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Spontaneous separation in idiopathic vitreomacular traction syndrome associated with contralateral full-thickness macular hole

A. RODRÍGUEZ, R. INFANTE, F.J. RODRÍGUEZ, M. VALENCIA

From the Servicio Retina y Vítreo, Fundacion Oftalmologica Nacional, Facultad de Medicina, Universidad del Rosario, Bogotá - Colombia

PURPOSE. *Vitreomacular traction syndrome (VMTS) and full-thickness macular hole are two different well-known entities that on follow-up may be subjected to clinical modifications. Precisely, a spontaneous separation of idiopathic VMTS occurred in three eyes of three patients relieving in addition traction of the posterior hyaloid that had led also to a focal macular pigment epithelium detachment (RPE). An association to a full-thickness macular hole was observed in the contralateral eye of one of the patients.*

METHODS. *This is a retrospective study of three patients evaluated with fluorescein angiography and documented with optical coherence tomography using the Stratus (OCT) model 3000, with scans analysis and protocols analysis, measuring the size and shape of vitreomacular adhesions, macular thickness changes before and after the spontaneous separation of the tractional posterior hyaloid adhesion. In addition, the vitreous was evaluated with contact lens slit lamp biomicroscopy and ultrasound. The associated contralateral macular hole in one of the patients was surgically treated.*

RESULTS. *Two of the three eyes with spontaneous separation of the VMTS recovered 20/25 central visual acuity; the other eye maintained the initial 20/50 visual acuity. The treated macular hole recovered 20/100 corrected visual acuity.*

CONCLUSIONS. *Spontaneous separation of posterior hyaloid is a possible outcome during follow-up of idiopathic VMTS that can be well evaluated and documented with OCT while macular fluorescein angiography may be silent in cases like these presently reported. Central vision recovery can be excellent following the spontaneous separation, which releases anterior–posterior traction including on the retinal pigment epithelium and decreases macular thickness as measured with OCT. Therefore, regarding management, the indication for vitrectomy should be delayed awaiting the spontaneous release of vitreomacular traction in 4 to 6 months. The association between idiopathic VMTS in one eye and full-thickness macular hole in the opposite eye of one patient is an important pathophysiologic consideration. (Eur J Ophthalmol 2006; 16: 733-40)*

KEY WORDS. *Vitreomacular traction, Idiopathic, Tractional RPE detachment, Spontaneous separation, Macular hole, Optical coherence tomography*

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INTRODUCTION

Vitreomacular traction syndrome (VMTS) is caused by a partial posterior vitreous detachment where the posterior hyaloid remains focally attached to the foveal surface resulting in blurred and fluctuating vision, metamorphopsia, epiretinal membrane (ERM) formation, possible development of a lamellar or full-thickness macular hole (MH), and the possibility of a retinal detachment in cases of unusually dense and firm vitreoretinal adhesions (1-4). VMTS can be idiopathic or secondary mostly to proliferative retinopathies. In the past, clinical diagnosis depended on slit-lamp biomicroscopy and ophthalmoscopy (4). Other important ancillary tests have included Amsler's, ultrasonography, fluorescein angiography (FA), and more recently optical coherence tomography (OCT) (5-9). FA may show a hyperfluorescent macula although in some cases the studies are silent. OCT is a good method to demonstrate focal vitreomacular traction and before its advent, clinical diagnosis of VMTS cases was difficult. In addition, OCT has contributed to understanding of the pathophysiology of vitreomacular traction and has allowed retinal thickness measurements and documentation.

The purpose of this presentation is to report three cases of spontaneous separation of the posterior hyaloidal tractional adhesion demonstrated with OCT performed before and after spontaneous separation and to make recommendations regarding management. The contralateral eye of one of the patients presenting a full-thickness MH was subsequently treated with surgery which closed the MH. The macular focal tractional detachment of the retinal pigment epithelium (RPE) in two of the three cases also disappeared coinciding with the hyaloidal posterior separation.

OCT was performed using Stratus OCT model 3000 (Carl Zeiss Meditec, Dublin, CA) scans analysis carried out with six radial lines centered in the fovea and 3 and 6 mm from the center of the fovea and a macular thickness map. The protocol analysis included Gaussian smoothing, retinal map, and retinal thickness. Normal central fovea thickness was considered 150 ± 17 µm and perifoveal thickness 250 ± 17 µm.

Case report

Case 1

A 67-year-old man, a practicing ophthalmologist from out of town, was seen in consultation in May 2003 presenting floaters and metamorphopsia in the right eye of 1 month's duration and diagnosed elsewhere as an impending MH. His medical and ophthalmic history were negative. Examination revealed the following: right eye, +1.00 sph 20/40 (cc 0.75 M); left eye, +0.50 sph 20/25+ (cc 0.50 M). Anterior biomicroscopy showed nuclear sclerosis (+) in both eyes and vitreous syneresis in the right eye. Ophthalmoscopy findings led us to suspect an impending MH in the right eye. Clinical findings in the opposite left eye were normal except for a posterior vitreous detachment having developed 2 years earlier with a subsequent ERM growth found with OCT examination.

Amsler test in the right eye revealed metamorphopsia, contact lens biomicroscopy and ultrasonography showed a partial posterior vitreous detachment. Color photographs and fluorescein angiography of the right eye appeared normal without any hyperfluorescent structures in the macula (Fig. 1A). The initial OCT (Fig. 1B) revealed an idiopathic VMTS in the right eye without association to macular ERM. A pars plana vitrectomy was advised but the patient returned 4 months later, in September 2003, reporting a sudden recent visual acuity improvement to 20/25 in his right eye without metamorphopsia. OCT in the right eye showed that the posterior hyaloid had spontaneously separated from the fovea, making complete a prior partial posterior vitreous detachment and possibly explaining the visual recovery (Fig. 1C). Following posterior vitreous detachment and similar to what had happened in the left eye, an ERM had developed in the macula of the right eye (Fig. 1D). Therefore, a scheduled pars plana vitrectomy in the right eye was canceled and the patient was placed under close observation. Examinations in April and August 2004 and September 2005 indicated a 20/20 visual acuity without metamorphopsia in spite of the growing macular ERM and an increased thickening of the posterior retina. Both eyes were treated with topical nonsteroidal anti-inflammatory medication, noticing a stable condition during follow-up.

Consecutive OCT measurements of the fovea of the right eye indicated 318 µm at the time of onset of the VRTS; 260 µm following spontaneous separation, and 319 µm at the last visit, following the development of the macular ERM. Furthermore, we measured 1) the size of the vitreoretinal adhesion in the vertical scanning 286 µm and in the horizontal scanning 52 µm; 2) the amount of separation between the posterior hyaloid and the internal limiting membrane at the border of the foveal adhesion in four scanning sections: inferior 265 µm, superior (no separation), nasal 224 µm, and temporal 298 µm; and 3) before

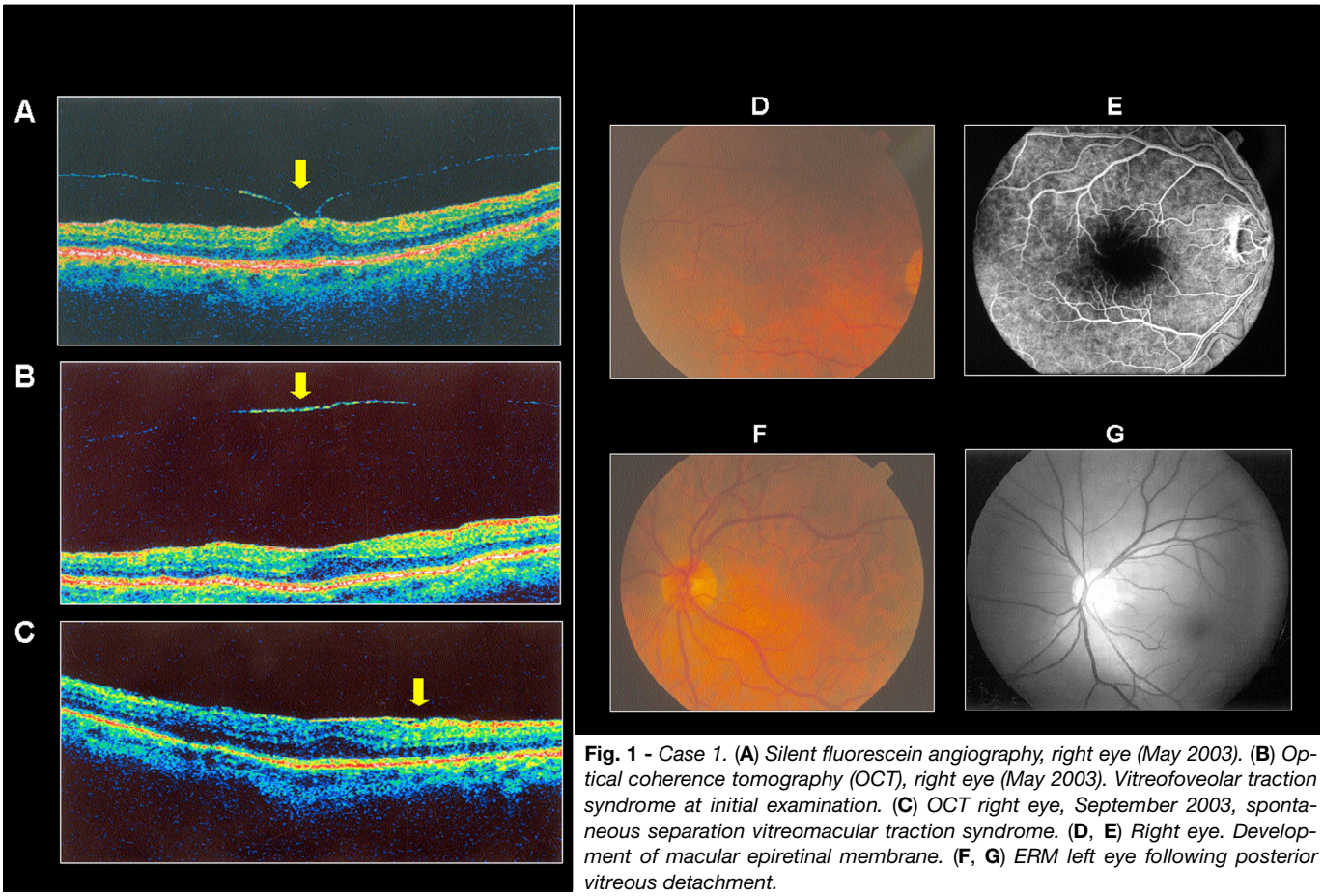

Fig. 1 - *Case 1.* (**A**) *Silent fluorescein angiography, right eye (May 2003).* (**B**) *Optical coherence tomography (OCT), right eye (May 2003). Vitreofoveolar traction syndrome at initial examination.* (**C**) *OCT right eye, September 2003, spontaneous separation vitreomacular traction syndrome.* (**D**, **E**) *Right eye. Development of macular epiretinal membrane.* (**F**, **G**) *ERM left eye following posterior vitreous detachment.*

separation, we measured the foveal thickness at the site of traction and found 318 µm compared with the retinal thickness outside the fovea, 273 µm that may provide an idea of the degree of retinal edema and perhaps of the anteroposterior vitreoretinal traction (Tabs. I–III).

Case 2

A 48-year-old woman, first seen in August 2003, complained of diminished visual acuity in both eyes for the past 6 months and was diagnosed elsewhere to have a macular hole in the right eye. The patient underwent bilateral LASIK for myopia of –5.00 sph. in each eye 7 years before. Otherwise, ocular and systemic evaluations were unremarkable.

Ocular examination revealed the following: right eye +0.50 – 0.25 cyl 0: CF 3 m, left eye + 0.50 – 0.50 cyl 0° = 20/30 (+2.00 sph add: 0.75 M) with fluctuating vision and metamorphopsia in the Amsler test. Contact lens biomicroscopy and ophthalmoscopy revealed a stage 4 macular hole, with posterior vitreous detachment (PVD) in the right eye according to Gass classification (21). The left eye had a partial PVD associated with a macular traction syndrome and where fluorescein macular angiography did not show any hyperfluorescent structures (Fig. 2, A and B). A VMTS was confirmed with OCT in the right eye in September 2003, associated with diffuse intraretinal edema and a tractional detachment of the retinal pigment epithelium/choriocapillaris complex, 48 µm in height (Fig. 2C). OCT measurements of the left eye at initial examination revealed 1) the size of the foveal vitreoretinal adhesion in different sections was 630 µm in the vertical scanning and 430 µm in the horizontal scanning; 2) the amount of separation between the posterior hyaloid and the internal limiting membrane outside the border of the vitreoretinal adhesion measured in four different OCT scans was inferior 250 µm, superior 212 µm, nasal 215 µm, and temporal 230 µm; and 3) the retinal thickness at the fovea was 303 µm compared to 280 µm in the extrafoveal macular area (Tabs. I–III).

Regarding management, a bilateral pars plana vitrectomy was recommended, to close the macular hole in the right eye and to release the vitreoretinal traction at the

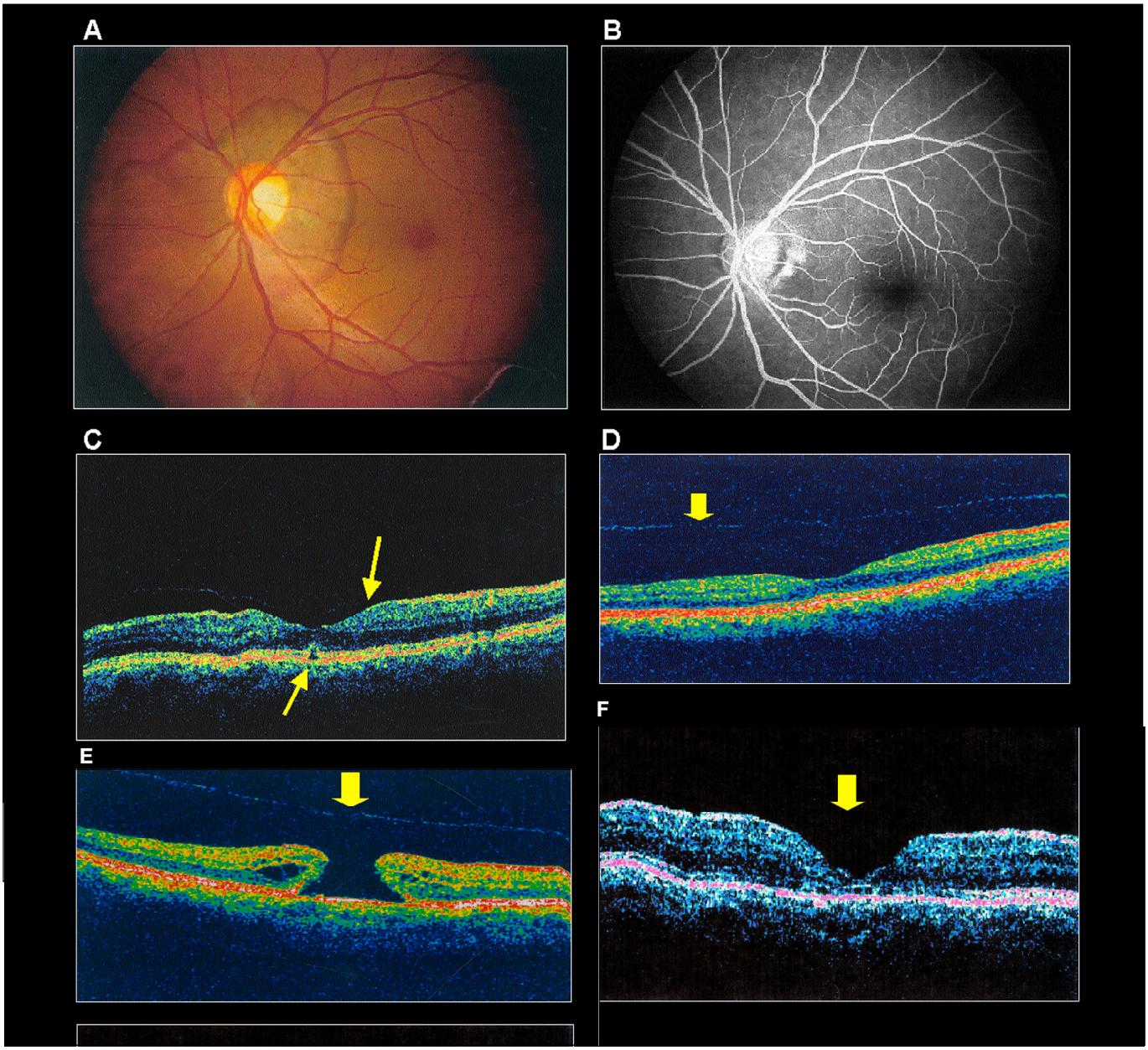

Fig. 2 - *Case 2.* (**A**) *Color fundus photograph left eye.* (**B**) *Silent fluorescein angiography in the left eye.* (**C**) *Optical coherence tomography (OCT) left eye, September 2003, vitreomacular traction syndrome (VMTS) at initial examination with focal macular retinal pigment epithelial (RPE) traction.* (**D**) *Spontaneous separation of VMTS, at the macula, December 2003, and disappearance of focal RPE traction, left eye.* (**E**) *Right eye. OCT before surgical repair of macular hole.* (**F**) *Right eye. OCT after surgical repair of macular hole.*

fovea in the left eye. However, 4 months later, in December 2003, the patient noticed a sudden improvement to 20/25 visual acuity in the left eye and OCT indicated a spontaneous complete separation of the posterior hyaloid from the neurosensory retina (Fig. 2D) with restoration of the normal contour of the fovea and disappearance of the tractional RPE detachment. Therefore, vitrectomy in the left eye was canceled. However, the patient accepted treatment of the macular hole in the right eye (Fig. 2E) with pars plana vitrectomy, ERM peeling, and removal of the ILM and gas injection, all performed in January 2004. On January 27, 2004, the macular hole in the right eye appeared closed (Fig. 2F) with lens nucleosclerosis and visual acuity –3.50 – 2.00 cyl 90 = 20/100 ; left eye = +0.50

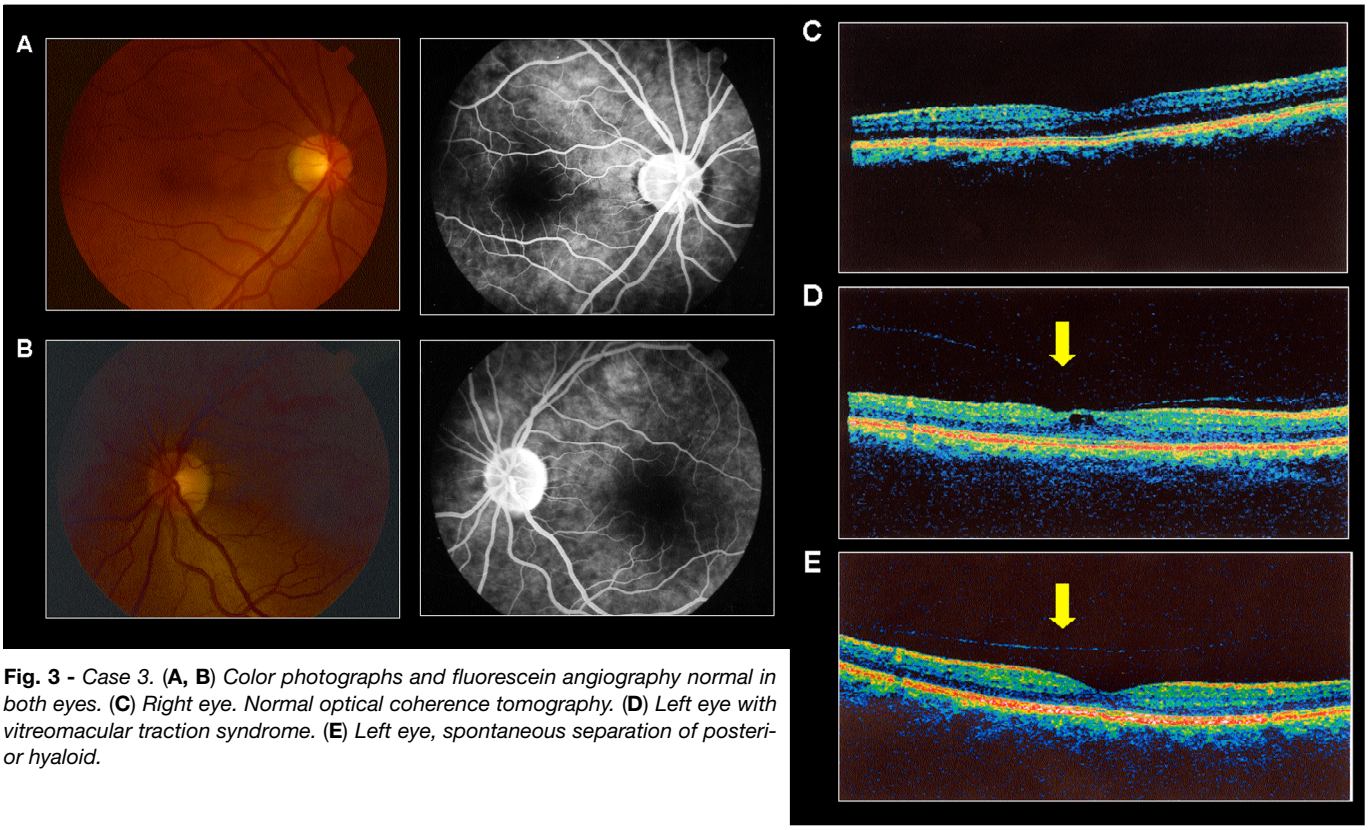

Fig. 3 - *Case 3.* (**A, B**) *Color photographs and fluorescein angiography normal in both eyes.* (**C**) *Right eye. Normal optical coherence tomography.* (**D**) *Left eye with vitreomacular traction syndrome.* (**E**) *Left eye, spontaneous separation of posterior hyaloid.*

– 0.50 cyl 0 = 20/25, without metamorphopsia. Eyes were stable in July 2004.

Case 3

A 47-year-old woman was seen on December 13, 2004, with diminished visual acuity in the left eye during the last 2 months. The patient had strabismus surgery as a child and had taken medication for thyroid disease and for blood hypertensive disease. On examination, visual acuity in the right eye was 20/20 with +0.50 sph and 20/50 in the left eye with +1.00 – 0.25 cyl 90. The patient had moderate exophoria and convergence insufficiency. Intraocular pressure was 14 mmHg in both eyes and the Amsler test showed a small relative central scotomata in the left eye.

Biomicroscopy of the anterior segment and the macula of the right eye was normal. Contact lens biomicroscopy of the right eye showed a partial posterior vitreous detachment. Ophthalmoscopy of the left eye fovea was suspicious for a VMTS. Color photographs and fluorescein angiography were normal in the macula of both eyes (Fig. 3, A and B). OCT was normal in the right eye (Fig. 3C) but in the left eye OCT demonstrated a VMTS (Fig. 3D). The posterior hyaloid was attached to the neurosensory retina in an irregular fashion and the focal traction exerted had developed a focal small RPE detachment. Foveal thickness, 327 µm, was probably due to diffuse and microcystic edema in the macula while extrafoveal retinal thickness was 269 µm. Regarding management, patient was given two options: observation versus pars plana vitrectomy in the left eye. The patient decided to wait and 6 months later (June 9, 2005) the posterior hyaloid detached spontaneously from the fovea of the left eye (Fig. 3E), with the following amount of separation: 149 µm inferior, 299 µm superior, 225 µm nasal, and 323 µm temporal.

Neurosensory epithelium of the retina recovered a smooth surface from 327 µm to 250 µm normal thickness, 160 µm thickness at the fovea, and disappearance of RPE detachment. Visual acuity has remained 20/50 in the left eye probably based on prior strabismus emblyopia (Tab. I-III).

DISCUSSION

Smiddy et al have recognized three types of relations at the vitreoretinal interface (10): the third type is a partial PVD with only a thin antero-posterior attachment to the

fovea. Precisely, we are reporting the spontaneous posterior hyaloidal separations of the adhesion that have developed in three cases of idiopathic VMTS, and these observations were well documented with OCT. To our knowledge, there are only four reports in the literature on spontaneous separation of the VMTS that were confirmed and documented with OCT. These cases were reported by Sulkes et al (9), Gallemore et al (7), Kusaka et al (11), and Carpineto et al (12), although our report contains additional information.

Differential diagnosis of the VMTS should be made with ERM that can develop after posterior vitreous detachment (PVD) (13, 14) causing retinal surface irregularities. VMTS can be simply associated with ERM as observed in Case 1, where the ERM developed after the spontaneous separation of the VMT (15, 16). VMTS should also be differentiated from impending macular hole, precisely the initial diagnosis made elsewhere in two of the three cases here reported. This is an understandable mistake, considering the clinical features observed (1-3, 10, 17, 18). VMTS is characterized by increased macular thickness, persistent retinal tissue at the base of the fovea, with the hyaloid attachment limited to the fovea and subjected to anteroposterior traction (19) that may be transmitted to the RPE as observed in the initial OCT examination of Cases 2 and 3 where RPE traction disappeared after spontaneous hyaloidal separation. Subsequent OCT measurements seem to indicate a decrease of retinal thickness in VMTS, giving confirmation to a prior report by Carpineto et al (12). Fluorescein angiography did not reveal macular edema and OCT did not reveal any cystic spaces, except in Case 3 which did not show hyperfluorescent structures. Silent angiographies could perhaps be explained on the basis of minimal initial tissue damage and absence of associated cystoid macular edema. Also, vitreitis has not been an associated finding in the cases reported here. Sebag (20) has postulated that VMTS is the result of an anomalous posterior vitreous detachment as one of the deleterious effects developing in the retina and the vitreous when the extent of vitreous liquefaction exceeds the degree of weakening of vitreoretinal adherence and traction exerted at this interface.

Our observation of a VMTS in one eye and a full-thickness macular hole in the contralateral eye of the same patient is a matter of speculation regarding pathogenesis (21). Management of VMTS can involve observation, due to the possibility of spontaneous vitreoretinal separation with release of vitreous traction at the fovea (7, 9, 11). Hikichi et al (4) reported 6 (11%) of 53 eyes with VMTS evaluated only with a special contact lens examination that developed spontaneous hyaloid separation and a complete posterior vitreous detachment developing over a 15-month term before the clinical OCT introduction. Should this not take place, pars plana vitrectomy could be indicated, although it is not devoid of complications (22). Treatment of complications such as full-thickness macular holes and retinal detachment (10, 17, 22-24) is obviously required but they were absent in the cases reported here.

To reduce the influence of OCT artifacts and image misinterpretation, a careful qualitative and quantitative measurement (5) of the vitreoretinal adhesion at the macula were performed, recalling that vitreoretinal traction quantification is difficult to calculate. Nevertheless, measurements revealed in the cases evaluated that the size of adhesion was different in the six scanning sections of examination thus creating a virtual mapping of an irregular area of vitreoretinal adhesion and traction.

Furthermore, we have intended to measure the degree of

TABLE I - VITREOMACULAR TRACTION SYNDROME (BEFORE SEPARATION)

	Size of VR adhesion (µm)		Retinal thickness (µm)	
	Vertical	Horizontal	Fovea	Outside
Case 1	286	52	318	273
Case 2	630	430	303	280
Case 3			327	269

TABLE II - VITREOMACULAR TRACTION SYNDROME (AFTER SEPARATION)

	Posterior hyaloid–ILM separation (µm)			
	Inferior	Superior	Nasal	Temporal
Case 1	265	None	224	298
Case 2				
Case 3	149	299	225	323

ILM = internal limiting membrane

TABLE III - FOVEAL THICKNESS

	Foveal thickness (µm)		
	Before	After separation	Last (2005)
Case 1	318	260	319 (EMR)
Case 2	Not obtained		
Case 3	327	250	160 (fovea)

hyaloidal separation, difference in thickness between the fovea and extrafoveal areas, that may help to assess the degree of AP vitreoretinal traction. Also, to compare retinal thickness before and after separation (Tabs. I–III) could be a matter of speculation on the pathophysiology, future anatomic and functional outcomes, and complications of VMTS cases when considering prognosis of the benefits of proper management. A macular profile has also been obtained with macular measurements by Haouchine et al (25), for the diagnosis of macular pseudo holes and lamellar macular holes. Chan et al (26) have introduced the concept of a stage 0 macular hole based on OCT observations and the subsequent risk of progression to a full-thickness macular hole. In macular microholes recently reported, Zambarakji et al (27) believe that vitreoretinal traction is likely to play an important role in pathogenesis.

Besides fluorescein and OCT findings, already described, other interesting observations are as follows: 1) Cases 2 and 3 seem to indicate that VRTS could lead to a focal RPE detachment which resolves following spontaneous posterior hyaloidal separation and subsequent release of traction. 2) Case 1 developed an ERM after hyaloidal separation. 3) In Case 2, there is a history of myopic bilateral refractive surgery (LASIK) performed 7 years before the development of a VMTS in one eye and a full-thickness macular hole in the contralateral eye. This case is additional to other previously reported similar ones (28). 4) All three cases of spontaneous separation occurred in idiopathic type of VMTS.

In closing, pars plana vitrectomy can be indicated in the treatment of selected cases of VMTS (10, 17, 18, 22-24) whether as a prophylactic measure before presumed macular hole development or as the treatment of such complications. However, given the possibility of the spontaneous separation of VMTS that may take 4 to 6 months to develop it is advisable to wait for a while before performing vitrectomy, particularly in the idiopathic type of VMTS. Patients should then be watched closely but vitrectomy proceeded with if symptoms increase or clinical findings worsen. Vitrectomy or spontaneous posterior hyaloidal separation do not rule out the possibility of subsequent macular hole development. Nevertheless, spontaneous or surgical separation of the vitreoretinal adhesion in VMTS may result in the anatomic restoration of the architecture in the affected structures following the release of vitreoretinal traction, hopefully with the resolution of irregularities in the vitreoretinal interface. Subsequent reduction of retinal thickness, elimination of tissue distortion, and recovery of a normal surface contour as observed in OCT studies may cause improvement of central visual acuity and elimination of bothersome metamorphopsia but not always. Progress in OCT technology, for example, tridimensional ultrahigh resolution instruments, may provide important additional information.

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Reprint requests to:
Alvaro Rodríguez
Calle 50 No. 13-50
Bogotá, Colombia
arodriguez@fundonal.org.co

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