CASE REPORT

Suction-induced retinopathy: optical coherence tomography correlations

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SUMMARY

We report a clinical case of a teenager whose eyes were exposed to highly negative suction pressures for brief seconds. The patient presented with a bilateral cystoid macular oedema associated with a thickening of outer nuclear layer evidenced by optical coherence tomography. The patient's constellation of findings is most easily explained by the abrupt expansion and traction of a cohesive vitreous base onto the retinal layers.

BACKGROUND

This case is, to the best of our knowledge, the first description of the traumatic acute effects of suction on the vitreoretinal interface.

CASE PRESENTATION

A 14-year-old boy presented at the emergency room of our department after having his face sucked into the drainage system of a public pool. The patient complained of an acute onset of a decreased visual acuity bilaterally and referred some minor ocular discomfort.

INVESTIGATIONS

He was submitted to a full ophthalmological examination which revealed a best-corrected visual acuity of 20/200 for the right eye (OD) and 20/60 for the left eye (OS). Anterior segment was normal on slit-lamp examination bilaterally, except for the presence of a subconjunctival haemorrhage on the OD. Normal pupillary response was showed with no relative afferent pupillary defect. Dilated funduscopic examination revealed a blurred appearance of the macula with mild elevation of retinal layers and flamed-shaped haemorrhages nasally to the optic disc bilaterally (figure 1). Orbital CT scan, spectral-domain optical coherence tomography (SD-OCT), autofluorescence retinography and fluorescein angiography were performed. The orbital CT scan showed no signs of bone fracture with no apparent lesion of the orbital structures. The post-trauma SD-OCT of the OD showed an increase in reflectivity of Henle's fibre layer (HFL) and an increase in thickness of outer nuclear layer (ONL) associated with subfoveal cystoid spaces and preservation of the foveal depression. Mild disorganisation of external limiting membrane is noted on subfoveal area of the OS (figure 2). No signs of vascular congestion or occlusion were reported during fluorescein angiography besides

the hypofluorescence nasal to optic disc due to flame-shaped haemorrhages (figure 1).

OUTCOME AND FOLLOW-UP

Six days after the trauma, the patient returned for a follow-up observation with best-corrected visual acuity of 20/20 bilaterally. No treatment was performed during this period. On SD-OCT, foveal anatomy was near-normal with full resolution of the macular oedema on both eyes with mild hyper-reflectivity of the outer retinal layers of the OD (figure 3).

DISCUSSION

Few reports are available regarding the effects of suction on ocular structures and are usually referred to the effect of microkeratome suction during Laser-Assisted in Situ Keratomileusis (LASIK) surgery. Several authors have reported a decrease in lens thickness and an increase in vitreous distance, with no or some changes in anterior chamber depth or axial length.^{1 2} In our reported case, the suction effect of the trauma could have a similar effect on vitreous base. To understand this, we reviewed all anatomy and physiology of middle and outer retina. The ONL is composed of cell bodies of rods and cones. In the central retina, the cones have oblique axons displacing cell bodies from their synaptic pedicles in the outer plexiform layer. These oblique axons with accompanying Muller cell processes form a pale-staining fibrous-looking area known as HFL.³ Muller cells mediate the extracellular space composition and volume. They also support the survival of photoreceptors and neurons and are responsible for the structural stabilisation of the retina. Under normal conditions, many vitreous fibres distribute tractional forces

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Figure 1 Retinography and fluorescein angiography of the right eye of the patient at the day of the trauma revealing a blurred appearance of the macula with mild elevation of retinal layers and flamed-shaped haemorrhages nasal to the optic disc more easily seen as hypofluorescent areas nasal to optic disc on the angiography.

Figure 2 Optical coherence tomography evidencing increase in reflectivity of Henle's fibre layer and an increase in thickness of outer nuclear layer associated with subfoveal cystoid spaces and preservation of the foveal depression in the right eye (OD). Mild disorganisation of external limiting membrane is noted on subfoveal area of the left eye (OS) (OD represented above and OS below).

to numerous Muller cells. In case of vitreous shrinkage, it can result in irritation of Muller cells and local release of gliosis and vascular leakage.⁴ The resulting cystoid spaces in ONL and altered geometry of the macula contributed to optical changes in

Figure 3 Restoration of normal macular anatomy with hyper-reflectivity of the outer retinal bands of the right eye (OD) at day 6 after the trauma. Left eye (OS) shows a normal presentation of all retinal layers (OD represented above and OS below).

HFL, which provides an explanation for augmented reflectivity of this layer—which is usually not recognised—and vision loss due to altered photoreceptors' cell bodies.⁵ The disruption of the HFL and the normally well-ordered macular cross pattern in macular diseases is already known.⁶ On the other hand, Muller cells prevent retinal damage by activation of mitogen-activated protein kinases and release of neuroprotective factors.⁴ This can explain the rapid resolution of cystoid oedema and regularisation of visual acuity. However, the posterior SD-OCT presents some hyper-reflectivity of outer retinal bands, which may be due to higher penetration of light after ONL thickness regularisation. Flame-shaped haemorrhages observed nasal to optic disc are probably explained by the abrupt vitreous traction that altered superficial nerve fibre layer and were easily reabsorbed.³

Learning points

- ▶ The effects of negative suction pressures are scarcely described.
- ▶ Suction can increase the risk of vitreoretinal pathologies due to the biomechanical deformation of the vitreous induced by the rapid sequence of compression and decompression forces.
- ▶ The alteration of Muller cells led to vascular leakage with macular oedema and alteration of cell bodies of photoreceptors with acute vision loss.
- ▶ Neuroprotective effect of Muller cells quickly restored macular anatomy and visual acuity.
- ▶ Full resolution of symptoms and restoration of normal retinal anatomy occurred without any treatment.

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