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Short communication

Bilateral macular injury caused by a femtosecond laser[☆]



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ABSTRACT

Case report: We describe the case of a 35-year-old man who arrived in the Emergency Department with bilateral macular injury caused by accidental exposure to an industrial femtosecond laser.

Discussion: Workers operating industrial lasers must protect their eyes properly when handling these devices. Otherwise, retina damage may occur which usually is recoverable. However, sometimes this damage causes permanent visual loss.

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Lesión macular bilateral tras la manipulación de un láser femtosegundo

RESUMEN

Caso clínico: Se describe el caso de un varón de 35 años de edad diagnosticado en Urgencias de lesión macular bilateral tras la exposición de forma accidental a la luz de un láser femtosegundo industrial.

Discusión: Los trabajadores que usan láseres industriales deben proteger sus ojos de forma adecuada cuando manejen estos instrumentos. Si no es así, pueden producirse lesiones en la retina, que aunque se suelen resolver, en ocasiones son causa de pérdida de visión mantenida.

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Introduction

Light damage of the posterior segment of the eye is well known. Light can cause a retinal lesion via three mechanisms: photomechanical, thermal and photochemical, although more than one of these processes may be involved in a particular case.¹

Retinal injuries in people working with industrial lasers are not common, but they are probably more common than expected when the safety measures established for handling these apparatuses are not complied with.

We present the case of a patient with bilateral macular injury caused by accidental exposure while using a femtosecond laser.

Clinical case

A 35-year-old male patient came to our Emergency Department with central scotoma in both eyes (BE). He removed his goggles for some seconds while calibrating a femtosecond laser at a distance of 40 cm in an experimental research laboratory. The laser was working with 1 kHz pulse frequencies, at 0.5 mJ of energy and a wavelength of 800 nm.

On the physical examination, he had a visual acuity of 1 in his right eye (RE) and 0.8 in his left eye (LE). The anterior segment was normal, as well as the pupillary reflexes and the intraocular pressure. The funduscopy revealed bilateral yellowish foveal and juxtafoveal lesions although the fluorescein angiography was normal. The visual field test did not show the scotoma mentioned by the patient and the Amsler grid did not show abnormalities. The optical coherence tomography (OCT, Stratus OCT 3000, Carl Zeiss Meditec, California, U.S.A.) showed increased reflectivity at foveal level affecting all the retinal layers (Figs. 1 and 2).

A watchful waiting approach was adopted with periodic checkups. The visual acuity in the LE has been recovering in a gradual manner and reached one unit over the following

months. Even though the scotoma has been reducing subjectively, it is still present in the LE. The funduscopy showed a subtle hypopigmented foveal injury in BE. The OCT showed a foveal disruption at the junction of the retinal pigment epithelium (RPE) and the external segments of photoreceptors in the LE, which accounts for the residual scotoma mentioned by the patient (Figs. 3 and 4).

Discussion

The femtosecond laser leads the Ophthalmology revolution, especially in the development of refractive surgery. Through the emission of a beam of high-frequency infrared laser pulses of very short duration, a plasma is generated, expanded at great speed and distributed throughout the tissue like a wavefront, separating the tissue at molecular level without transferring heat or affecting the adjacent area.²

The literature includes only one case of macular damage produced by femtosecond laser.³ The maculopathy caused by this kind of apparatus is a rare entity since the effective radiation on the retina is minimal in the case of an accidental momentary exposure.⁴ However, in our patient, the exposure to a beam of high-energy laser pulses at a short distance for several seconds may have contributed to the macular damage seen.

When the patient visited the ER, his OCT showed a circumscribed foveal alteration and hyperreflectivity in BE due to the inflammation of all the retinal layers. This phenomenon is consistent with a laser thermal effect due to the RPE excessive light absorption and the consequent increase in temperature of the surrounding tissues, causing damage.¹ In the following months, in the OCT the alteration was limited to the more external layers of the retina, typical of photochemical injuries, such as the ones seen in solar or welding arc maculopathy.⁵ It is believed that, in these cases, the damage is due to the formation of free radicals that damage the RPE and the external segments of photoreceptors, which are more sensitive than

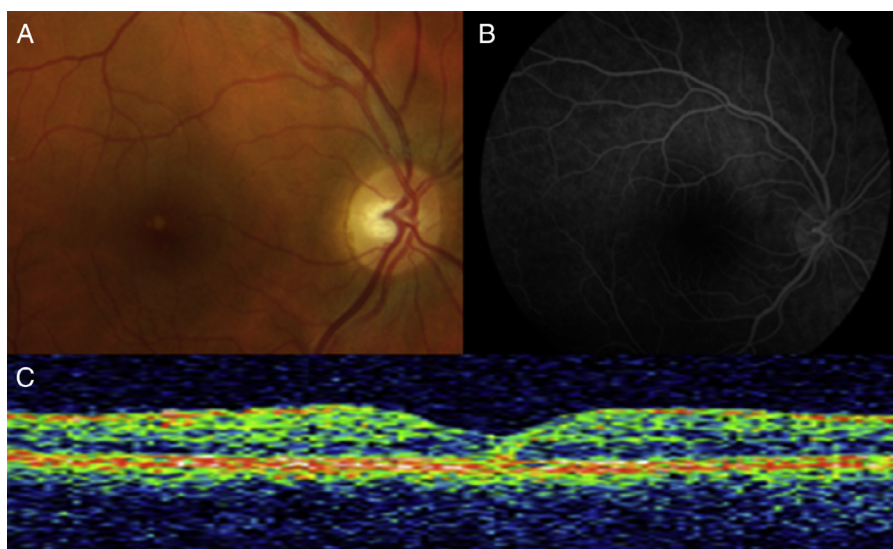


Fig. 1 – Tests performed on the RE upon patient's arrival at the Emergency Room. (A) Retinoscopy: yellowish foveal injury. (B) FAG: normal. (C) OCT: increased reflectivity of all the layers at foveal level.

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