Bilateral macular injury from a green laser pointer

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Abstract: We report the case of a 13-year-old boy who had a bilateral macular injury after playing with a green laser pointer for a duration of 1 minute. Clinical examination revealed a decrease in visual acuity and macular injury in both eyes, and imaging investigations revealed a bilateral macular lesion due to exposure to the laser pointer. At 3 months’ follow up, visual function had improved but remained partially impaired. This case emphasizes the importance of cautious and appropriate use of laser pointer devices because of the potential vision-threatening hazards induced by mishandling of these devices.

Keywords: green laser pointer, bilateral, macular injury

Introduction
Lasers produce a beam of light that is coherent, monochromatic, and unidirectional, and can converge most of its radiant power over small areas, even at great distances. Laser pointers are useful ubiquitous devices used in everyday situations, especially in the educational environment. They are also used frequently by children as toys. Their potential to cause retinal damage is a matter of concern, and manufacturers warn against injudicious ocular exposure to laser light. Low-energy green laser pointers are generally considered to be safe devices and their potential to cause retinal damage is questionable. Here we report a case of macular damage caused by a green laser pointer in a teenager, along with a brief review of the literature.

Case report
A 13-year-old boy presented to our clinic complaining of decreased vision in both eyes 1 day after having intentionally gazed directly into the beam of a green laser pointing device (wavelength 532 nm), that had a maximum power rating of 5 mW (US Food and Drug Administration class 3A or IEC class 3R) stated on its labeling. He held the laser 5 cm away from his eyes for an estimated 30–60 seconds. Prior to this incident, the boy had reported no visual complaints. His last ocular examination had revealed visual acuity of 20/20 in both eyes.

Current examination revealed best-corrected visual acuity of 20/50 in the right eye and 20/30 in the left eye. Anterior segments were normal in both eyes. Fundus examination showed bilateral, yellowish, oval-shaped, drusenoid-like lesions with attenuation of the foveal reflex (Figure 1A and B).

Imaging studies were done on presentation to our practice 18 hours after exposure to the laser device. Optical coherence tomography (3D OCT; Topcon, Tokyo, Japan)
of both eyes showed disruption of the outer retinal layer with nonspecific retinal thickening (Figure 2A and B); red-free photographs demonstrated hypopigmented foveal dots bilaterally (Figure 1C and D); fluorescein angiography showed early foveal hyperfluorescence in both eyes with late ill-defined leakage (Figure 1E and F); and autofluorescence images showed heterogeneous hyperfluorescence in the macula of both eyes (Figure 1G and H). Finally, a computerized 10–2 visual field threshold test (Humphrey Automated Perimeter; Humphrey Instruments, San Leandro, CA, USA), showed small pericentral scotomata in the right eye and a normal field in the left eye.

The patient was treated with an oral steroid (Prednisone; H.J. Harkins Company, Inc., Grover Beach, CA, USA) 1 mg/kg for 4 weeks then tapered over 2 months. At 3 months, visual acuity remained impaired but improved to 20/30 in the right eye and 20/25 in the left eye.

At 3 months, optical coherence tomography showed improvement of the retinal thickening in both eyes. The hyperreflective line representing the inner segment/outer segment junction was disrupted in the right eye and the left eye (Figure 2C and D). The visual field improved and no scotoma was detected in the right eye.

Discussion

Laser pointer devices are a common and essential part of everyday life. This may lead to an increasing number of exposures to this type of laser device. However, there is debate about the ocular risks posed by inadvertent exposure to standard laser pointer devices, with the presence of an actual laser-induced injury often inconclusive or entirely absent in some studies. Literature supporting laser pointer-induced retinal injury has been limited to only a few articles on class 3A red laser
Table 1: Reported cases in the literature of retinal damage caused specifically by green lasers

<table>
<thead>
<tr>
<th>Reference</th>
<th>Age (years)</th>
<th>Eye</th>
<th>Wavelength of laser (color)</th>
<th>Initial fundus findings</th>
<th>Initial OCT findings</th>
<th>Initial FAF findings</th>
<th>Initial FA findings</th>
<th>F/U</th>
<th>Findings at last F/U</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fujinami et al</td>
<td>8</td>
<td>OD</td>
<td>Green, unknown wavelength, unknown power</td>
<td>Macular yellow exudate-like lesion or fibrous tissue surrounded by subretinal hemorrhage OD</td>
<td>–</td>
<td>–</td>
<td>n/s</td>
<td>36M</td>
<td>TD-OCT at 24 months F/U, macular CNV OD</td>
</tr>
<tr>
<td>Wysch et al</td>
<td>10</td>
<td>OU</td>
<td>Green, unknown wavelength, 150 mW (class 3B)</td>
<td>Multiple tiny scars OD Macular edema and central subretinal hemorrhage OS</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>4M</td>
<td>On examination, foveal hyperpigmented scar OU</td>
</tr>
<tr>
<td>Ziahoesseini et al</td>
<td>Teens</td>
<td>OU</td>
<td>Green, unknown wavelength, unknown power</td>
<td>Foveolar burns with hyperpigmented borders OU</td>
<td>Subfoveal disturbances in the RPE OU</td>
<td>–</td>
<td>Foveolar window defect (i.e., late leakage) OU</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Hossein et al</td>
<td>25</td>
<td>OD</td>
<td>Green, wavelength 532 nm, 3.5–4.5 mW (class 3A)</td>
<td>Yellow-white spot at foveola OD</td>
<td>On SD-OCT, foveolar full-thickness hyper-reflective signal OU</td>
<td>–</td>
<td>On SD-OCT, residual disruption of retinal layer OD</td>
<td>6M</td>
<td>–</td>
</tr>
<tr>
<td>Pollithy et al</td>
<td>11</td>
<td>OU</td>
<td>Green, 532 ± 10 nm, &lt; 100 mW (class B)</td>
<td>Circular-shaped defects of RPE with surrounding hyperpigmentation in fovea OU</td>
<td>On TD-OCT, foveolar disruption of retinal layer at RPE photoreceptor layer OU</td>
<td>Irregular areas of reduced autofluorescence in fovea OU</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Dirani A (current study)</td>
<td>13</td>
<td>OU</td>
<td>Green, 532 nm, 5 mW (class 3A)</td>
<td>Foveolar yellowish, oval-shaped, drusenoid-like lesions OU</td>
<td>Disruption of outer retinal layers with nonspecific hyperpigmentation OU</td>
<td>Foveolar areas of heterogeneous hyperfluorescence OU</td>
<td>Foveolar late ill-defined leakage OU</td>
<td>3M</td>
<td>Disruption of IS/OS junction</td>
</tr>
</tbody>
</table>

Abbreviations: FAF, fundus autofluorescence imaging; FA, fluorescein angiography; F/U, follow-up; IS/OS, inner segment/outer segment; RPE, retinal pigment epithelium; TD-OCT, time domain optical coherence tomography; SD-OCT, spectral domain optical coherence tomography; OU, both eyes; OD, right eye; OS, left eye; CNV, choroidal neovascularization; M, months; n/s, non specified.
��，更多的文献已经研究到对光的伤害，特别是激光笔。推荐的购买和使用规定这些设备需要更严格的限制。此外，考虑通过政府机构发布立法。

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**References**