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APRIL 28th to MAY 1st 2023
47th BRAVS MEETING
WINDSOR BARRA HOTEL
RIO DE JANEIRO - BRAZIL

Subretinal metallic foreign body removal: electroretinographic repercussions guiding surgical decision

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Purpose

To describe the surgical decision in a case of intraocular foreign body (IOFB) based on imaging and electrophysiological examinations.

Methods

Review of the patient's medical record.

Case Report

A 29-year-old man reports visual escotoma in the left eye (OS) after trauma with an unknown object while working as Carpenter 1 day ago. The patient denies comorbidities or ophthalmological pathologies.

On ophthalmologic examination, the visual acuity was 20/20 in both eyes (OU). Biomicroscopy of OS presented a laceration of the conjunctiva and sclera measuring 1 mm in diameter near the caruncula, transparent cornea, without alterations in the anterior chamber. The fundus examination is described in **Image 1**.

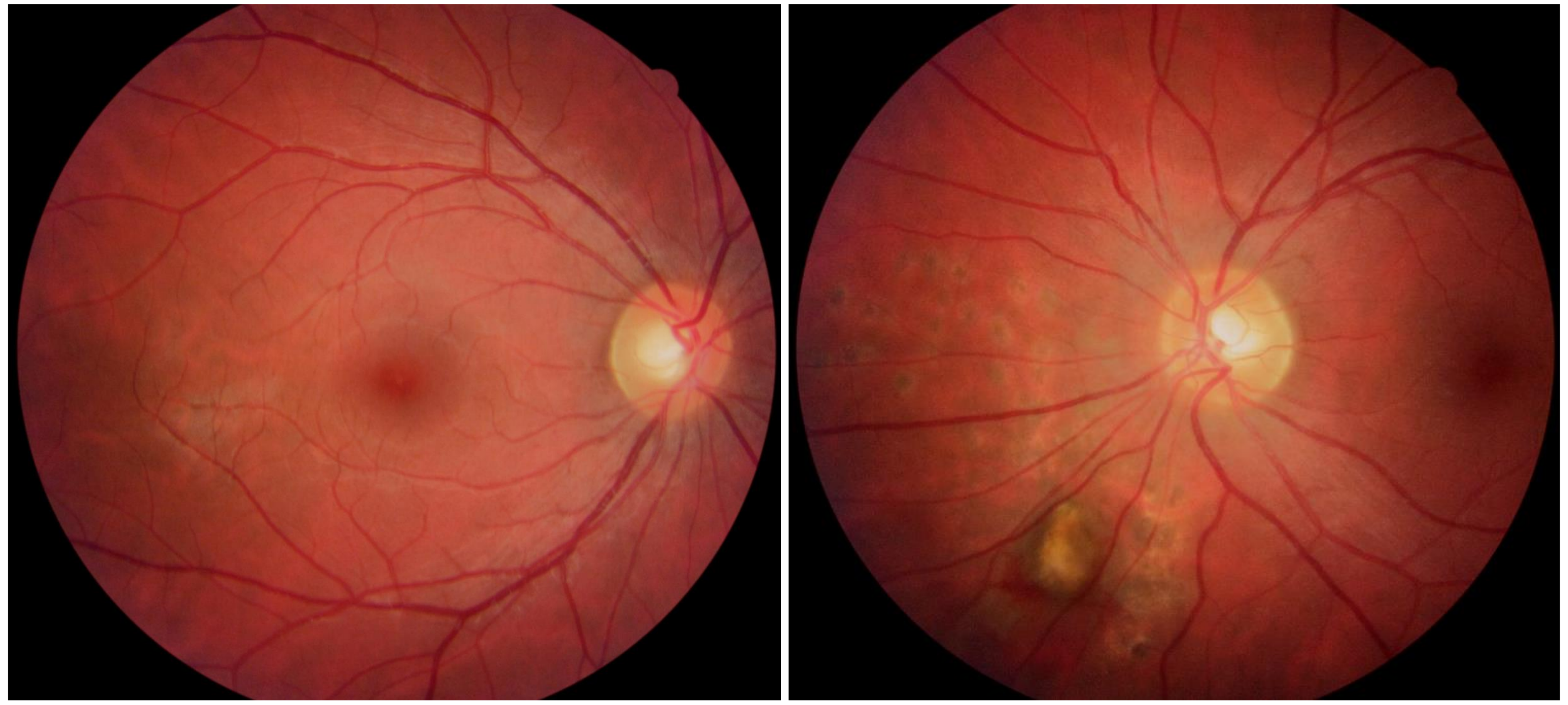

Image 1: Conventional color fundus picture of OU. OS fundus showing transparent media and a elevated region in the inferior nasal retina with prophylactic laser marks surrounding the lesion.

Admission OCT revealed a subretinal hyperreflective lesion in the previously described topography, suggestive of a subretinal foreign body, as shown in **Image 2**.

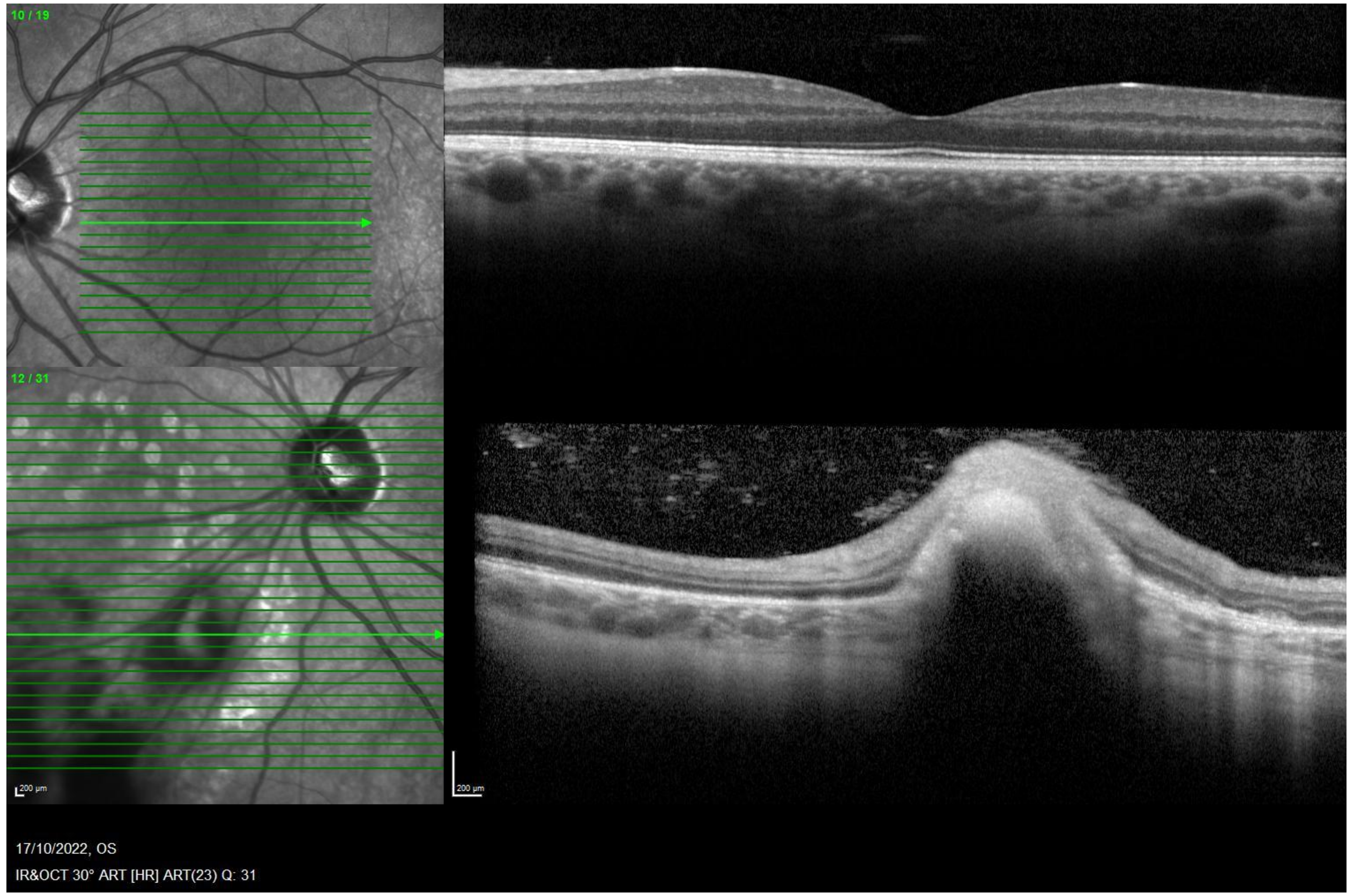

Image 2: OCT of OS showing subretinal hyperreflective lesion, sugestive of IOFB.

Due to the diagnose of an IOFB, the patient underwent anti-rabies prophylaxis and computed tomography of the orbits (**Image 3**).

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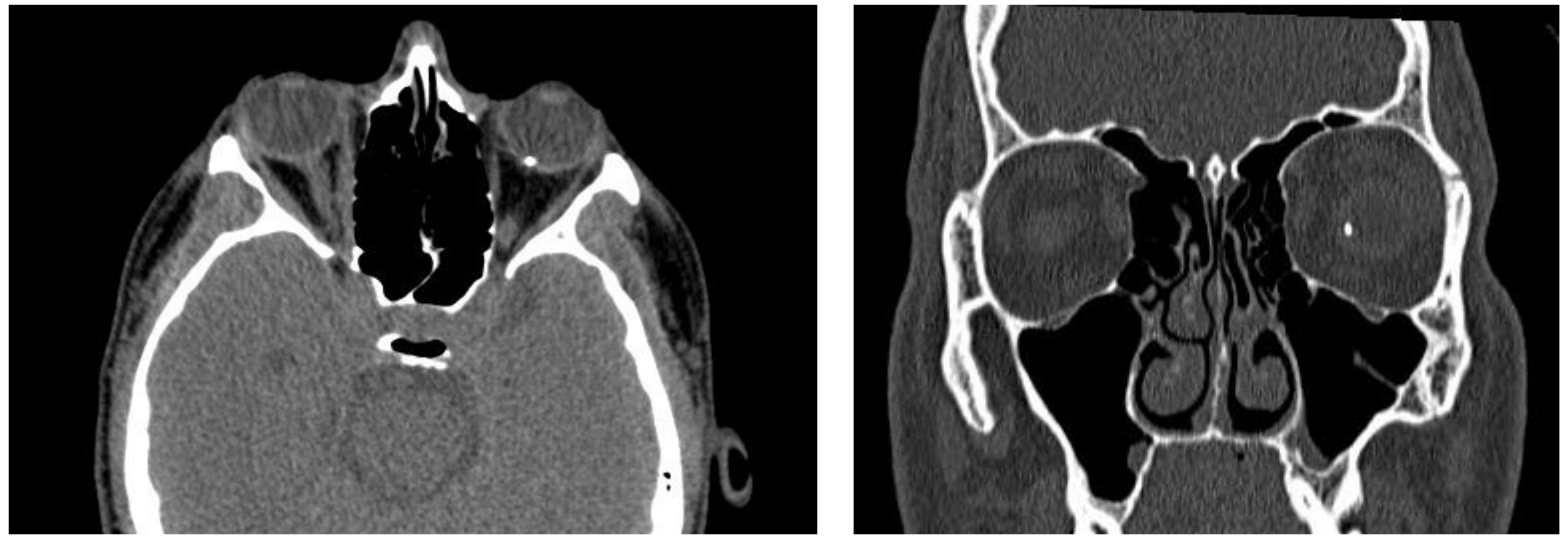

Image 3: Axial (left) and coronal (right) sections of computed tomography of the orbits show an intraocular foreign body in OS. Note that the IOFB is localized near the optic disc.

As the patient had excellent visual acuity, it was decided to perform an electroretinography exam to assess possible retinal toxicity by IOFB over a period of 7 days.

Full-field ERG (Diagnosys LLC) was recorded following ISCEV standard recommendations, with dark adapted protocol (20 min in the dark) using flashes of white light in two steps (0.01 and 3.0 cd.s/m^2) and a light-adapted protocol (10 min. 30 cd.s/m^2) using flashes of white light (6,500 K; 4 ms) in 2 steps (3.0 cd.s/m^2) and flicker 30Hz (**Image 4**).

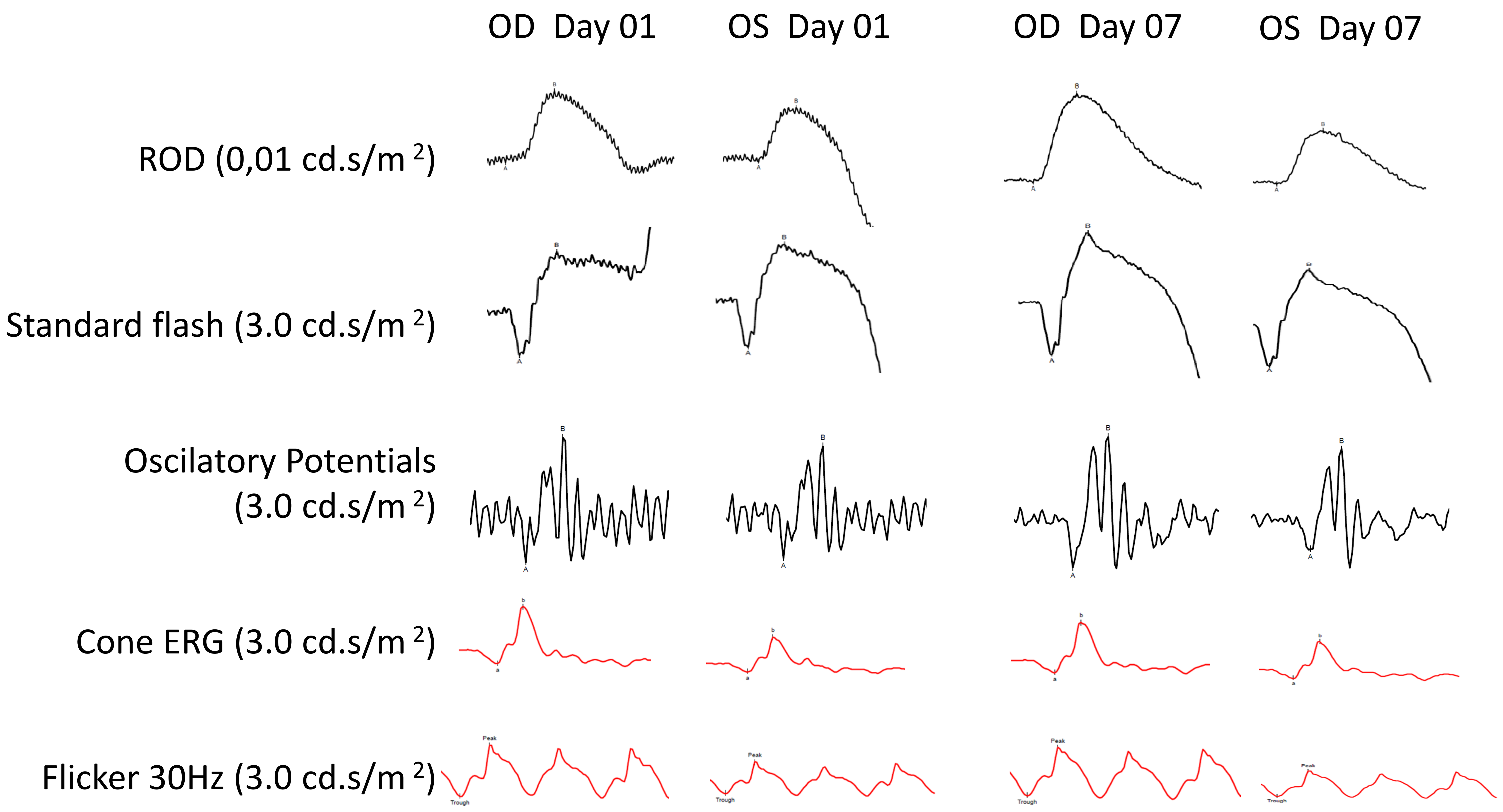

Image 4: Graphical representation of the electroretinogram examination of both eyes perfomed following ISCEV recommendations, on admission and on the seventh day after trauma.

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Analyzing the amplitude values of the electroretinography tracings, a difference of 40,6% between the eyes was observed on the first day in the tracing of oscillatory potentials. On the seventh day, the greatest difference in response between the eyes was observed in the b wave of photopic stimulus 3.0, with a difference in amplitude of 38.3% between the eyes.

Response amplitude values for each stimulus and differences between eyes on the first and seventh day are detailed in **Table 1** Note that there was an increase in the difference of amplitude for almost all types of stimulus, comparing the right eye (OD) with the OS, over the seven days.

			OD (µV)	OS (µV)	Difference (%)
Day 01	stimulus 0.01 scotopic	b wave	394,6	293	26
	stimulus 3.0 scotopic	a wave	-342,2	-279	18,4
		b wave	733,5	556	24,2
	stimulus 3.0 photopic	a wave	-46	-41	10,8
		b wave	205	183	10,7
	Osc. Pot	amplitude a	-128	-143	11,7
		amplitude b	544	323	40,6
	Flicker (30 Hz)	amplitude	216	147	31,9
Day 07	stimulus 0.01 scotopic	b wave	409	275	32,7
	stimulus 3.0 scotopic	a wave	-351,3	-257	26,8
		b wave	809	548	32,2
	stimulus 3.0 photopic	a wave	-53	-33	37,7
		b wave	240	148	38,3
	Osc. Pot	amplitude a	-186,5	-140	24,9
		amplitude b	458	339	25,9
	Flicker (30 Hz)	amplitude	196	134	31,6

Table 1: Amplitude values (µV) of response to stimuli for each eye on admission and on the seventh day. The column on the right details the percentage difference in amplitude between the eyes.

Specifically evaluating the responses of the left eye to stimuli, we noticed a decrease of response amplitude over the seven days. The greatest difference occurred in the a wave to the 3.0 scotopic stimulus, with an amplitude 24.8% lower compared to admission. There was no significant difference in response between the tests regarding oscillatory potentials.

The amplitude values for each stimulus are specified in **Table 2**.

		Day 1 (µV)	Day 7 (µV)	difference (%)
stimulus 0.01 scotopic	b wave	293	275	6,1
stimulus 3.0 scotopic	a wave	-279	-257	24,8
	b wave	556	548	1,45
stimulus 3.0 photopic	a wave	-41	-33	19,5
	b wave	183	148	21,8
Osc. Pot	amplitude a	-143	-140	2
	amplitude b	323	339	4,9
Flicker (30 Hz)	amplitude	147	134	8,8

Table 2: Amplitude values (µV) of response to stimuli in the left eye on the first and seventh days. The column on the right shows the percentage difference in amplitude between the two exams of the same eye.

The described electroretinographic findings provided unequivocal data on retinal toxicity, making IOFB surgical excision mandatory, even with good visual acuity.

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We decided for a posterior vitrectomy via pars plana, without phacoemulsification, in an attempt to preserve the lens. After placement of three trocar-canullas 23 gauge we started posterior vitrectomy via pars plana and performed the injection of triamcinolone to help detach the posterior hyaloid, which was adhered to the optic nerve and macular region.

Laser photocoagulation was performed in areas adjacent to the IOFB to avoid hemorrhage, followed by endodiathermy and delicate opening of the retina above the IOFB. With specific tweezers, we remove the IOFB through a previously enlarged sclerotomy.

After, we injected perfluorocarbon to stabilize the macular region and remove the vitreous base more safely; afterwards, we performed fluid-air exchange and suture of the sclerotomies with vycril 7.0.

In the end, we showed the IOFB in sterile gauze and that there was no significant lens involvement.

In **Image 5**, pictures of the main part of the surgery.

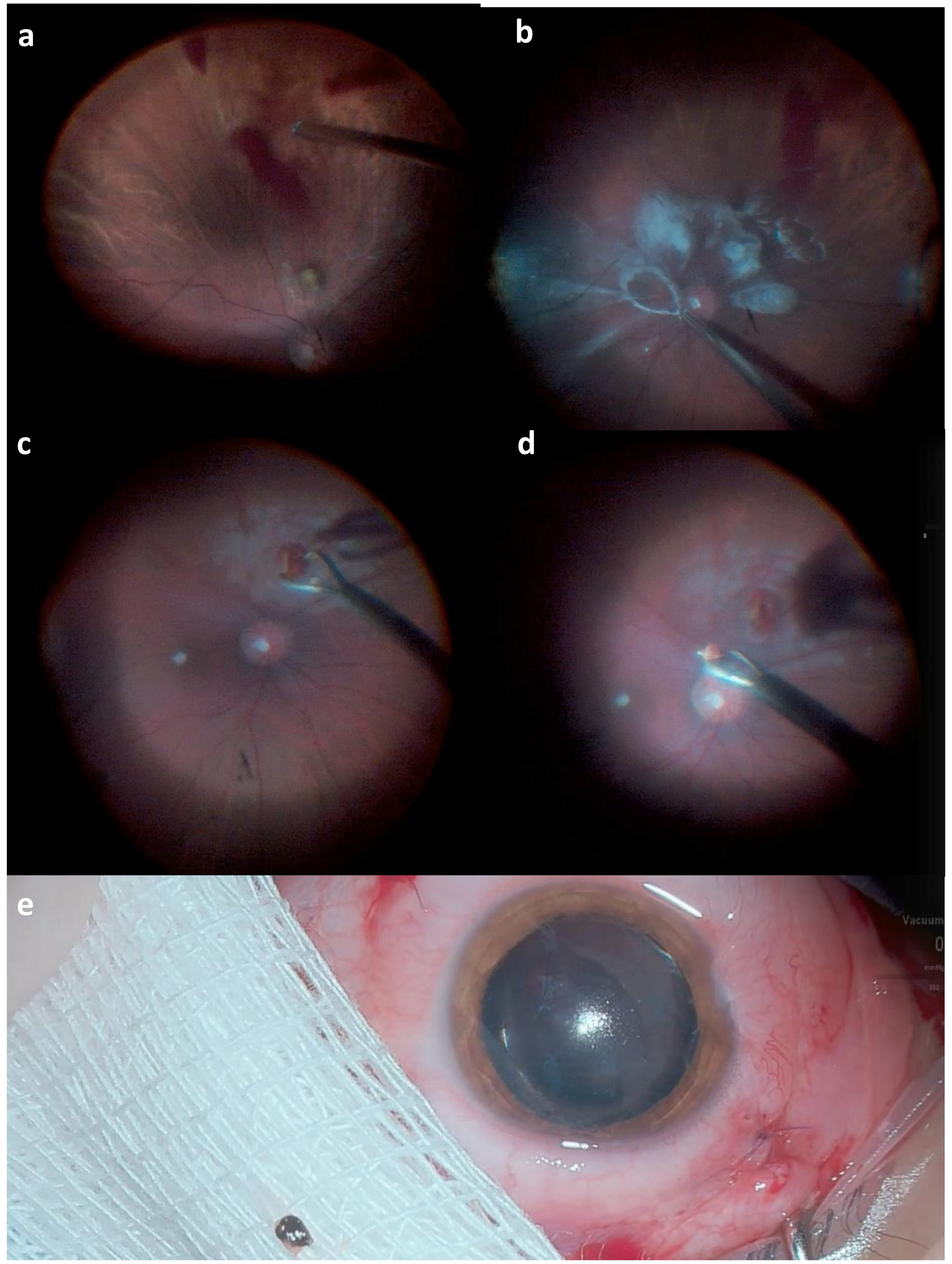

Image 5: intraoperative images of some steps of IOFB removal
(a) posterior vitrectomy via pars plana;
(b) posterior hyaloid removal after triamcinolone;
(c) removal of subretinal foreign body after adjacent laser and endodiathermy;
(d) foreign body excision by sclerotomy;
(e) foreign body visualized on the surface of a sterile gauze.

One month after surgery, the patient presented visual acuity of 20/40 in the left eye, disorganization of the retinal layers in the topography of the foreign body, but with a preserved macular region (**Image 6**).

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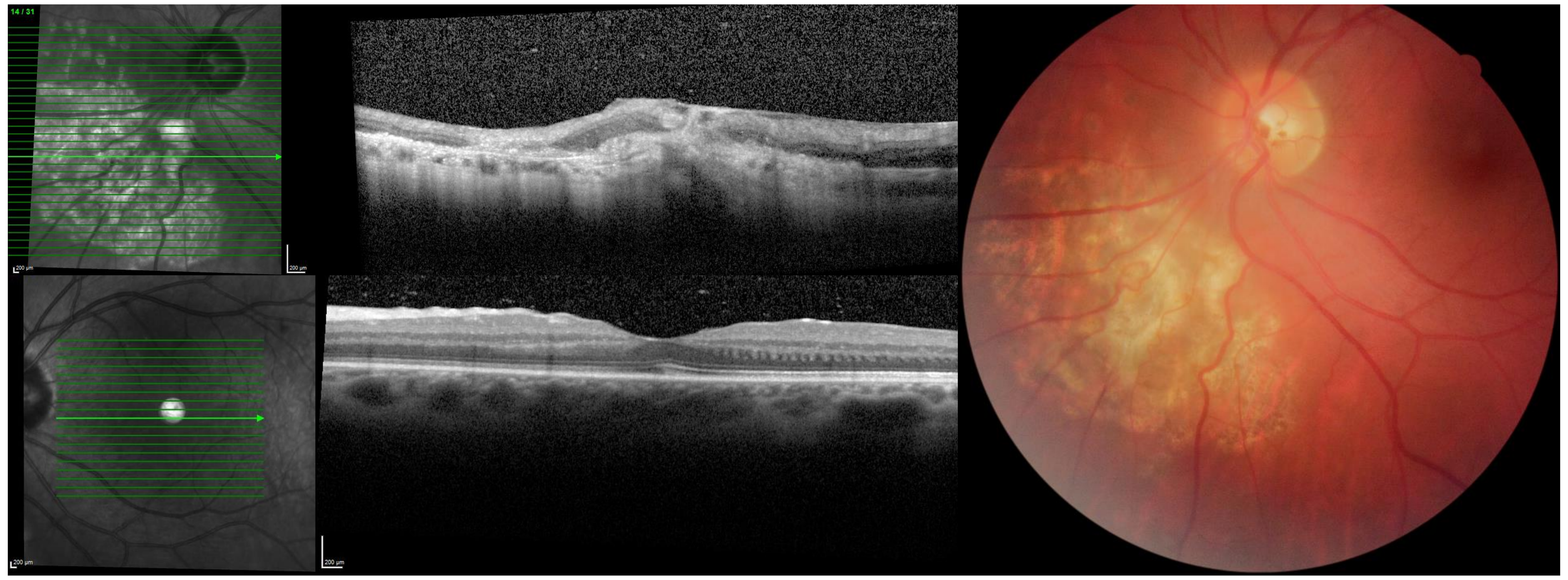

Image 6: OCT and post-operative color fundus picture.

Discussion

Ocular trauma with the presence of an IOFB is a dramatic event and may account for 18 to 41% of cases of open globe injury, with 60 to 88% of IOFB located in the posterior segment[1]. Most episodes occur in young male patients due to occupational activity[2]. Visual damage can be extensive and varies according to the size of the IOFB, location, trauma mechanism and type of material[3]. Small lesions can cause more retinal damage due to less energy dissipation, as well as scleral penetration, which occurs in 25% of cases[4].

Imaging exams can be important in detecting IOFB. X-rays are an easily accessible test. However, they may present limitations depending on the constitution of the material, which makes computed tomography the main confirmatory test. Ultrasonography should be performed cautiously and magnetic resonance should only be chosen if metallic IOFB is ruled out[5,6].

Removal of IOFB is often recommended as early as possible, especially in suspected endophthalmitis. When this is not possible, initial closure of the lesion and subsequent removal of the IOFB is suggested.

In the present case, we opted for initial follow-up due to the absence of signs of endophthalmitis and 20/20 visual acuity. Thus, retinal function was assessed using serial ERG.

It is known that the presence of a metallic foreign body causes functional alterations in the retina. Early cases of siderosis are accompanied by increased a and b waves, followed by decline in advanced stages. In cases of initial chalcosis, ERG changes precede clinical findings in 50% of cases, showing more subtle changes, such as decreased b-wave amplitude[7]. The case presented here showed an unequivocal decrease in the amplitude of a and b waves, disproportionately to the clinical findings.

As demonstrated by the ERG, the retinal toxicity caused by the foreign body made its removal mandatory. Although the surgery was uneventful, frequent surgical complications are endophthalmitis, retinal detachment, proliferative vitreoretinopathy, Sympathetic Ophthalmia[8, 9].

The prognosis of an IOFB depends on multiple factors, such as: time of presentation, visual acuity presented, lesion extension, foreign body location, associated factors (endophthalmitis, retinal detachment, vitreous hemorrhage)[10]. Fortunately, our patient did not have several bad prognostic factors, and he recovered satisfactorily, with visual acuity of 20/40 one month after surgery.

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