Case Report

Accidental Retinal Injury by Self-Applied Cosmetic Laser: A Case Report

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ABSTRACT

The use of lasers for dermatological procedures is common now days. We report a case of accidental retina injury and vitreous hemorrhage due to self-applied cosmetic laser, and the aftermath of the injury. A female dermatology nurse complained of blurry vision after an Nd:YAG cosmetic laser accidentally shot at her right eye. She was applying laser to her own face without wearing protective goggles. Afterwards, she felt a black line with moving shadows concealing her vision, without any pain, foreign body sensation, or redness. Her visual acuity was 6/45, with normal IOP and anterior segment. Fundus examination revealed vitreous hemorrhage, pre-retinal hemorrhage, and pallor in the peri macular area. In 10-month follow-up, the best-corrected visual acuity remained 6/6 but tractional membrane developed in the injured area. Laser injury did not directly affect the fovea, resulting in preserved vision. However, long-term follow-up is still warranted to monitor late complications.

Keywords: Laser, Retinal hemorrhage, Vitreous hemorrhage, Nd:YAG.

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INTRODUCTION

The increasing use of lasers for facial dermatologic procedure imposes higher risk for accidental injuries, including ophthalmic injuries due to the proximity of the probe to the eye. The injury can range from minor to severe in various parts of the eye, such as iris atrophy, bullous keratopathy, cataract, uveitis, glaucoma, and posterior synechiae. The retina is also at risk for laser injuries and may cause severe visual impairment due to macular holes, retinal hemorrhage, Epiretinal membrane, and choroidal neovascularization. We describe a case of accidental retinal injury and vitreous hemorrhage due to self-applied cosmetic laser, with preserved vision and development of retinal tractional membrane at follow-up.

Case Presentation

A 29-year-old female dermatology nurse presented to the emergency department with blurred vision in her right eye following accidental exposure to a cosmetic Nd:YAG laser. It was a Q-switched Nd:YAG cosmetic laser (Fotona, Europe).She was applying the laser to her own face without any protective goggles. After the incident, she felt a black line with a moving gray shadow concealing her vision. No pain, foreign body sensation, nor red eye was reported. Her presenting visual acuity (VA) was 6/45 without correction with normal intraocular pressure. There were no inflammatory cells in the anterior chamber, no lens opacity or any pupillary defect. The right fundus examination using indirect ophthalmoscope revealed vitreous hemorrhage, pre-retinal hemorrhage, and

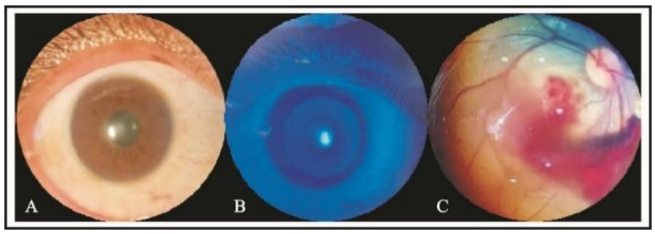

Figure1: (Adriono, Nadhira, Amerina, Primaputri, Barus). Initial presentation of the right eye. Anterior segment revealed no corneal burns or other abnormalities (A and B), while fundus examination showed vitreous hemorrhage, pre-retinal hemorrhage, and retinal pallor at peri-macula area (C). Vision of the right eye was 6/45.

pallor at peri-macula area (Figure 1). No damage was observed at the center of the macula.

We diagnosed her with a vitreous hemorrhage and laser-induced retinal injury of the right eye. We prescribed Sodium diclofenac eyedrops every three hours, oral 8 mg of methylprednisolone thrice daily, and 500 mg of tranexamic acid thrice daily. She was advised for semi- fowler position.

On the next day, VA improved to 6/6 with correction and the vitreous hemorrhage seemed to be resolved, although the pre-retinal hemorrhage and pale perifoveal area were still observed (Figure 2). Optical coherence tomography (OCT) of the macula was unremarkable (Figure 3). Oral and topical medications were continued, and 500 mg of vitamin C once daily was added to the therapy. She was advised to come for a follow- up visit within two weeks.

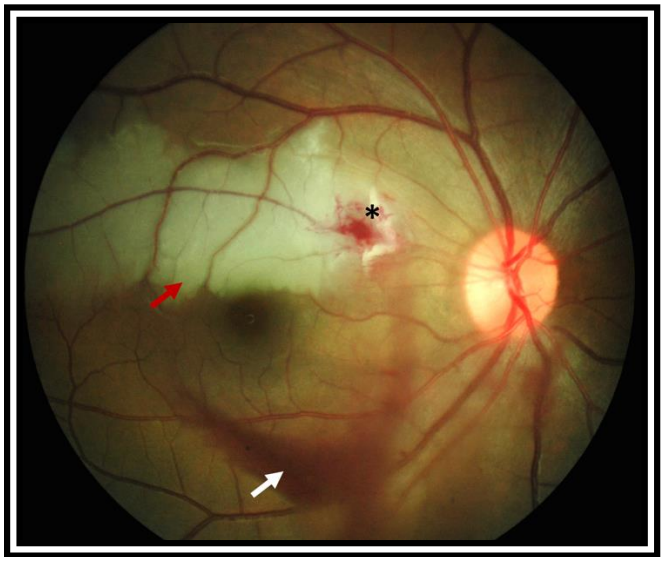

Figure 2: (Adriono, Nadhira, Amerina, Primaputri, Barus). Right eye fundus photography upon follow-up the next day, showing retinal hemorrhage (asterisk) and pallor of the superior/upper part of perifovea area (red arrow) with clearing vitreous hemorrhage (white arrow). Vision improved to 6/6 with correction.

The patient lost to follow up, and nine months later came for a routine ophthalmology examination for glasses, in which she reported a small spot with a partially diminished view on her right central vision. Her right uncorrected VA was 6/40 and achieved 6/6 with correction. The IOP and anterior segments were normal. Fundus photography showed tractional membrane covering the injury area (Figure 4). The findings were also confirmed by macular OCT (Figure 5). She was prescribed corrective glasses and scheduled for a follow-up examination in six months. She was also advised to seek immediate medical attention if she experienced any sudden worsening of vision, including symptoms such as metamorphopsia or scotoma.

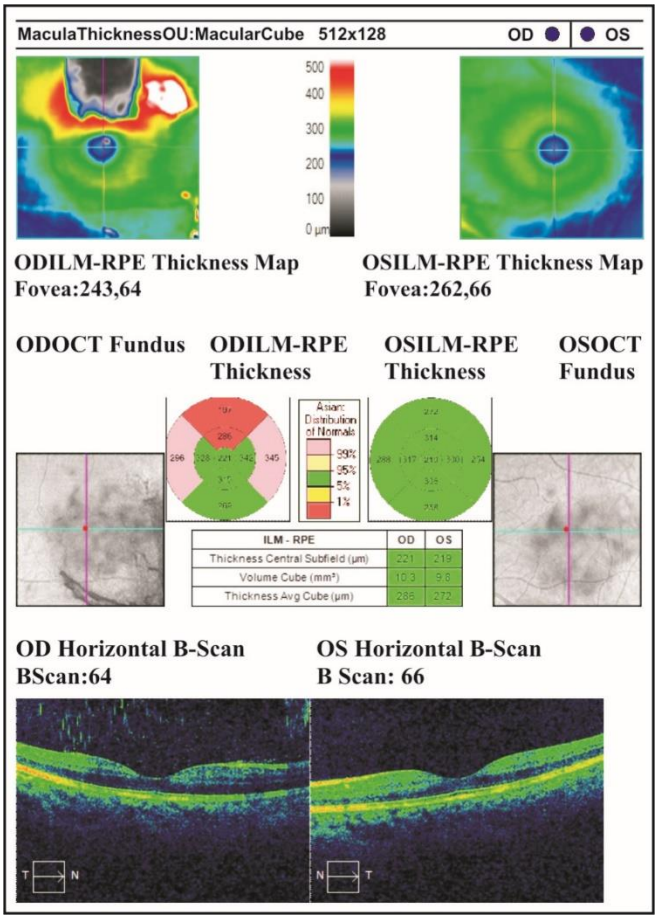

Figure 3: (Adriono, Nadhira, Amerina, Primaputri, Barus). Macula OCT of on the next day revealed normal structure of both eyes, although superior subfields showed retinal thinning of the right eye.

DISCUSSION

Since its invention and development, laser technology

has been widely applied across various fields, including medicine, academia, the military, industry, and entertainment.[1] With the growing prevalence of laser use, reports of laser-induced injuries have also increased. The mechanisms of such injuries vary and may include misuse of laser devices—such as laser pointers—accidental exposure (either self-inflicted or caused by others), or intentional assault. Lasers have been classified into four groups. Class 1 is considered safe, class 2 is considered low risk, class 3 carries moderate risk, and class 4 is marked as high risk. Class 3 and class 4 lasers are usually used for industrial purposes and ophthalmological equipment, such as procedures in glaucoma or retina.[2]

Figure 4: (Adriono, Nadhira, Amerina, Primaputri, Barus). Fundus photography of the right eye ten months after the accident showed tractional membrane covering the perimacular area of what once was the injury site (red arrow). Vision remained 6/6 with correction.

Based on Canadian Community Health Survey, out of all laser-induced injuries reported in Canada in 2019, 59.1% affected the eyes.[3] Majority of the injuries resulted from cosmetic laser. Our patient was a female nurse who worked in a dermatology clinic and was accidentally injured while applying laser to her own face without using protection. The most reported clinical symptoms after laser-induced ocular injury are itchiness, floaters, pain, blurry vision, burning sensation, flash blindness, and epiphora.[3] Our patient complained of blurry vision without other symptoms.

The optical characteristics of the ocular structures and the laser's wavelength determine the tissue implicated in laser-induced ocular damage.[2] Various parts of the eye, from the eyelid, cornea, iris, lens, to the retina, can be subject to laser-induced injuries. Iris atrophy, lens opacity, anterior chamber inflammation, visual field defect, glaucoma, and posterior synechiae, have been reported.[4] However, the laser-induced damages to other ocular tissues apart from the retina, are actually rare.[2] This is because these structures are usually optically transparent, and the eye's refractive power concentrates the beam into the retina.[1,2] Laser injury to the retina ranges from focal retinal defects, hemorrhage, cystoid macular edema and macular holes.[5]

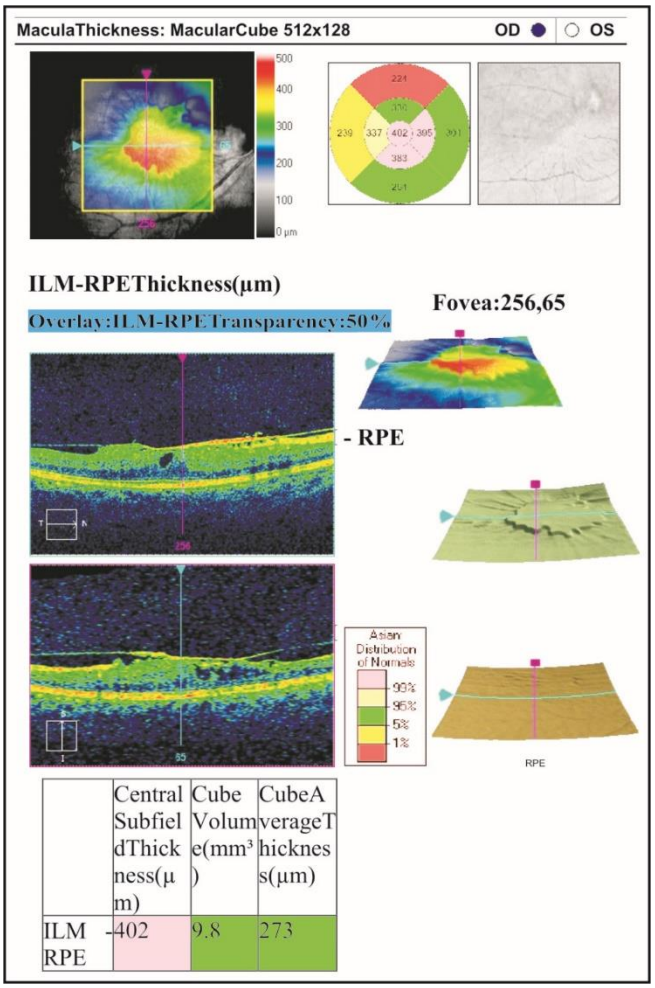

Figure5: (Adriono, Nadhira, Amerina, Primaputri, Barus). OCT of the right eye macula ten months after injury, showing epiretinal membrane attached to the central area of the macula, as well as macular edema and intraretinal fluid.

The natural blink reflex and aversion responses offer only partial protection against laser exposure, and are generally effective only for lasers up to Class 2

(output power less than 1 mW).[2] The interaction between laser beams and human tissue depends on the energy level and pulse duration of the laser, and the resulting damage mechanisms can be classified into three main types: photodisruptive, photochemical, and photothermal effects.[2] Photodisruptive reaction results from the energy that is rapidly absorbed with a pulse duration of between picoseconds and nanoseconds.[1] Rapid temperature rise leads to the loss of electrons from atoms and the tissue breakdown into plasma. A compressive pressure pulse is produced along with the subsequent vaporization of water molecules, mechanically disturbing the tissues in the area.[2,6]

The laser used by our patient was a Q-switched Nd:YAG laser, and it caused a photodisruptive effect. It generally results in more severe damage because of the high-power concentration produced in a limited area.[2] A similar case was reported by Kim et al, in which dermatological laser was used.[7] The patient usually reports seeing dark large spots or large floating objects.[8] This symptom was also present in our patient, in line with initial findings of pre-retinal and vitreous hemorrhage. However, her best corrected VA was preserved as the fovea remained unaffected. It gradually improved as the vitreous hemorrhage was clearing. Some others reported effects include pigmentary changes (hypopigmentation or hyperpigmentation) and macular hole formation.[2]

At 10-month follow-up, scotoma was present as a sequela of her injury, acknowledged as a spot with partially diminished vision of her right eye, most likely due to the presence of fibrous traction in her retina. Barkana et al, have reported retinal scarring and contraction at 1-year follow-up of a patient with accidental Nd:YAG laser injury.[6]

There is currently no agreed algorithm in the diagnosis and management of laser-induced retinal injury. Fundus photography and macular OCT are useful in identifying the extent of retinal lesion and macular involvement, as well as the progression of the injury.[7] Subjective functional impairments, such as metamorphopsia and scotoma, can be examined by Amsler grid test.

The purpose of given treatments in this case was to minimize inflammatory response. Head-up position was advised to let the hemorrhage settle down. Tranexamic acid was given to inhibit the breakdown of fibrin clots and corticosteroids were given to control inflammation, albeit no consensus on dosing has been determined.[6] In a study by Chen et al, complete or partial recovery of the outer nuclear and internal limiting membrane layers, as well as improvement of VA, were observed in a group of laser-induced maculopathy patients that received oral prednisolone of 1mg/kg for three days, and then tapered by 10mg/week during the initial period of the injury.[9] An experimental study on monkeys by Brown et al, reported an improvement in photoreceptor survival after administration of systemic corticosteroids.[5] Corticosteroids may decrease cytokine release and conserve the integrity of blood-retinal barrier, hence minimizing damage caused by the laser.[9,10]

Marinescu et al, reported favorable outcome in laser-induced retinal injury after administration of oral prednisolone in fast-tapering regimen, followed by consumption of lutein a week after the injury.[10] We prescribed oral vitamin C once daily as ascorbic acid promotes fibroblast activity, acts as antioxidant and prevents further light-induced retinal damage.[4,7]

Most of such injuries show initial improvement, but more serious lesions and complications may necessitate surgical intervention, such as non-clearing retinal hemorrhage, full-thickness macular holes, epiretinal membrane, macular pucker, and formation of pre-retinal membrane.[2,6] In cases of smaller retinal holes (under 250 mm), observation can be an option since spontaneous closures have been documented.[2] Cases where macular pucker develops can also be observed, as regression has been reported previously.[6] We chose to monitor our patient closely without initiating surgery since her VA was preserved without remarkable complaints regarding her vision.

The prognosis of laser-related ocular injury is determined by the extent of the lesion, distance from macula and the presence of long-term sequelae.[2]

To our knowledge, this is the first reported case of laser-related retinal injury with a long-term follow-up of ten months, supported by both fundus photography and macular OCT imaging. Although further cases and research are necessary to draw definitive conclusions, our findings suggest that even in patients with preserved visual acuity, prolonged monitoring is warranted to detect potential long-term sequelae that may require further intervention.

CONCLUSION

Laser may cause permanent damage to ocular tissues, especially retina. Visual acuity may be preserved if the fovea is not affected. Comprehensive examination and

documentation with multimodal imaging during presentation and follow-up period are necessary to monitor possible late complications that may cause visual deterioration. Safe practice of laser procedure is mandatory, especially wearing protective goggles and avoid performing self-applied laser, to prevent laser-induced ophthalmic injury.

Patient's Consent: Researchers followed the guide lines set forth in the Declaration of Helsinki.

Conflict of Interest: Authors declared no conflict of interest.

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