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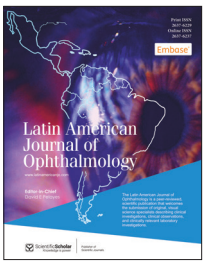

Case Report *Retina*

Unusual case of epiretinal membrane in an adolescent patient following exposure to a laser pointer

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ABSTRACT

This study aims to present a rare manifestation of ocular injury following exposure to a laser pointer. It also seeks to raise awareness about the potential hazards of such devices and the need for proper regulation. This descriptive, retrospective case report focuses on a 17-year-old male with decreased visual acuity in his left eye after accidental exposure to a green laser pointer 24 h prior. Fundoscopic examination and findings revealed a dense epiretinal membrane (ERM) with a fibrotic appearance, macular thickening, and protrusion of a large foveal fold. The patient subsequently underwent peeling of the ERM, with a favorable anatomical and functional outcome. This case highlights the potential for significant retinal injuries resulting from exposure to laser pointers. It emphasizes the importance of prompt diagnosis and appropriate treatment, including surgical intervention, to achieve optimal visual outcomes.

Keywords: Epiretinal membrane, Laser pointer, Ocular trauma, Pediatric ophthalmology, Retinal fold

INTRODUCTION

Lasers have a wide range of technological applications across many sectors of modern industrialized societies. Portable laser devices marketed as laser pointers have gained widespread popularity due to their low cost and easy accessibility. Often used for recreational purposes, accidental or intentional ocular exposure to these devices can result in injuries with varying visual repercussions. The risk is compounded when it comes to lasers available online, where labeling can be misleading and energy classification underestimated.[1]

In recent years, there has been an increasing number of reported cases of ocular damage from laser pointers, primarily affecting children and adolescents who use them without proper caution.[2] The most common injuries include macular damage to the outer retina, which can vary in severity depending on the potency of the laser and the duration of exposure.[3]

In this context, a rare case is described involving an adolescent who developed an epiretinal membrane (ERM) with significant retinal folding following accidental exposure to a laser pointer.

CASE REPORT

A 17-year-old male patient presented to the emergency department in April 2013 with a 24-hour history of decreased visual acuity in the left eye. The patient reported that while sitting in class,

a classmate inadvertently aimed a green laser pointer at him from the back of the room, leading to an ocular exposure of approximately 1 s. After the incident, he went about his day without noticing immediate symptoms. However, 6–8 h later, he began experiencing blurred vision in the left eye, which prompted him to seek medical attention the next day. The laser device, purchased online, lacked appropriate labeling but was reported to have a power output of 5 mW and an effective range of 3 km.

On ophthalmological examination, the best-corrected visual acuity (BCVA) was 1.0 (20/20) in the right eye and 0.5 (20/40) in the left eye. Anterior segment examination and intraocular pressure were within normal limits for both eyes. Fundoscopic evaluation of the right eye revealed no significant abnormalities [Figure 1]. In contrast, examination of the left eye revealed a very dense, opaque ERM with a fibrotic appearance, radial folds, and moderate vascular traction.

Macular optical coherence tomography (OCT) further confirmed the presence of an ERM, leading to macular thickening and distortion of the foveal contour, with a prominent fold extending into the vitreous cavity through the central defect of the fibrotic membrane. Notably, the hyperreflective bands corresponding to the retinal pigment epithelium (RPE), ellipsoid zone, and external limiting membrane (ELM) remained intact in this area [Figure 2].

At the 1-month follow-up, the patient showed no significant improvement; visual acuity in the left eye remained at 0.5 (20/40). Given the patient's parents' reluctance to pursue invasive interventions, a conservative management approach was adopted.

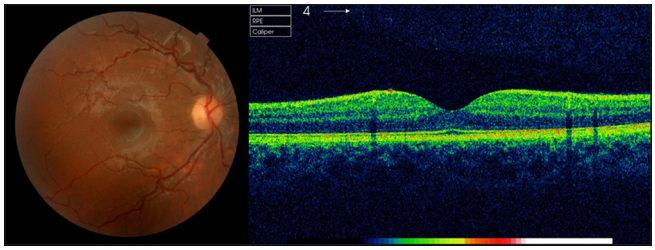

Figure 1: Retinography and macular optical coherence tomography (OCT) right eye (OCT 2000 Topcon) – No significant alterations observed.

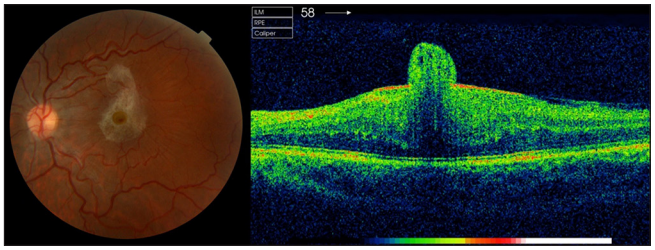

Figure 2: Retinography and macular optical coherence tomography (OCT) left eye (OCT 2000 Topcon) – Fibrotic epiretinal membrane with radial folds and protrusion of the foveal fold due to pronounced contraction of the epiretinal membrane. External layers preserved.

After a period of observation, the patient was reevaluated in October, at which time a further decline in visual acuity in the left eye was noted, decreasing to 0.2 (20/100). Fundus examination and OCT revealed marked progression, including increased contraction of the ERM and protrusion of the foveal fold [Figure 3]. In light of these findings, surgical intervention was recommended.

A 23-gauge pars plana vitrectomy with hyaloidectomy was performed following the administration of triamcinolone. This procedure included peeling of the ERM and internal limiting membrane (ILM) using dual staining with Monoblue NafX + ILM-BLUE DORC [Figure 4].

The patient had a favorable post-operative evolution. In February, 4 months after the surgery, BCVA in the left eye reached 0.7 (20/32), with a fundoscopic appearance of a pseudo-macular hole. The OCT showed the absence of the ERM and the pseudo-hole with microcystic degeneration along the margins. The RPE, ellipsoid, and ELM lines remained preserved; however, a hyperreflective vertical

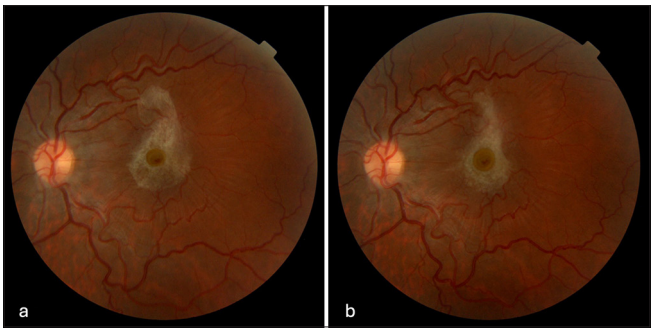

Figure 3: (a) Retinography on the day of the emergency visit (best-corrected visual acuity [BCVA] 0.5). (b) Retinography 6 months later (BCVA 0.2). Rapid contraction of the epiretinal membrane is evident, along with an increase in the protrusion of the foveal fold.

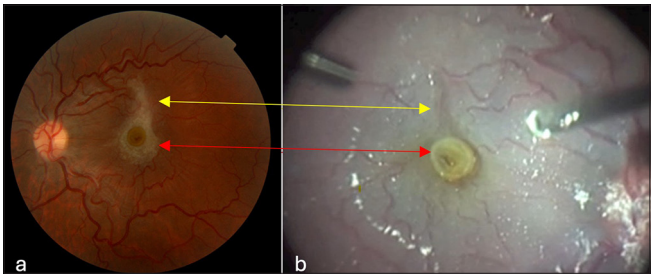

Figure 4: (a) Retinography before vitrectomy. (b) Intraoperative image following the removal of the epiretinal membrane. A perifoveal depression is observed due to the thickness and contraction of the epiretinal membrane (yellow arrow) and the foveal fold (red arrow).

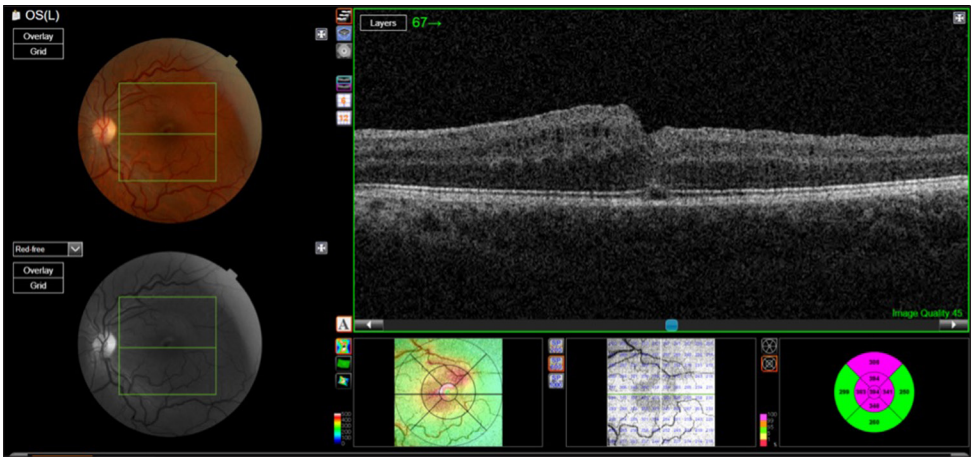

Figure 5: Retinography and post-operative macular optical coherence tomography (OCT) (DRI OCT Triton Topcon): Absence of the epiretinal membrane with thickening and flattening of the foveal profile. Microcysts are present in the inner layers. The external layers are preserved, with minimal cavitation at the level of the external segment bands of the photoreceptors.

band extending from the outer plexiform layer to Bruch's membrane was observed, with minimal cavitation at the level of the photoreceptor outer segments [Figure 5].

The patient continued to undergo periodic revisions over the years. In one of these long-term follow-up visits, conducted in November 2019, 6 years after the surgery, the patient achieved a BCVA of 1.0 (20/20). The OCT revealed persistence of alterations in the foveal profile with microcysts in the inner layers, but showed evidence of reorganization in the outer layers, with a central macular thickness of 321 micrometers [Figure 6].

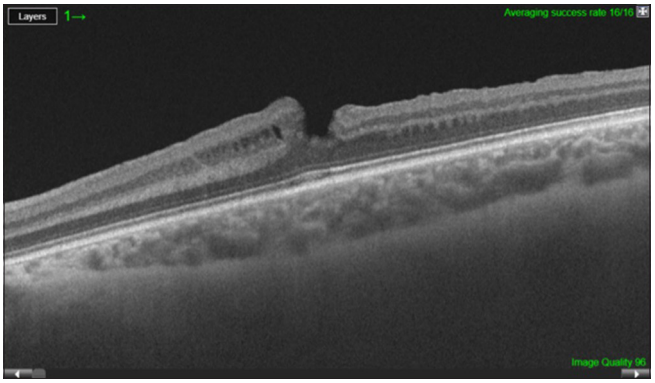

Figure 6: Macular optical coherence tomography (OCT) 6 years post-vitrectomy (DRI OCT Triton Topcon): Persistence of alteration in the foveal profile with microcysts in the inner layers. Restructuring of the external layers is observed. DRI: Deep range imaging

DISCUSSION

The retina is particularly vulnerable to laser damage due to the high energy absorption by retinal pigments, especially the melanin in the RPE. The primary mechanisms of injury include photodisruption, photochemical reactions, and predominantly, photocoagulation or photothermal damage. The latter is especially relevant with short-wavelength lasers, such as green and blue lasers, which are more readily absorbed by retinal chromophores compared to long-wavelength lasers, such as red ones.[3] The severity of the damage is also influenced by factors such as duration of the exposure, size of the beam, power of the laser, site of retinal impact, and the degree of retinal pigmentation.[1]

The eye's natural defense mechanisms, such as blinking and aversion responses, can limit exposure and mitigate damage from low-power lasers (<5 mW). However, these mechanisms are insufficient against high-power devices, even with brief exposure.[4] Visual symptoms after laser exposure may appear from a few hours to several days later, and in pediatric patients, these symptoms often go unnoticed for longer due to a lack of symptom awareness.[5] Reported manifestations include unilateral or bilateral blurred vision and central scotomas, although cases of transient pain and, in rare instances, an audible sound associated with chorioretinal thermal expansion have also been reported.[6,7] BCVA during the acute phase can vary significantly, ranging from 1.0 to counting fingers, depending on the extent and location of the damage.[8]

Laser-induced retinal injuries typically present with focal alterations in the architecture of the outer retina. Acute lesions at the fovea may manifest as granularity, drusen-like deposits, peripheral foveal pigmentary accumulations, and hypopigmented ring lesions.[1,7] In addition, retinal edema and hemorrhages of various locations may occur, such as vitreous, subhyaloid, intraretinal, or subretinal.[3] OCT plays a crucial role in identifying these damages, revealing abnormalities such as disruption of the RPE, hyperreflective

vertical bands extending from the RPE to Bruch's membrane, breaks in the ellipsoid zone and RPE, and opacification of Henle's fiber layer.[5,9] Over time, signs of partial restoration may be observed, such as recovery of the RPE, reduction of hyperreflective bands, and normalization of Henle's layer, although these improvements do not always translate into complete visual recovery.[7,8]

The treatment of retinal injuries caused by laser pointers varies depending on the severity of the damage. While systemic corticosteroid treatment has been used in some cases, evidence suggests that this approach does not significantly improve the visual prognosis compared to observation.[1,6] Long-term complications, such as the formation of ERMs, full-thickness macular holes, choroidal neovascularization, and RPE scarring, may arise months or years after the initial exposure, complicating the clinical course and negatively impacting final visual recovery.[7,8] These late complications emphasize the importance of long-term follow-up in patients with laser-induced retinal injuries.

The development of an ERM due to laser pointer exposure, though rare, has been documented in the literature.[3] In the present case, exposure to a laser pointer caused an acute ERM with fibrotic characteristics, which rapidly progressed to significant contraction and protrusion of a foveal fold. The inner retina showed significant folding through the central defect of the ERM, consistent with characteristics of pediatric ERM described by Rothman *et al*. Although the retinal folds observed in this case were less typical than the commonly described "taco" folds, the case is notable for the formation of an ERM with distinctive morphological features.[10]

Surgical treatment involving peeling of the ERM in this patient resulted in a reduction of retinal folding. Despite the formation of a pseudo-macular hole, the final visual acuity was satisfactory, demonstrating the effectiveness of surgical intervention in selected cases. Post-operative OCT showed preservation of the hyper-reflective lines of the outer retina, including the ELM and ellipsoid zone, indicating good photoreceptor integrity and supporting favorable visual recovery.

CONCLUSION

This case highlights the rare but concerning potential for laser pointers to induce early ERM formation with retinal folding. Surgical intervention led to significant anatomical improvement and satisfactory visual recovery, demonstrating the effectiveness of timely surgical management in selected cases. Given the substantial risk for severe ocular injury, it is essential to establish stricter regulations controlling access to such devices, especially among children and adolescents. Furthermore, this case also emphasizes the need to increase public awareness about the risks associated with the irresponsible use of laser pointers and the importance of prompt diagnosis and treatment following ocular exposure to optimize visual outcomes and prevent long-term complications.

Ethical approval: Institutional Review Board approval is not required.
Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patients have given their consent for their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.
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