship**

Nil.
Figure 3: (a) Color fundus photograph of right eye shows normal fundus. (b) Color fundus photograph of left eye showed RPE alterations. (c) After laser exposure the MC image of right eye showed circumscribed area of orange – yellow hue over macula over area between optic disc and fovea. Within this area there was a circular zone of altered hue near (arrows) near superior arcade which was the site of laser beam impact. (d) MC image of left eye shows margins of SRF with multiple orange red areas within SRF suggestive of RPE atrophy. (e) SD OCT line scan through the macula does not show any change in the reflectivity of individual layers. (f) SD OCT image of left eye shows trace SRF with loss of external limiting membrane and ellipsoid zone along with thinning of outer nuclear layer. (g) BAF image of right eye showed a circular zone of hyperautofluorescence which corresponded with circular zone of altered hue seen on MC [Figure 3c] image. Rest of the macula showed normal fluorescence. (h) Hyperautofluorescence was noted over SRF in left eye on BAF image.

Conflicts of interest
There are no conflicts of interest.

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A 68-year-old woman with end-stage Stevens–Johnson syndrome (SJS) developed cystoid macular edema (CME) 3 months following Boston keratoprosthesis type-II implantation and developed recurrent CME after 2 weeks with full visual and anatomical recovery. Here, we describe the first case report of recurrent CME following Boston KPro Type-II implantation.

The Boston keratoprosthesis type II (KPro-II) implantation and cystoid macular edema (CME) following Boston keratoprosthesis type II implantation: A treatment option.

Key words: Boston keratoprosthesis type-II implantation, cystoid macular edema, peribulbar injection of triamcinolone acetonide (TA).

Case Report

A 68-year-old woman with end-stage SJS was operated for Boston KPro-II keratoprosthesis type-II implantation in August 2018 [Fig. 1a]. This was combined with extracapsular cataract surgery (ECCE), pars plana vitrectomy (PPV), and Ahmed valve (AGV) implantation along with intraocular lens implantation.

The reported incidence of CME following Boston KPro-II implantation was 8.3%, but, without any treatment guidelines in the literature. The treatment as described for ‘CME following Boston KPro Type-I’ (in which eyelids remain open just like after conventional penetrating keratoplasty) is not possible in KPro-II because of the eyelids which are protruded.

The KPro-II is similar to the KPro-I but, without any treatment guidelines so far, more than 200 Boston KPro-II implantations have been done worldwide.

The KPro-II implantation in the nondiabetic individual. She was operated for Boston KPro-II keratoprosthesis type-II implantation. Postoperative period was uneventful. On the 7th day, she developed recurrent CME.

The reported incidence of CME following Boston KPro-II implantation was 8.3%, but, without any treatment guidelines so far, more than 200 Boston KPro-II implantations have been done worldwide.

After 14 days, CME resolved completely, and she regained 20/30 vision. Seven months later, she developed recurrent CME. She was again treated with single-dose injection of triamcinolone acetonide (TA).

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