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Case Report

LASER Toy-induced Macular Burn: An Illustrative Case

Adam Mohammed Elbarghathi[1], Ruwida Mohammed Abdullah[1]

[1]Department of Ophthalmology, University of Benghazi, Benghazi, Libya

Abstract

Introduction: Light amplification by stimulated emission of radiation (LASER) toys are widely available in the market with no clear information about their wavelength and hazardous effects. To be safe to the eyes, LASER should be classified <3b (according to international safety classification). **Case History:** We here report an illustrative case of macular injury post LASER toy direct exposure. A 12-year-old boy, previously known hypermetrope with left-eye (LE) amblyopia, presented complaining of drop of vision in the right eye (RE) after his colleague pointed a LASER toy directly over his RE. His corrected visual acuity (VA) was 5/60 (amblyopic) in the LE and 6/18 in the RE. The anterior segment was normal in both eyes. Fundus examination showed the LE to be normal, and the RE had a macular yellowish, oval-shaped lesion. Optical coherence tomography and fundus picture revealed central macular burn. Local and systemic corticosteroids were prescribed tapering over 9 days. After 1-week, the patient noticed some improvement in VA in RE to 6/9. **Conclusion:** LASER toys available in several markets are reported to be vision threatening and cause macular burn which responds partially to corticosteroids. More education and strict regulation of distribution and use of LASER toys and instruments is urgently needed.

Keywords: Corticosteroids, LASER toys, macular burn

Introduction

Light amplification by stimulated emission of radiation (LASER) is a highly monochromatic and coherent radiation beam. LASER effect on ocular tissues depends on the wavelength, duration of exposure, and tissue absorption characteristics, but when it exceeds the threshold, it causes tissue damage by ionization and thermal and photochromic effects, which all depend on the duration of exposure. LASER is classified according to their safety by many classifications in the United States, Canada and the European community. The International Safety Classification of LASERs is summarized in Table 1.[1] All lasers, including those used in ophthalmology, are capable of damaging the eye and are classified as 3b or 4.[1]

LASER toys are widely available in several regions including the Libyan market. In Libya, they cost between 5 and 350 Libyan Dinars according to their power. However, many people are ignorant about their harmful effects. In many countries, LASER instruments including toys are regulated. For instance, in the United Kingdom, Public Health England recommends that the so-called toy LASERS should be British Standard Class 2 lasers or less.[2]

We report a case of maculopathy following exposure to locally available LASER toy to illustrate the clinical picture, investigations, and response to management.

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Case Report

A 12-year-old boy, who is previously known hypermetrope with left-eye (LE) amblyopia, presented complaining of blurred vision in the right eye (RE) after his classl-mate pointed a LASER toy directly over his RE while he was wearing his glasses. On examination, his best-corrected visual acuity (BCVA) was LE 5/60 (amblyopic) and RE 6/18. Autorefractometer reading was as follows: RE +2.37 DS/+0.12 DC 2° and LE +5.75 DS/+0.75 DC 95° (miosis). The anterior segment was normal bilaterally. Fundus examination showed LE to be normal, and the RE had a macular yellowish, oval-shaped lesion. Optical coherence tomography (OCT-TOPCON 3D OCT-2000, 3D macula) of the RE revealed the following: no evidence of peripheral vascular disease (PVD) or vitreomacular traction (VMT), persevered foveal pit, central foveal thickness: +149 μ, and subfoveal hyporeflective outer retinal cavity-simulating lesion, with interrupted both external limiting membrane and

Address for correspondence: Dr. Ruwida Mohammed Abdullah, Department of Ophthalmology, University of Benghazi, Benghazi, Libya.
E-mail: weda.libya@gmail.com

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Table 1: International Safety Classification of light amplification by stimulated emission of radiation

Class	Output (mW)	Common name	Safety
1	≤0.0004	Blue or green	Eye safe
	≤0.024	Red	
2	<1	Visible wavelengths	Eye safe: Brightness causes blink and aversion
3a	1-5	Visible wavelengths	Eye safe: Brightness causes blink and aversion
3b	5-500	Visible wavelengths	Significant eye damage, for example, retinal photocoagulation
4	≥500	Visible wavelengths	Serious irreversible damage, for example, medical, industrial, military

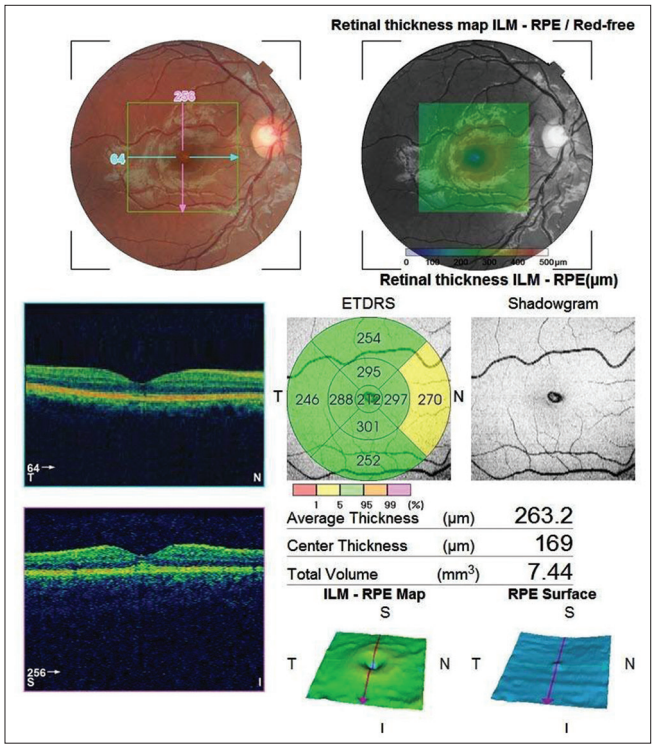

Figure 1: Optical coherence tomography of the right eye on the first visit after LASER toy macular burn

photoreceptor integrity line (IS/OS junction) [Figure 1], all indicative of macular burn lesion.

Both local Pred Forte eyedrops (1% w/v eyedrops suspension) four times daily and systemic steroid syrup (dose calculated based on his weight) were prescribed with tapering over 9 days for both.

After 1-week follow-up, the patient noticed some improvement in BCVA in RE 6/9 partial, and cycloplegic refraction (paralysis of ciliary muscles which leads to loss of accommodation) done RE revealed +4.00 DS, LE: +6.25 DS/+0.5 DC 90°. Fundus examination to the RE revealed the following: the same lesion was seen with healing margins. On OCT, there was no evidence of PVD or VMT, persevered foveal pit contour with normal retinal thickness, and distorted outer retinal layers with cavity-simulating lesion, caused by interrupted external limiting membrane and photoreceptor integrity line [Figure 2].

Monthly follow-up was done for 6 months, and unfortunately the same lesion was seen in OCT, BCVA 6/9.

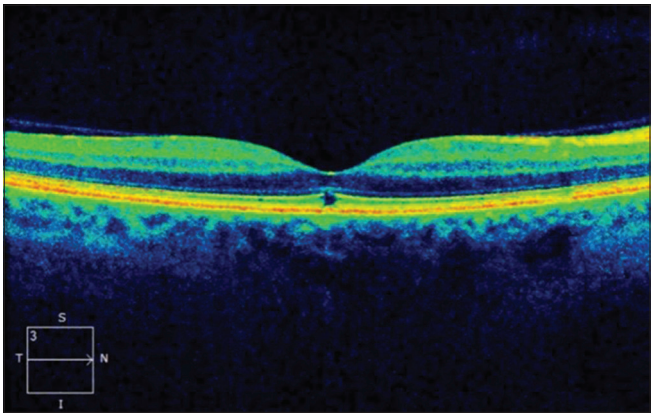

Figure 2: Optical coherence tomography of the right eye after 1 week of the trauma, distorted outer retinal layers with cavity lesion, caused by interrupted external limiting membrane and photoreceptor integrity line

Discussion

LASER pointers and toys are commonly used by children and young adults. While adults terminate accidental laser pointer exposure in <0.25 s by pupillary, blink, and aversion responses, children have been reported to display an "unusual" behavior, i.e., staring for a prolonged period of time into the laser beam without blinking or averting the eye.[3,4] In many developing countries including Libya, LASER points and toys are widely available, especially during celebrations and festive seasons (Eid). Many previously reported cases have occurred in parties. However, LASER misuse has also been reported due to harassment and school bullying similar to our case.[5]

Several factors contribute to laser-related retinal damage. These can be divided into two categories, namely, laser-related factors and patient-related factors.[6] Laser-related factors include wavelength of the radiation, pulse duration, and energy level of the beam. Whereas, patient-related factors include size of the pupil with injury being more severe in larger pupil sizes; degree of retinal pigmentation with dark-skinned individuals suffering more severe injury than light-skinned ones; proximity of incident beam to the fovea; and refraction status, with damage being more severe in emmetropic eyes due to the laser beam being more focused on the retina.[6]

A recent systematic review of the literature (2017) identified 48 publications describing a total of 111 patients in whom both acute and permanent damage due to laser pointers was documented.[7] The wide spectrum of damages to the retina and

the limited therapies available were highlighted.[7] Most notable is the macular injury caused by Class IIIA and higher LASER instruments.[8-11] In our case, the nature of exposure could not be ascertained as he was a victim of harassment. In addition, as this has happened while he was wearing his glasses, perhaps, the glasses' dioptric power could have played a role.[5,6]

Several types of maculopathies have been described due to LASER toys or pointers.[10] These include intraocular hemorrhage with subhyaloid hemorrhage, subinternal limiting membrane hemorrhage, a full-thickness macular hole, an outer retinal disruption, an epiretinal membrane and a schisis-like cavity, retinal pigment epithelium alterations, macular burn similar to our case, and vitreous hemorrhages.[11]

Treatment for LASER-induced retinal injuries is uncertain. Oral corticosteroids have been used perhaps empirically.[6] We have used steroids both locally and systemically but we accept that its role remains controversial. The use of steroids was tried in several studies previously. For instance, Brown *et al*. suggested that treatment with systemic methylprednisolone improves photoreceptor survival in argon retinal lesions in rhesus monkeys.[12] However, the final outcome and vision improvement in humans depend on the size and location of the macular lesion.[13]

The present case lend further support to the literature recommending rigorous regulation of potentially hazardous vision-threatening LASER toys and perhaps even pointers, with strict restrictions from local authorities on their import and prevent access and and us by children. Further restrictions on their sale and use by the general public will require more than simple recommendations. Legislation will have to be passed and enforced by health and safety authorities. Perhaps, education of the public through media campaigns before and during festivities may be more fruitful.

Conclusion

LASER toys available in the Libyan market are reported to be vision threatening and cause macular burn which may improve partially by corticosteroids. Regulatory restriction on their use by irresponsible or vulnerable individuals is an urgent matter.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient's guardian has given his consent for his child's images and other clinical information to be reported in the journal. The patient's guardian understands that his child's name and initials will not be published and due efforts will be made to conceal identity, but anonymity cannot be guaranteed.

Authors' contributions

Both authors contributed to the care of the patient, drafting of the case report, revision, and approval of its final version.

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Conflicts of interest

There are no conflicts of interest.

Compliance with ethical principles

No prior ethical approval is usually required for single case reports. However, the parents of the patient provided consent for publication as stated above.

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