American Journal of Ophthalmology Case Reports 23 (2021) 101129

Contents lists available at ScienceDirect

American Journal of Ophthalmology Case Reports

journal homepage: www.ajocasereports.com/

Case report

Macular hemorrhage after laser exposure and cannabinoid intake during a disco party

Federica Fossataro [a,b,*], Alfredo Pece [b], Maria Belotti [b], Eustachio Maragno [b]

[a] Department of Neurosciences, Reproductive Sciences and Dentistry, University of Naples Federico II, Naples, Italy
[b] Eye Clinic, Melegnano Hospital, Vizzolo Predabissi, Italy

ARTICLE INFO

Keywords:
Laser exposure
Cannabinoid intake
Macular hemorrhage

ABSTRACT

Purpose: To describe two cases of macular hemorrhage in young patients, both occurred after laser exposure and cannabinoid intake during a disco party.
Observations: Case 1: a 21-year-old man was evaluated at our Emergency Unit for sudden vision loss in the right eye (RE). Best-corrected visual acuity (BCVA) was count fingers in the RE and 20/20 in the left eye (LE). Fundus examination revealed a broad pre-retinal hemorrhage in macular region of RE, confirmed by optical coherence tomography. The patient reported vision loss, suddenly occurred after fixation of a laser source and cannabinoid intake during a disco party the night before. We administered a macular supplement and closely followed up the patient. After two months BCVA of the right eye was 20/20.
Case 2: The following day another 21-year-old man was referred to our Emergency Unit complaining of sudden vision loss in LE. As in Case 1, he reported to have fixed a laser beam as well as the consumption of cannabinoids at the same disco. BCVA was count fingers in the LE and 20/20 in the RE. Fundus examination showed a broad pre-retinal hemorrhage in macular region of LE. He had taken the macular supplement for two months and then the hemorrhage was reabsorbed.
Conclusion and importance: Laser exposure must be considered as a possible cause of macular hemorrhage. Furthermore, low cost of drugs and lack of formal control of laser sources may increase the emergence of new cases of retinal injuries especially among young people.

1. Introduction

Unilateral hemorrhage in the macular region of a young patient is a particularly rare condition that causes sudden vision loss. The two most frequent causes are previous trauma and Valsalva maneuver-induced retinopathy.[1] Vascular alterations secondary to systemic diseases, such as diabetic retinopathy, hypertension, Terson's syndrome, blood disorders and also ocular diseases may be potential causes that determine the development of macular hemorrhage.[2,3] Forms depending on external factors include those caused by laser beams.[4]

We describe two cases of macular hemorrhage in two young patients, both of which occurred after exposure to laser sources and after the intake of cannabinoids at a disco party.

2. Case 1

A 21-year-old man was referred to our Emergency Unit complaining of sudden vision loss in the right eye (RE). Medical history was otherwise unremarkable. Best-corrected visual acuity (BCVA) was count fingers in the RE and 20/20 in the left eye (LE). Slit-lamp examination of the anterior segment and intraocular pressure were unremarkable in both eyes. Dilated fundus examination of the RE showed a broad ovoid pre-retinal hemorrhage in the macular region. Optical coherence tomography (OCT) centered on the fovea showed an increase in central macular thickness due to a wide hyperreflective area located above the inner retina layers, under the inner limiting membrane (ILM) and shadowing the underlying retinal layers. Above the ILM there was a hyporeflective space under the hyaloid (Fig. 1 – A, B). Fluorescein angiography (FA) of the RE showed macular hypofluorescence due to the blocking effect of the macular hemorrhage. Blood chemistry was normal. We questioned the patient about his recent medical history to seek a possible cause. He reported that vision loss had occurred suddenly after he had fixed a laser source during a disco party the night before. He mentioned he had taken synthetic cannabinoids that same evening. We therefore scheduled close

* Corresponding author. Department of Neurosciences, Reproductive Sciences and Dentistry, University of Naples Federico II, Via S. Pansini 5, 80133, Naples, Italy.
E-mail addresses: federicafossataro@alice.it, fossatarof@gmail.com (F. Fossataro).

https://doi.org/10.1016/j.ajoc.2021.101129
Received 20 November 2020; Received in revised form 28 March 2021; Accepted 24 May 2021
Available online 2 June 2021

follow-up: first at 5 days, then at 2 weeks, 1 month (Fig. 1 – A1, B1), 45 days and 2 months. During this period the patient took no medication except a daily macular supplement containing lutein and turmeric.

At two months follow-up the wide ovoid pre-retinal hemorrhage in the macular region of the RE had almost disappeared and mild atrophic changes were detected in the foveal inner retina layers (Fig. 1 – A2, B2). BCVA of the RE was 20/20.

3. Case 2

The next day, another 21-year-old man was referred to our Emergency Unit complaining of sudden vision loss in his LE. Similarly to Case 1, he reported to have fixed a laser beam during the same disco party the night before. The patient admitted taking synthetic cannabinoids. He had no other medical history. BCVA was count fingers in the LE and 20/20 in the RE. Slit-lamp examination of the anterior segment and eye pressure were normal in both eyes. Dilated fundus examination showed a broad pre-retinal hemorrhage in the macular region of the LE, confirmed by FA. This excluded vascular damage or systemic pathologies, and there were no changes during the different stages of the examination. OCT showed an increase in the central macular thickness with a wide hyperreflective area located above the inner retina layers, under the ILM, corresponding to the hemorrhage with posterior shadowing (Fig. 2 – A, B). Similarly to Case 1, we scheduled a strict follow-up discharging the patient with a macular supplement containing lutein and turmeric (Fig. 2 – A1, B1).

At two months follow-up the broad ovoid pre-retinal hemorrhage in the macular region of the LE had disappeared. BCVA of the RE was 20/20, fundus examination was within limits. OCT showed restoration of a physiological fovea depression, with small hyperreflective points on the ILM. (Fig. 2 – A2, B2).

Both patients gave written informed consent to publish this manuscript.

4. Discussion

Unilateral macular hemorrhage in a young adult is a particular and rare finding caused by a wide number of ocular and systemic conditions. Among them, the two most frequent causes are previous trauma and Valsalva retinopathy.[1] In addition, macular hemorrhages can occur after vascular alterations secondary to systemic diseases (diabetic retinopathy, hypertension, arteriosclerosis, Terson's syndrome and blood disorders such as anemia, hyperviscosity, coagulopathies and leukemias).[2] Retinal artery or vein occlusion, retinal macroaneurysms, ocular neovascularization and radiation retinopathy may be potential ocular causes that determine the development of macular hemorrhage.[3] Idiopathic forms have also been described, without any apparent cause.[5] Moreover, there are also forms induced by external factors including those caused by laser beams.[4]

The laser beam can cause retinal lesions on account of its high directionality, coherence and power. The ocular structures focus and condense the beam on the retina, amplifying the irradiance 5–6 times, making the retina the most vulnerable tissue to injury. The severity of retinal damage is determined by the wavelength, duration of exposure, spot size, power, and location.[6]

Laser can generate three different changes in relation to the damage: photothermal effects, caused by the absorption of energy by the melanin of the retinal pigment epithelium (RPE); photochemical effects, where a low-power but long-exposure beam denatures the RPE; photomechanical effects when a high-energy and high-charge laser causes direct tissue

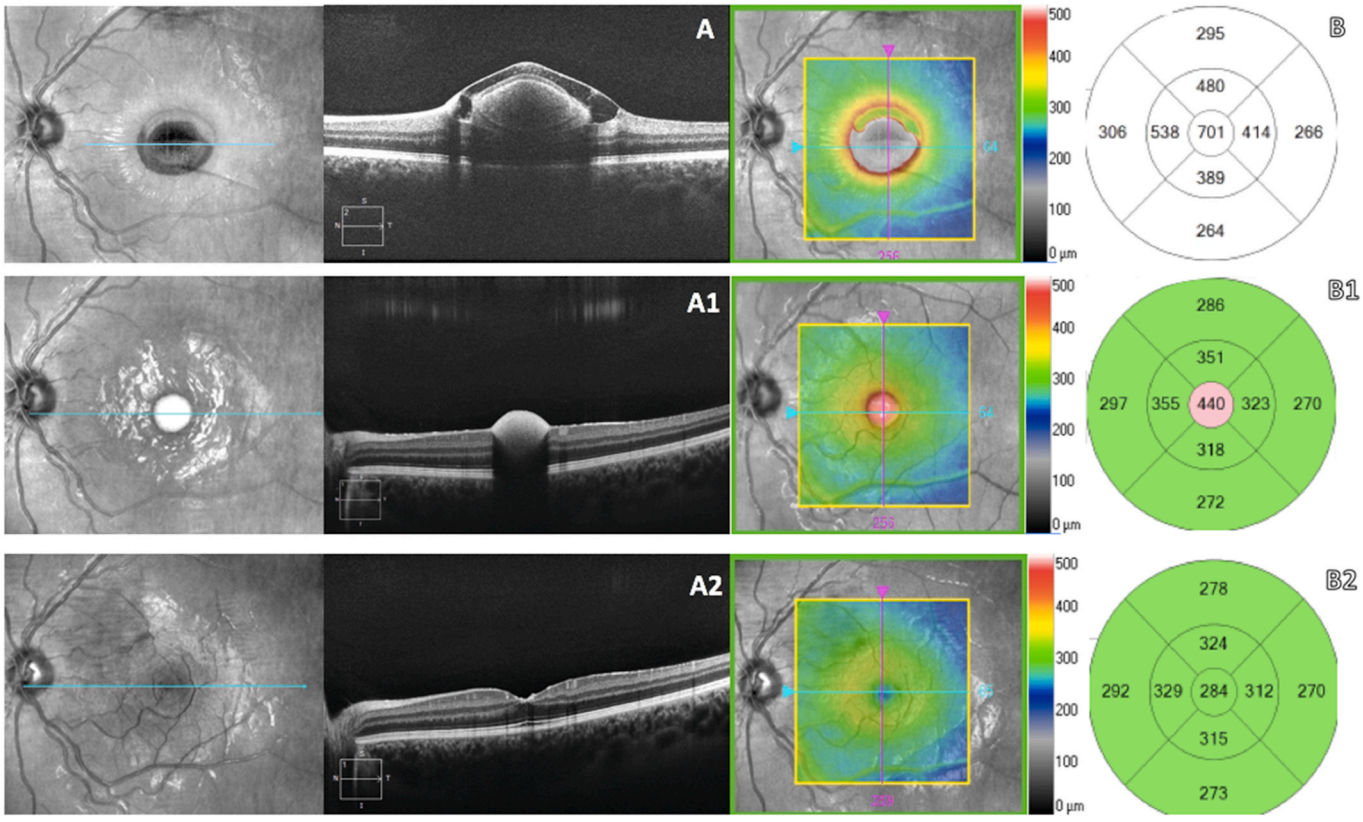

Fig. 1. A: Swept-Source optical coherence tomography (SS-OCT) on presentation detecting a dome-shaped lesion characterized by a combine location of sub-hyaloid and sub-internal limiting membrane macular hemorrhage. **B:** The mean value of macular central thickness was 701µ. **A1:** SS-OCT obtained 30 days after showing hyperreflective area with posterior shadowing representing the reduced hemorrhage. **B1**: The mean value of macular central thickness was 440µ. **A2, B2:** SS-OCT, obtained 2 months later, showing restoration of a physiological fovea depression, with small hyperreflective points on the ILM and a normal macular central thickness.

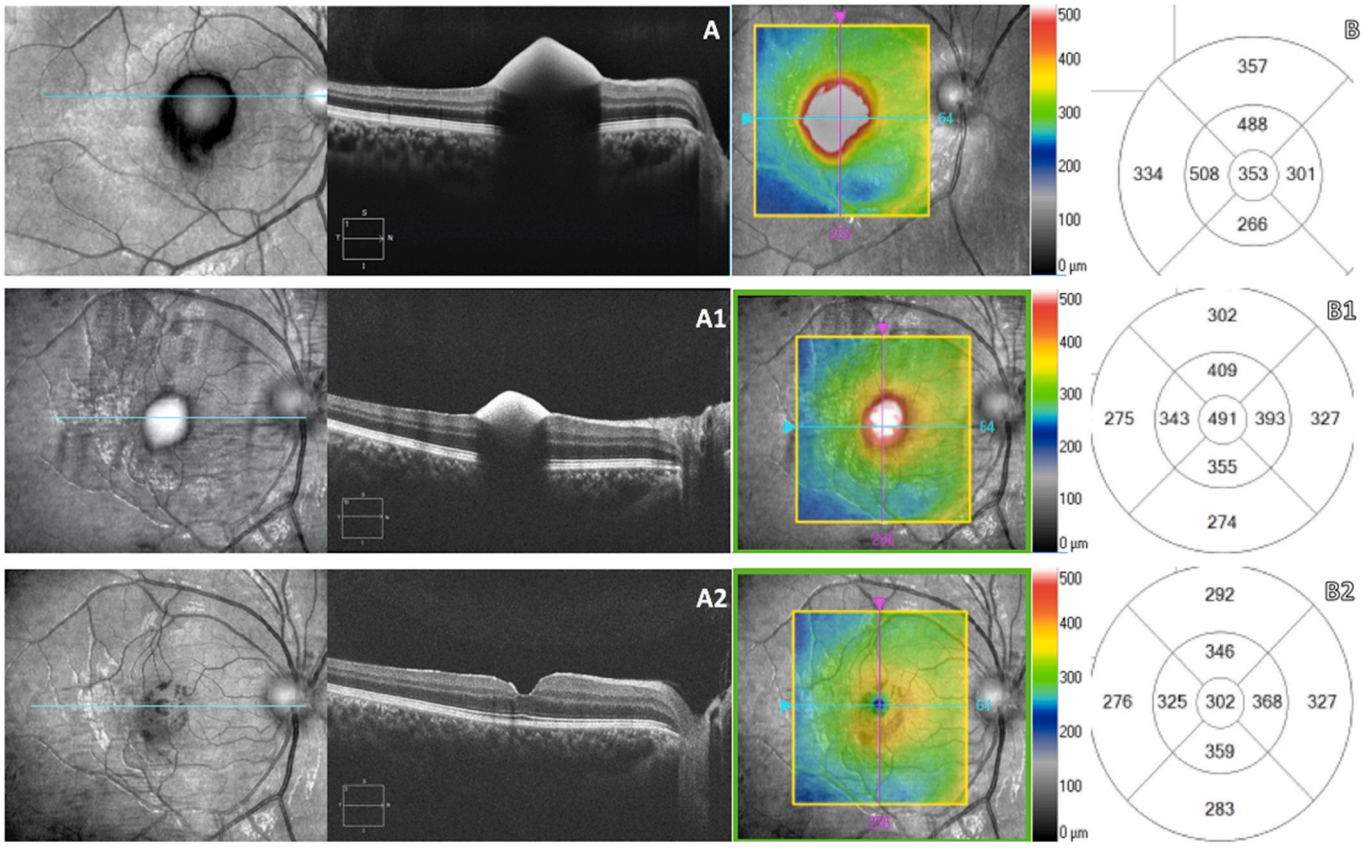

Fig. 2. **A**: Swept-Source optical coherence tomography (SS-OCT) image of the left eye showing the sub-ILM hemorrhage as a hyperreflective area with posterior shadowing. **B:** Due to the hemorrhage the patient did not fix and consequently the measurement of macular central thickness was not centered on the fovea. **A1:** SS-OCT obtained 25 days after showing a reduction of the macular hemorrhage. **B1**: The mean value of macular central thickness was 491µ. **A2:** SS-OCT obtained 2 months after showing that the hemorrhage had resolved. **B2:** Visual acuity turned to 20/20 and macular central thickness was within the limits.

ablation, photo-disruption, photo-fragmentation and photo-vaporization.

Retinal injuries caused by lasers include RPE alterations and defects, vitreous, sub-hyaloid, sub-ILM and intra-retinal hemorrhages, as well as macular hole.[6]

In our cases, due to the large haemorrhages that caused shadowing of the underlying layers, it was not possible to identify chorioretinal alterations in the phases immediately following the fixation of the laser source. Nevertheless, upon resolution of the clinical picture, the finding of small hypereflective points of the ILM and mild atrophic changes detected in both patients may support the laser beam as the cause of the damage.

Laser lesions present an unambiguous temporal relationship between the laser incident and the sudden vision defects and patients report no chronic headache, neck or jaw pain. Furthermore, the severity of the visual symptoms is proportional to the extent of retinal damage demonstrable with retinal imaging and examination.

Nowadays the widespread availability of lasers in medicine, industry, military and everyday life has raised the risk of injuries due to laser exposure. The United States Food and Drug Administration and the Laser Institute of America in 2007 proposed a reclassification from class 1 (no hazard) to class 4 (severe hazard), based on the potential risk of a laser beam causing biological damage to skin or eyes.[7,8] This classification was revised by the European Union in 2009, in the EN60825 CEI standard, and divides the potential damage of the laser into seven risk classes.[8]

As described by Perez-Montano CR et al.,[9] the main regulations for laser beams at these locations include power <1.5 W and beams should always be 2.5 m above the floor and in continuous movement so as to prevent eye exposure.

In both patients, macular hemorrhage is high probably due to a laser source. Some cases, with similar clinical findings, have been previously reported in young adults after laser exposure at previous party or festival.[10,11]

Unfortunately, we could not find any technical information regarding the laser that provoked these injuries, but both patients reported to have stared for a long time at the laser source that came directly from behind the DJ's station.

In our study it appears incredible how the same retinal damage with extensive macular hemorrhage occurred in two patients on two different days even if in the same disco.

Finally, both patients reported using synthetic cannabinoids during the disco party. The influence of such drugs on the ciliary muscle is well known but not unique. Some studies demonstrate that pupillary constriction is present especially immediately after intake, others evince an important and lasting mydriasis.[12] In our study we cannot rule out that the cannabinoids taken by the patients, causing a mydriatic response, have facilitated the entrance of the laser rays, and consequently, the retinal damage.

Although several approaches to retinal hemorrhage have been described, such as vitrectomy with ILM peeling and the use of a Nd:YAG laser or others, we adopted a conservative strategy. After two months we observed resolution of the clinical condition, avoiding any risk of complications related to these treatments.[13]

5. Conclusions

In conclusion laser exposure must be borne in mind when faced with a macular hemorrhage. Although the rules for laser quality in public spaces like a disco are very strict, the wide availability of low-cost, high-

power lasers may increase the emergence of new cases of retinal injuries especially among young people. Finally, the easy access of cannabinoids by young people could represents a further risk of aggravating potential visual damage from laser sources at disco.

Patient consent

Signed informed consent for patients' information and images to be published was provided by the subjects.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

Authorship

All authors attest that they meet the current ICMJE criteria for Authorship.

Declaration of competing interest

The author(s) have no financial disclosure.

Acknowledgments

Fondazione Retina 3000 for English editing.

References

1. Russel SR, Hageman GS. Hemorrhagic detachment of the internal limiting membrane after penetrating ocular injury. *Retina*. 1992;12:346–350. https://doi.org/10.1097/00006982-199212040-00009.
2. Anderson Jr B. Activity and diabetic vitreous hemorrhages. *Ophthalmology*. 1980;87(3):173–175. https://doi.org/10.1016/s0161-6420(80)35256-1.
3. Albert DM, Jakobiec FA. *Principles and Practice of Ophthalmology*. vol. 2. Philadelphia, PA: Saunders WB; 1994.
4. Joseph M, Simonnet BS, Scarinci F, et al. A case of recurrent, self-inflicted handheld laser retinopathy. *J. AAPOS*. 2016 Apr;20(2):168–170. https://doi.org/10.1016/j.jaapos.2015.11.007.
5. Abdelmseih M. Idiopathic macular hemorrhage. *N. Front. Ophthalmol.* 2017;3. https://doi.org/10.15761/NFO.1000167.
6. Barkana Y, Belkin M. Laser eye injuries. *Surv Ophthalmol*. 2000;44(6):459–478. https://doi.org/10.1016/s0039-6257(00)00112-0.
7. *American National Standard for the Safe Use of Lasers, ANSI Z136.1-2007*. Washington, DC: American National Standards Institute; 2007.
8. U.S. Food and Drug Administration. FDA safety notification: risk of eye and skin injuries from high-powered, hand-held lasers used for pointing or entertainment. December 16. http://www.fda.gov/MedicalDevices/Safety/AlertsandNotices/ucm237129.htm; 2010. Accessed April 4, 2013.
9. Perez-Montano CR, Palomares-Ordonez JL, Ramirez-Estudilo A, Sanchez-Ramos J, Gonzalez-Saldivar G. Sub-hyaloid and sub-internal limiting membrane macular hemorrhage after laser exposure at music festival: a case report. *Doc Ophthalmol*. 2019;138(1):71–76. https://doi.org/10.1007/s10633-018-9666-6.
10. Jeon S, Lee WK. Inner retinal damage after exposure to green diode laser during a laser show. *Clin Ophthalmol*. 2014;8:2467–2470. https://doi.org/10.2147/OPTH.S68254.
11. Alba-Linero C, Rocha de Lossada C, Calvo de Mora MR, de las Rivas RM, Hernando AC. Laser light retinopathy. *Rom. J. Ophthalmol.* 2019;63(4):372–374.
12. Dhingra D, Kaur S, Ram J. Illicit drugs: effects on eye. *Indian J Med Res*. 2019;150(3):228–238.
13. Alsulaiman SM, Alrushood AA, Almasaud J, et al. High-power handheld blue laser-induced maculopathy: the results of the king Khaled eye specialist hospital collaborative retina study group. *Ophthalmology*. 2014;121(2):566–572. https://doi.org/10.1016/j.ophtha.2013.09.006. Epub 2013 Nov 1.