

An unusual complication of blunt ocular trauma: A horseshoe-shaped macular tear with spontaneous closure

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A case of horseshoe-shaped macular tear after blunt trauma with the course of the tear and the relevant findings obtained by spectral-domain optical coherence tomography (SD-OCT) is described. A 21-year-old man who had suffered blunt trauma 5 days previously visited our clinic complaining of vision loss in his left eye. Ophthalmic examination and SD-OCT images revealed a horseshoe-shaped macular tear. A month later at the second visit, the macular tear was found to have spontaneously closed. There have been many cases reported previously of the spontaneous closure of traumatic macular holes. A horseshoe-shaped macular tear is an atypical clinical presentation. However, the mechanism of spontaneous closure is hypothetically as same as that for a macular hole. High-resolution images and three-dimensional maps taken with SD-OCT can provide more details on macular diseases and are more useful than time-domain OCT images.

Key words: Blunt trauma, horseshoe-shaped macular tear, spectral-domain optical coherence tomography

A frequent macular pathology after blunt trauma is a macular hole. In this report, a patient with a horseshoe-shaped traumatic macular tear was assessed using spectral-domain optical coherence tomography (SD-OCT; Cirrus High Definition-OCT; Carl Zeiss Meditec Inc., Jena, Germany) and fluorescein angiography (Heidelberg Retina Angiograph 2, Heidelberg Engineering, Heidelberg, Germany). To the best of our knowledge, this is the first horseshoe-shaped traumatic macular tear to be reported.

Case Report

A 21-year-old man presented with low vision in his left eye due to an accidental blunt trauma involving a metal bar of a bunk bed 5 days ago. At the initial examination on the fifth day after

the trauma, his best corrected visual acuity was 20/20 in the right eye and was counting fingers in the left eye. Slit-lamp examination revealed a temporal subconjunctival hemorrhage and a 2-cm-long sutured skin lesion at the infraorbital region. There was no hyphema. The ophthalmoscopic examination revealed a horseshoe-shaped macular tear with detached margins. Fluorescein angiography revealed very slight hyperfluorescence in the fovea and hypofluorescence in the hemorrhagic areas [Fig. 1a and b]. Additionally, subretinal hemorrhage at the peripapillary area and subretinal and preretinal hemorrhages in lower nasal area at the periphery were observed. No pathology was observed in the peripheral retina. The Watzke-Allen test was positive. SD-OCT revealed a horseshoe-shaped macular tear and subretinal serous elevation of the margins with no vitreous traction on the retinal flap [Fig. 2a and b]. The inward direction of the apex of horseshoe-shaped tear was observed in the vertical scan of the macula [Fig. 2b]. Three-dimensional layer map and macular thickness map topographically revealed horseshoe-shaped tear of the left eye [Fig. 3]. After discussing the possibility of spontaneous closure, the patient elected observation.

At a follow-up examination, 1 month after the initial visit, the best-corrected visual acuity of the left eye remained unchanged without any intervention. However, horseshoe-shaped macular tear appeared to have spontaneously closed [Fig. 1c and d]. SD-OCT demonstrated resolution of the subfoveal fluid. The macular tear had closed, the subfoveal fluid had resolved, and the edges of the tear assumed a more normal appearance. Foveal atrophy was present [Fig. 2c and d].

Discussion

The effects of blunt trauma to the eye are typical and have been previously studied in standardized experimental traumatic

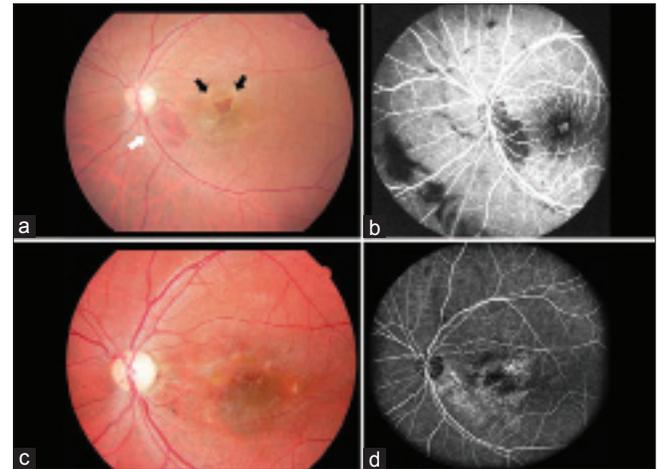


Figure 1: (a) Fundus photograph of the left eye revealing a horseshoe-shaped macular tear and subretinal serous elevation of the parafoveal area. The white arrow shows subretinal hemorrhage at the lower temporal peripapillary area. Black arrows show the borders of horseshoe-shaped macular tear. (b) Fluorescein angiography of the left eye revealing very slight hyperfluorescence in the fovea and hypofluorescence in the hemorrhagic areas (lower temporal peripapillary area and lower nasal peripheral area). (c) Fundus photograph of the left eye showing spontaneous closure of the tear and optic atrophy formation 1 month after the trauma. (d) Fluorescein angiography of the left eye after 1 month

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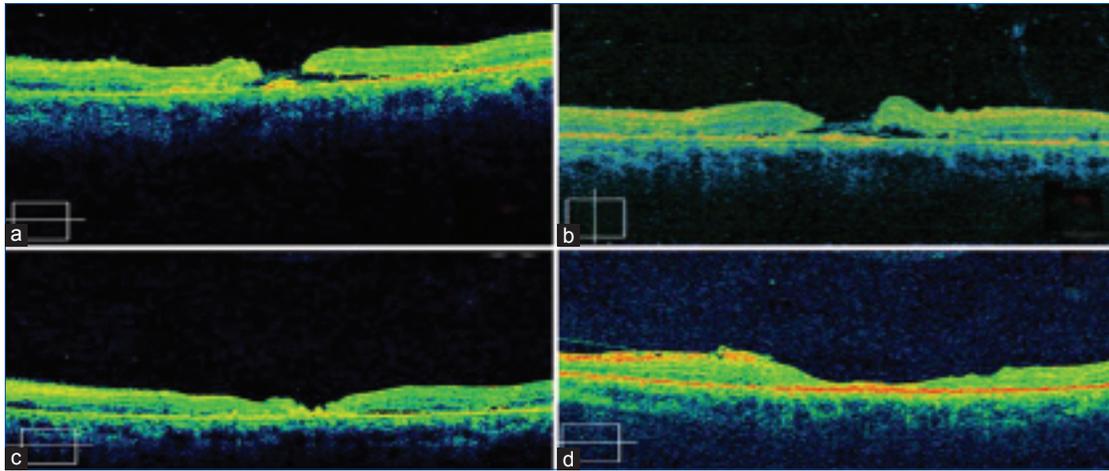


Figure 2: (a) Spectral-domain optical coherence tomography (OCT) images of the lesion showing a full-thickness macular tear with subretinal fluid. The macular thickness of the central fovea was 175 μm , and the thickness of the edge was 370 μm . Bridge formation of neuroretinal tissue was observed. There was no posterior vitreous detachment. (b) Superoinferior cross-sectional OCT image of the macular tear showing the inward protrusion of the edge and subretinal fluid. Additionally, the wrinkling of the retina on the inner surface is noteworthy. (c and d) Spectral-domain OCT images of the lesion 1 month later revealed spontaneous closure of the macular tear and perifoveal retinal nerve fiber layer atrophy. The thickness of the central macula was 78 μm . Clear evidence of posterior hyaloid detachment and traction of upper temporal edge of macula are present in the second image

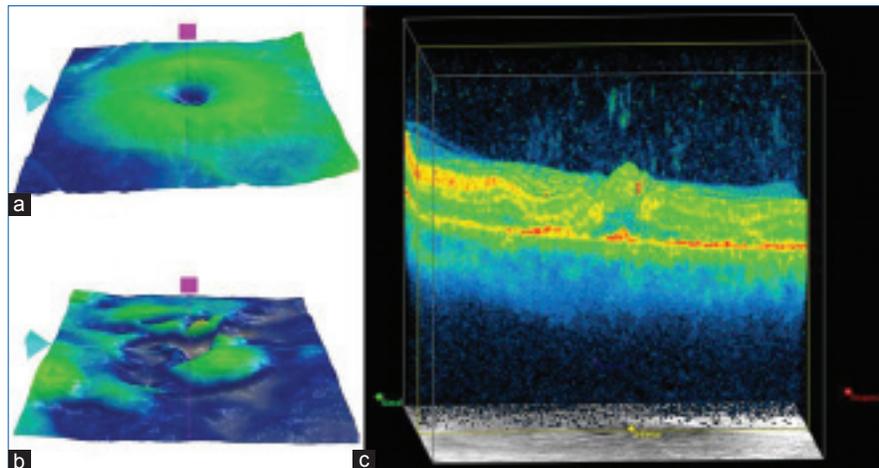


Figure 3: Topographic macular thickness map between the internal limiting membrane and the retinal pigment epithelium of the healthy right eye (a) and the left eye with horseshoe-shaped macular tear (b). Cube of data showing a cross-sectional image of three-dimensional map at the macular tear area (c)

injury models.^[1] Commotio retinae, peripheral tears and dialysis, preretinal and subretinal hemorrhages, choroidal rupture, and macular holes are common retinal complications.

Although the majority of full-thickness macular holes are idiopathic, a small proportion of tears are caused by blunt trauma, especially in young patients as a result of sports-related accidents. There have been many cases of traumatic macular holes with spontaneous closure reported previously in the literature.^[2-4] Arevalo *et al.*^[5] investigated the OCT characteristics of full-thickness traumatic macular holes, and they concluded that OCT complements biomicroscopy in the evaluation of full-thickness macular holes. A horseshoe-shaped macular tear after a blunt trauma is a rare clinical presentation. Khakima *et al.*^[6] reported a case of horseshoe-shaped macular tear after recurrent branch retinal vein occlusion, but they concluded that chronic macular edema and retinal ischemia following branch retinal vein occlusion were additional contributing factors besides the vitreous traction.

The exact mechanism of the formation of traumatic macular holes is uncertain, and different mechanisms have been proposed previously. Yanagiya *et al.*^[7] proposed the attachment of vitreous body and direct rupture as causes. Tangential traction on the retina is another hypothesis for the formation of macular holes.^[8] Sudden compression and expansion of the eye after a blunt trauma produce tractional stress on the retina exactly at the point of vitreous attachment. The direct contour-coup effect of the traumatic force, the distortion of the vitreous body, and sudden traction of the macula may explain the formation of macular holes. Hypothetically, if vitreous attachment is not equal at all sides of macula, the sudden traction exerted on the macula could result in a macular tear, not a hole. To our knowledge, traumatic horseshoe-shaped macular tear has not been described previously.

Spontaneous closure is the expected result of traumatic macular defects, especially in young patients with small macular holes. Mitamura *et al.*^[9] reported spontaneous closure

in 7 of 11 cases (63.6%), and the mean age of these patients was 13.6 years. According to Takahashi and Kishi,^[10] closure begins with the release of vitreal traction followed by connection of the protruding margins and the neuroretinal bridge. Glial and retinal pigment epithelial cell proliferation is the most accepted hypothesis for closure in the literature. The immediate vision loss after injury could be explained by acute retinal tear formation, and visual improvement might be expected after spontaneous closure. However, refractory vision loss in spite of spontaneous closure is due to photoreceptor cell damage and glial proliferation. In our case, we observed the closure after 1 month, but visual acuity remained unchanged.

SD-OCT creates higher speed and higher resolution images than time-domain OCT does, thus providing more details on the retinal layers. Additionally, the three-dimensional SD-OCT map provides a new perspective for specialists. With OCT, we could observe the configuration of the tear in two- and three-dimensional maps. We could determine the shape of the tear and could document the presence of neuroretinal tissue over the central foveal area, which has been reported as the first step of spontaneous closure by Menchini *et al.*^[8] and Mitamura *et al.*^[9] After 1 month, we observed spontaneous closure of the tear.

Choosing an appropriate treatment procedure is the most complicated process in these cases. Several authors recommend follow-up without any surgical intervention in young patients with a small hole or tear. Vitreous bleeding, subretinal hemorrhage, and remaining macular edema may be indications for surgical treatment. On the other side, the longer the delay in performing vitrectomy, the greater the possible photoreceptor cell damage.

In conclusion, we presented spontaneous closure of a horseshoe-shaped macular tear due to blunt ocular trauma. To the best of our knowledge, this is the first macular horseshoe-shaped tear presented in the literature.

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