Laser Pointer Retinal Injury: A Case Report

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ABSTRACT

A healthy 15-year-old boy presented with decreased visual acuity and central blur in the right eye following the misapplication of a green laser pointer. Focal retinal pigment epithelial disturbance at the fovea was revealed on optical coherence tomography and ophthalmoscopy examination. Visual function remained impaired 9 weeks following the incident, however it is unclear whether the misuse of laser pointers results in a permanent decrease in vision. This case emphasises that laser pointer devices may cause macular injury when used inappropriately.

Keywords: laser pointer, retina, retinal pigment epithelium

INTRODUCTION

Handheld laser pointers are commercially available for purchase in Australia or via the internet and are used in lecture theatres and sometimes misused as toys. Lasers are generally classified by their wavelength (visible lasers range from 400-700nm) and by power output (mW). Class 1 lasers have a power of less than 1mW, Class 2 lasers range from 1-5mW and Class 3 and 4 lasers are in excess of 5mW.[1] Commercially available laser pointers are considered Class 2 and are available in red (635nm), green (532nm) and less commonly in blue (445nm).

Previous reports of laser pointer retinal injuries have described vitreous and choroidal haemorrhage, foveal granularity, pigment epithelial scars and subretinal haemorrhage.[2-4] However it is unclear whether retinal injuries as a result of laser pointing devices result in a permanent decrease in visual acuity. While some studies reported that decreased visual acuity may be permanent, follow-up periods did not extend beyond 12 months.[5,6] In contrast, others have reported decreases in lesion size and visual improvement following retinal laser exposure.[7,8]

The importation and possession of laser pointers is regulated in Australia and the Australian government announced significant changes to the legislation in 2008 following laser pointer attacks on passenger jets in Sydney.[9] In Victoria for example, the *Control of Weapons Act 1990* stipulates that handheld laser pointers over 1mW are prohibited and both importation and possession require a 'Chief Commissioner's approval for prohibited weapons'. Difficulties arise when the power of the laser pointer is not labelled or the label is not consistent with the actual power emitted. Customs and Border Protection have reported a significant increase in the illegal importation of laser pointers as of July 2012 and cite that over 14,000 pointers were seized at Sydney International Mail Centre in a one-year period, a 60% increase.[10] This suggests that importers are either unaware of the legislation or are importing laser pointers which are described as less than 1mW but in fact are much stronger when tested.

This case report describes the injury caused by a handheld laser pointer directed at the eyes.

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CASE REPORT

A healthy 15-year-old boy presented for ophthalmic consultation complaining of decreased vision and central blur in his right eye for 3 weeks. He denied a precipitating event but upon careful questioning following ocular examination he revealed that he noticed the blur after playing with a handheld laser pointer with his friends. He remembered having the laser shone directly into his eye for an estimated 30 seconds and that it was labelled '532 nm' which is consistent with the wavelength of a green laser pointer.

His best corrected visual acuity was 6/9 right and 6/5 left. There were no anterior segment abnormalities, however examination of the posterior pole via ophthalmoscopy and retinal photography revealed a small, pale sub-macular lesion at the fovea (Figure 1). There was no sign of haemorrhage, sub-retinal fluid or exudates.

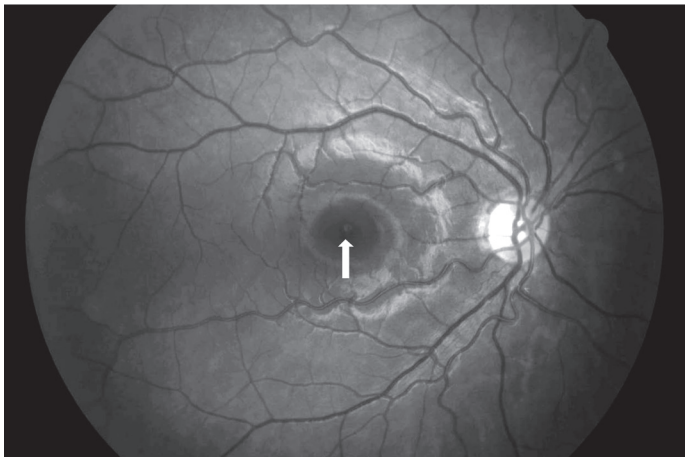

Figure 1. Pale sub-macular lesion at the fovea.

Spectral-Domain Optical Coherence Tomography (SD-OCT) was performed. This showed a small focal defect in the sub-foveal retinal pigment epithelium (RPE) and photoreceptor inner segment/outer segment (IS/OS) line (Figure 2). This highlighted that the visible abnormalities revealed via ophthalmoscopy were at the level of the RPE. Also evident were inner retinal condensations along the track of the laser beam.

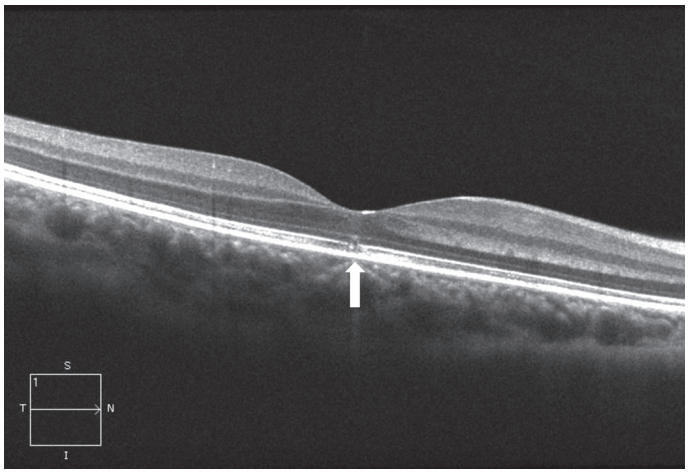

Figure 2. SD-OCT showing small focal defect in the sub-foveal retinal pigment epithelium and photoreceptor IS/OS line and inner retinal condensations along the track of the laser beam.

The patient returned 6 weeks later. The vision in his right eye had improved to 6/7.5 and the central blur had shifted slightly to the right. SD-OCT showed the small focal defect in the sub-foveal RPE and the IS/OS line (Figure 3). The inner retinal condensations had resolved but there was a track of decreased reflectivity persisting. There was no evidence of a thin shaft of increased choroidal reflectivity, indicating the focal RPE defect may have healed somewhat, presumably by metaplasia.

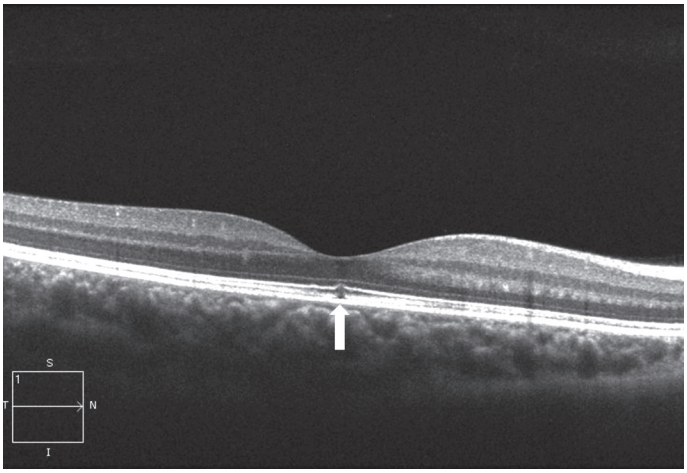

Figure 3. SD-OCT showing the small focal defect in the sub-foveal RPE and the IS/OS line. Inner retinal condensations have resolved but there is a track of decreased reflectivity left behind.

DISCUSSION

It is not surprising that retinal disturbance was observed in this case when considering that the human retina is more sensitive to shorter wavelengths.[7] This is evident from previous research that has indicated that melanin in the retinal pigment epithelium absorbs more energy at shorter wavelengths than longer wavelengths.[11]

Whilst we are uncertain as to the precise power (mW) of the laser that caused the injury to this adolescent, we do know that it was of similar wavelength (532nm) to that of an Argon laser which is commonly used by ophthalmologists in the treatment of diabetic retinopathy. Therefore, it can be hypothesised that the RPE disturbance described in the present case may be similar to that caused by argon laser treatment of retinal photocoagulation.

To date, researchers are not in agreement as to whether retinal injuries as a result of laser pointing devices result in a permanent decrease in vision. Previous case reports of individuals with retinal damage induced by green laser pointers have consistently described a reduction in lesion size and often full visual recovery at follow-up.[7,8] Therefore permanent visual impairment is unlikely in the present case. It appears that pulse duration and the energy level of the laser beam are important risk factors related to the extent of the eye injury. Furthermore, the exposed retinal location is also an important determinant of the persistence of ocular damage.[3] That is, a laser burn closer to the fovea centre results in more functional loss compared to more peripheral laser burns.[12]

The findings of this case emphasise the importance of the cautious use of commercially available green laser devices. Future research should adopt longer follow-up periods in order to determine the extent of the persistence of these laser injuries.

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