Paediatric Laser Pointer Induced Retinopathy in a Successfully Treated Amblyope: A Case Report

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ABSTRACT

A 14 year-old male presented with a two-week history of blurred vision and a central scotoma after having a laser shone into his left eye. The patient had a significant previous ocular history of an infantile non-accommodative right esotropia for which he had amblyopia therapy and strabismus surgery. The patient's amblyopia had been successfully treated with part-time occlusion resulting in equal vison of 6/6 in each eye, with a residual right micro esotropia. Clinical examination from two weeks to six months post injury revealed reduced left vision and a central scotoma which did not improve. Optical coherence tomography and fundoscopy revealed focal atrophy of the photoreceptor layer at the fovea. The patient switched fixation and now has a left micro esotropia and can maintain 6/6 vison with the use of his previously amblyopic eye. This case highlights the importance of both amblyopia treatment and the dangers of misused lasers.

Keywords: amblyopia, laser pointer, retinopathy

INTRODUCTION

Retinal laser injuries have been reported in the literature, with varying short and long-term effects including retinal haemorrhage, macular hole and photoreceptor defects which can cause reduced vision and scotomas.[1,2,3] High-powered lasers can cause thermal burns and result in photocoagulation of the retinal tissue,[1] and as such, the World Health Organization recommends that any laser above a Class 2 rating has an unacceptable risk to consumers.[4] In most Australian states low-power lasers can be commercially used and imported if their power is <1mW (Class 2).[5] This level of laser has been determined to be safe for the duration of a blink reflex which is approximately 0.25 seconds.[4]

The case of a 14 year-old with previous successfully treated strabismic amblyopia, who later suffered a focal photoreceptor defect from a handheld laser pointer being shone into his fixing eye at school, resulting in a central scotoma and reduced visual acuity in this fixing eye is presented.

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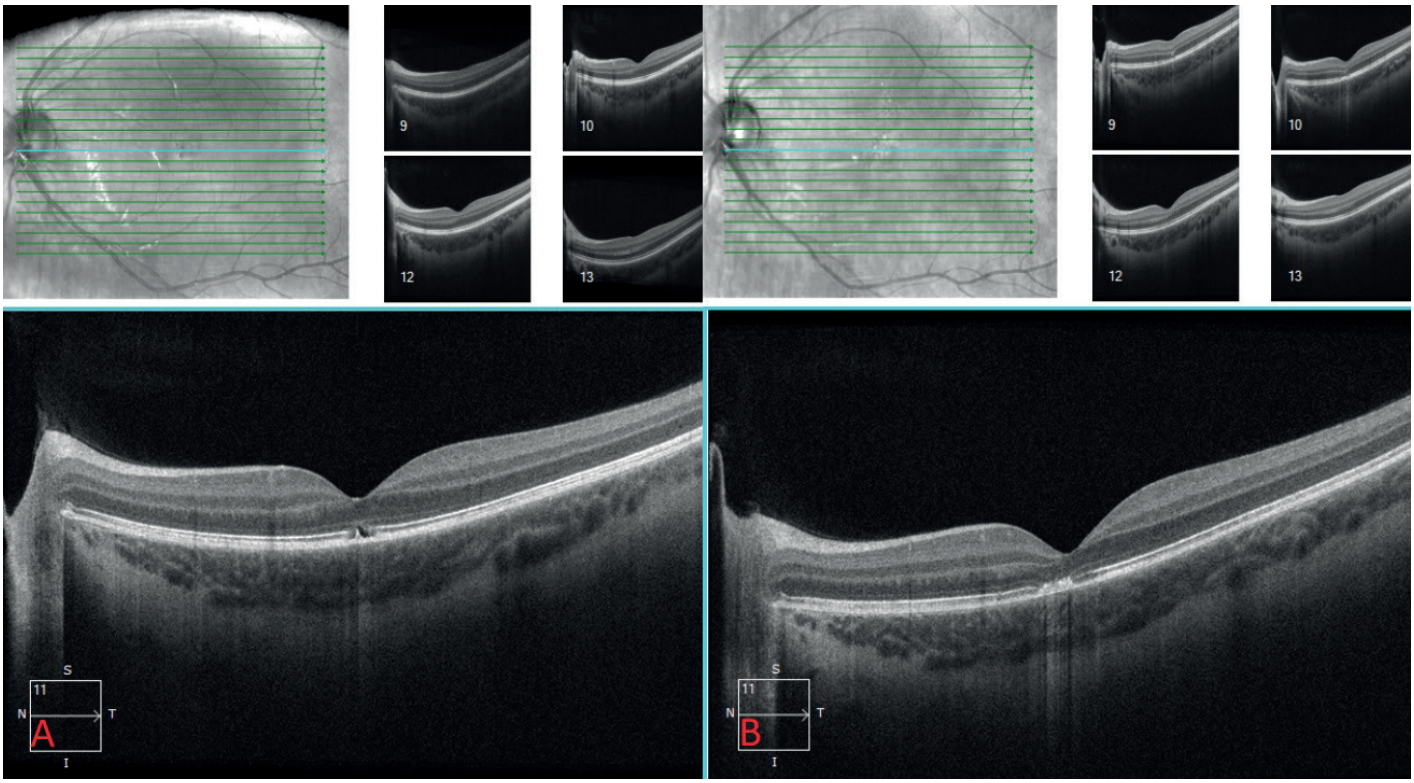
CASE REPORT

A 14 year-old male patient presented to our ophthalmology clinic 18 months early for his routine two-year strabismus review. He complained of a two-week history of blurred left vision and needing to look 'around an object/word' to identify it. His father added that his son returned from school complaining of these symptoms after he had had a bright torch shone in his eye. Approximately one week later, the patient admitted that it was in fact a green handheld laser pointer that was purchased online from the auction site eBay, that was shone into his left eye for approximately 5 seconds.

The patient's ocular history included infantile non-accommodative right esotropia for which he had been seen from birth in the public hospital system. The patient underwent two strabismus surgeries at eight years of age and has a residual right micro esotropia. He also had successful right amblyopia treatment of part-time left eye occlusion which resulted in equal vision of 6/6 in both eyes.

Upon examination the patient's Snellen chart visual acuity was right 6/6, left 6/9.5. At near he could read N5 with either eye but reading speed was slower with his left. The patient also described a central scotoma in his left eye and using eccentric fixation, explaining that he needed to 'look around an object to see it better'. A cover test at distance and near showed a right micro esotropia with dissociated vertical deviation. His intraocular pressure was normal, RE 16 and LE 13 mmHg. The optical coherence tomography (OCT) of the left eye showed



Figures 1A, foveal focal photoreceptor defect seen on optical coherence tomography two weeks post laser burn. **1B**, atrophy of photoreceptor layer eight weeks post laser burn.

a focal area of hyporeflectivity at the fovea (Figure 1A) and fundoscopy showed foveal pigmentary changes (Figures 2A and 3A), the right eye looked healthy (Figure 3B). The management at this appointment was to monitor the patient with review planned in six weeks.

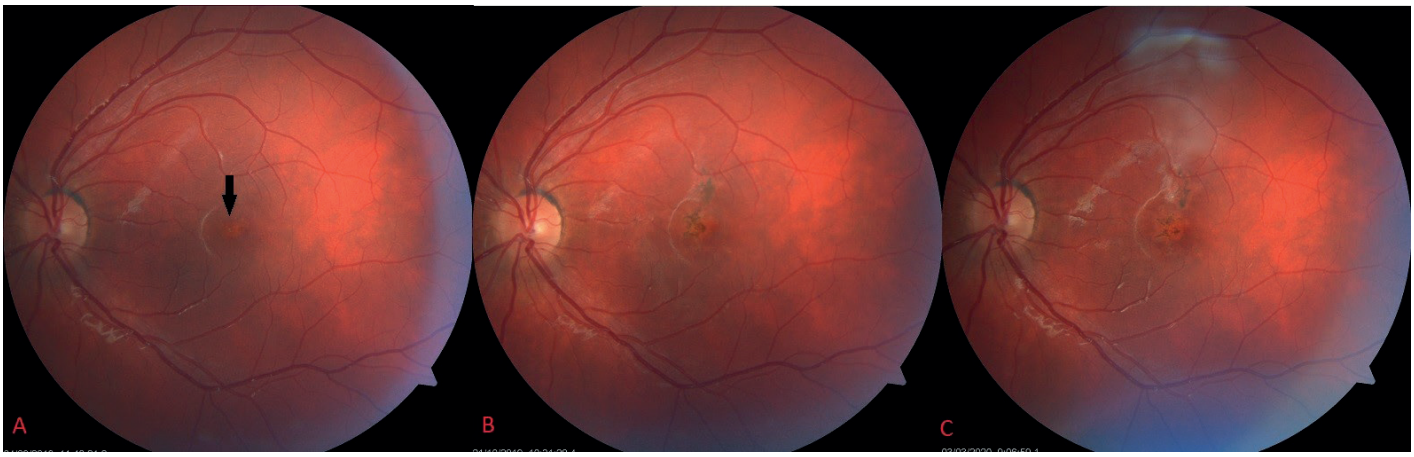
Six weeks later, the patient's left vision had reduced to 6/19 and he had switched fixation to a left micro esotropia. His fundoscopy showed atrophy at the macula (Figure 2B), also evident on the OCT which showed focal atrophy of the photoreceptor layer (Figure 1B). Management continued to be observational with no intervention and a follow-up appointment was booked for six-month's time.

At his six-month follow-up visit, visual acuity had improved slightly to 6/15, although subjectively the patient was still very bothered by his central scotoma. He maintained right fixation with a micro left esotropia and his fundoscopy was stable (Figure 2C).

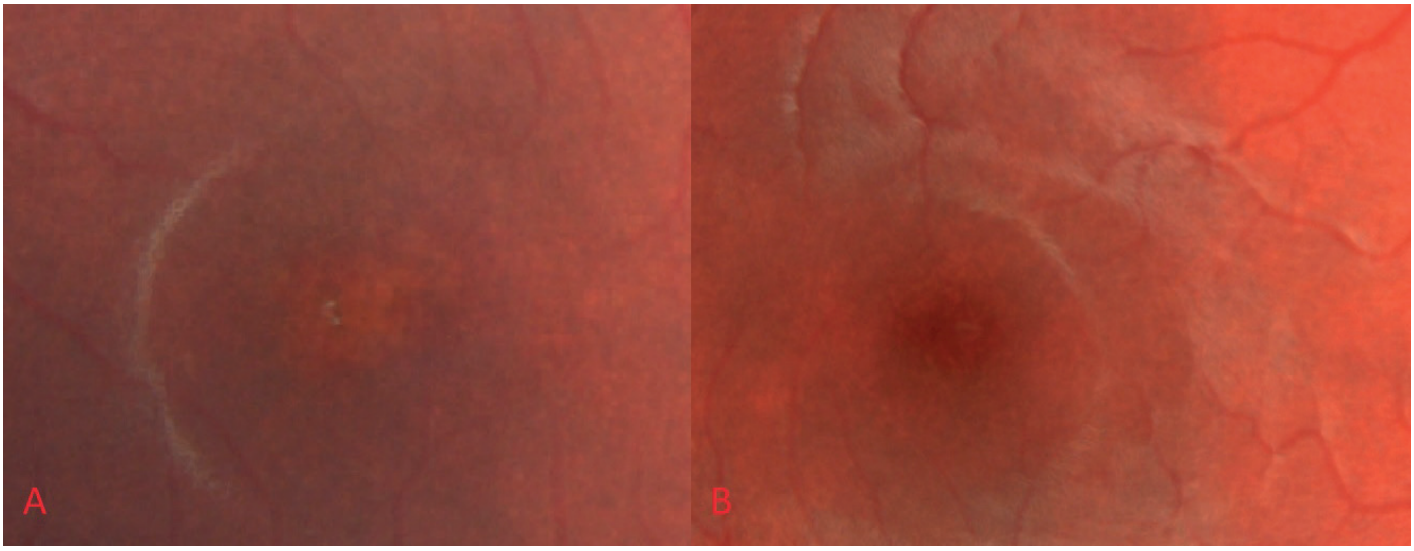
DISCUSSION

Previous studies have found that injury should not occur to retinal tissue from Class 2 (<1mW) lasers due to the protective mechanisms of the natural blink reflex.[2,4] However, our patient reported staring into the laser for up to 5 seconds eliminating this natural protection. While we do not know the power of the laser used in our case study, we do know that it was a green laser that was purchased online. It is well reported that shorter wavelengths (green 490 - 575 nm) cause more photothermal damage to the retina compared to longer wavelengths (red 635 - 750 nm) and thus may result in greater injury.[6] Additionally, it has been reported that lasers above Australia's legal import requirements are readily available at online sites. Importers package these items in ways that often pass through border security easily.[7] This has also been reported in other cases of laser maculopathy where children have been able to purchase lasers with powers of 150mW online and have suffered maculopathy as a result.[8] Our patient's obvious lack of understanding about the potential dangers from lasers demonstrate the need for wider reaching public health warnings about the risk of serious eye injuries and vision loss from laser pointers.

In patients with a focal photoreceptor defect from retinal laser burns there is limited treatment available. Subretinal haemorrhage has been reported in some cases of laser burns and this can be treated with intravitreal anti-vascular endothelial growth factor therapy.[8] The literature suggests that in most cases vision improves over the first month post exposure, but generally remains reduced.[1,8,9] Patients also report reduced perception of scotomas over time,[1] however this was not the case for our patient. Importantly for our patient's visual prognosis, he has had successful right amblyopia treatment. Untreated amblyopia would likely have resulted in permanently reduced vision potentially limiting work opportunities, social activities and his ability to drive, and resulting in a significant disablement for our patient post injury to his dominant eye.



Figures 2A, focal pigmentary change at fovea two weeks post laser burn. **2B**, atrophy at the macula eight weeks post laser burn. **2C**, stable fundus image six months post laser burn.



Figures 3A, magnified view from Figure **2A** of focal pigmentary change at fovea two weeks post laser burn. **3B**, healthy right eye comparison.

CONCLUSION

This case highlighted not only the importance of regulating the sale and importation of laser products, but also the value of paediatric eye care, specifically amblyopia treatment. Despite receiving damage to his dominant eye resulting in decreased vision and a central scotoma, due to previous successful amblyopia treatment this patient maintained excellent eyesight resulting in minimal impedance on daily activities by relying on his once amblyopic eye.

REFERENCES

1. Birtel J, Harmening WM, Krohne TU, et al. Retinal injury following laser pointer exposure: a systematic review and case series. Dtsch Arztebl Int 2017;114(49):831-837.
2. Ajudua S, Mello MJ. Shedding some light on laser pointer eye injuries. Pediatr Emerg Care 2007;23(9):669-672.
3. Vukicevic M, Gin T, Keel S. Laser pointer retinal injury: a case report. Aust Orthopt J 2014;46:14-16.
4. World Health Organization. 1998 Information Fact Sheet No. 202. Health risks from the use of laser pointers. [Cited 16 Oct 2019] Available from: https://www.who.int/uv/resources/fact/fs202laserpointers.pdf.
5. Australian Government, Australian Customs and Border Protection Service. Restriction on the importation of handheld laser pointers, 2012. [Cited 16 Oct 2019] Available from: https://ris.pmc.gov.au/sites/default/files/posts/2012/05/03-Laser-Pointers-PIR.pdf.
6. Robertson DM, McLaren JW, Salomao DR, Link PT. Retinopathy from a green laser pointer: a clinicopathologic study. Arch Ophthalmol 2005;123(5):629-633.
7. Wheatley TA. Laser pointer prohibition: improving safety or driving misclassification. 2014. Proceedings of the International Laser Safety Conference, 2013, pp. 48-54 [Cited 16 Oct 2019] Available from: https://arxiv.org/ftp/arxiv/papers/1406/1406.4924.pdf.
8. Wyrsch S, Baenninger PB, Schmid MK. Retinal injuries from a handheld laser pointer. N Engl J Med 2010;363(11):1089-1091.
9. Yeo DC, Osei-Bempong C, Shirodkar A, Williams GS. Foveal haemorrhage from makeshift 'Lightsaber': funduscopy and optical coherence tomography findings. BMJ Case Rep 2016;2016:bcr2016214711.