Long-term Outcomes of Pars Plana Vitrectomy, Endolaser and Gas Tamponade in Patients with Optic Disc Pit Maculopathy

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ABSTRACT

Purpose: To evaluate the clinical outcomes of pars plana vitrectomy (PPV), endolaser and C3F8 tamponade for the treatment of optic disc pit maculopathy (ODP-M).

Materials and Methods: Thirteen eyes of twelve patients with serous macular detachment and/or macular retinoschisis associated with optic disc pit were included in this study. Preoperative and postoperative best-corrected visual acuity (BCVA) was recorded and optical coherence tomography (OCT) imaging was performed. All eyes underwent PPV, posterior hyaloid removal, endolaser photocoagulation on the temporal edge of optic disc and perfluoropropane (C3F8) gas tamponade . Anatomic success and functional outcomes determined retrospectively by OCT and BCVA.

Results: There were 9 male and 3 female patients in this study and the average age of patients was 24.8 years. Visual acuity improved in 12 of 13 eyes and nine eyes gained 3 or more lines. There was significant difference in the postoperative visual acuity (p=.004). Subretinal or intraretinal fluid was completely resorbed in all patients from the17th to the 27th postoperative month.

Conclusion: Our outcomes show PPV, posterior hyaloid removal, endolaser photocoagulation and C3F8 gas tamponade appears to be an effective treatment for optic pit-associated maculopathy .

Keywords: Optic disc pit, Serous macular detachment, Pars plana vitrectomy, Gas tamponade.

INTRODUCTION

Congenital optic disc pit (ODP) is a rare congenital excavation of the optic disc and occurs with the prevalence of one in 10 000.[1] These pits are caused to incomplete closure of the embriyonic fissure.[2] It is most often situated in the temporal or inferotemporal portion of optic disc and 20% of ODP are observed centrally.[3] Congenital ODP is bilateral in 10-15% of patients.[4,5] Optic pits are usually asymptomatic unless complicated by macular pathologies such as schisis, edema or serous detachment.[5] ODP-M is unpredictable with no known triggers and occurs in most commonly between age group of 20 and 40.[6] The source of fluid that cause serous detachment is still controversial. Vitreous fluid, cerebrospinal fluid, leakage from the peripapillary blood vessels or leakage from choroid have been suggested to be possible sources.[7,8] Although the mechanism of ODP-M has not been fully understood, ıt results in serous macular detachment and separation in the inner and outer retinal layers.[9,10,11,12]

There is no consensus on the management of patients with ODP-M. Variable treatment modalities that have been reported are small series and noncomparative. Various techniques have been defined, including conservative management, laser photocoagulation, macular buckling, intravitreal gas injection, and vitrectomy with different combined procedures. This study will analyze the long-term results and efficacy of PPV, the removal of the posterior hyaloid, endolaser at the temporal edge of the optic disc and C3F8 gas tamponade for the treatment of ODP-M.

MATERIALS AND METHODS

This retrospective study was conducted at a single center (Ulucanlar Eye Training and Research Hospital) by the use

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of the database of Ulucanlar Eye Training and Research Hospital files and OCT archives. Patients undergoing vitrectomy for ODP maculopathy have been enrolled in this study, after providing written informed consent, between January 2008 and September 2015. The present study was approved by The Ethical Committee of Numune Training and Research Hospital and followed the tenets of the Declaration of Helsinki.

Patients underwent a comprehensive ocular examination, including slit-lamp examination, best-corrected visual acuity (BCVA) measure, intraocular pressure assessment by using Goldmann applanation tonometer and dilated fundus examination by using a slit-lamp with a 90 diopter lens. The BCVAs measured by Snellen Chart were converted to the logarithm of the minimal angle of resolution (logMAR) chart before statistical analysis. OCT data also were recorded before the surgery and at each follow-up period. The spectral-domain optical coherence tomography (SD OCT) volume scan (20 × 20 degrees with 49 horizontal sections, ART 15) including en face images and macular image obtained with HRA2 (Heidelberg Retina Angiograph-Optical Coherence Tomography; Heidelberg Engineering, Heidelberg, Germany) was performed for each case. FAF images were obtained with a confocal scanning laser ophthalmoscope with scanning fields of 50 degrees.

After local anesthesia, surgery was performed by one surgeon (M.Y.T.). Three cannula-trocar systems were placed transconjunctivally into the eye. After ensuring that the inferotemporal infusion cannula is into vitreous cavity and the remaining two cannulas were placed to access the vitreous cavity with some tolls in the superonasal and superotemporal quadrants. During vitrectomy, firm attachment of the posterior hyaloid was observed and removal of the posterior hyaloid was performed hardly. ILM was not separated in any of the cases. Condansed vitreous and glial tissue was also seen within the optic pit intraoperatively in some eyes. Posterior hyaloid was stained with triamcinolone acetonide for better visualization. Detachment of posterior hyaloid was induced. During this procedure, careful attention was paid not to damage the highly thinned foveal area due to serous detachment and internal retinal schisis.

Peripapillary endolaser barrage photocoagulation was performed in mild-to-moderate intensity on the temporal margin of the optic disc, and air-gas exchange was performed with 16% perfluoropropane (C3F8) gas. After surgery, the patients were asked to keep to prone position for a week.

Statistical analyses were performed using the SPSS software (version 21 ; SPSS ınc, Chicago, Illinois, USA). Non-parametric tests were employed in the analysis of the data. $P<0.05$ was regarded as evidence of significance.

RESULTS

Thirteen eyes of 12 patients were reviewed. Eleven eyes were right and 2 eyes were left. Nine of the patients were male and 3 were female. The ages of the cases ranged from 8 to 39 years and the mean age was 24.83±9.93years. In one patient, pit and associated maculopathy was bilateral. Patients complained visual loss, central scotoma and metamorphopsia and none of the patients had severe refraction errors (±3 diopters). All pits were located on the temporal side of the disc. None of the patients had been treated previously for ODP-M.

Preoperative BCVA was between logMAR 1.5 (20/640) and 0.5 (20/66). The mean preoperative BCVA 0.9±0.3 (0.6 -1.2) (mean 20/160, range 20/80-20/320). Postoperative BCVA was between 1.1 (20/250) and 0.1 (20/28) and mean postoperative BCVA was 0.5±0.3 (0.2-0.8) (mean 20/63, range 20/32-20/125). In comparison to preoperative BCVA, there was a significant improvement (P = .002). Visual acuity improved in 12 of 13 eyes and nine eyes gained 3 or more lines. The BCVA of one patient decreased from 0.9 (20/160) to 1.10 (20/320) (due to the formation of a macular hole after vitrectomy for ODP-M).

The mean preoperative IOP was 12.76±1.96 mmHg (range: 10-16 mmHg) and mean overall postoperative IOP was 13.76±2.83 mmHg (range:6-18) at last visit (p=.27) The mean macular thickness was 710±179.3 μm and 161±18.3 μm preoperative and postoperative respectively. There were statistically significant changes of the macular thickness (p=.001).

Preoperative OCT showed schisis-like separation in the sensory retina and serous detachment in 12 eyes (Figure 1-2), schisis-like intraretinal separation alone in one eye (Figure 3). Intraretinal fluid was observed in the outer retinal layer in 7 eyes and fluid in the inner nuclear layer was detected in 6 eyes. Sub-ILM fluid was observed in 2 eyes. Neither PVD (posterior vitreous detachment) nor vitreomacular or vitreopapillary traction was observed in any eyes preoperatively.

Full-thickness macular hole was observed in 1 eye at the first postoperative month. Internal limitan membrane peeling, fluid-air exchange and 16% C3F8 gas tamponade was performed to this patient. After macular hole surgery, type 2 closure was observed and OCT showed that the hole edge is thinned and attached to the underlying retinal pigment epithelial layer (Figure 4). Postoperative complete resolution of subretinal fluid by OCT evaluation was determined in all eyes except that one. The mean duration of complete anatomic improvement was

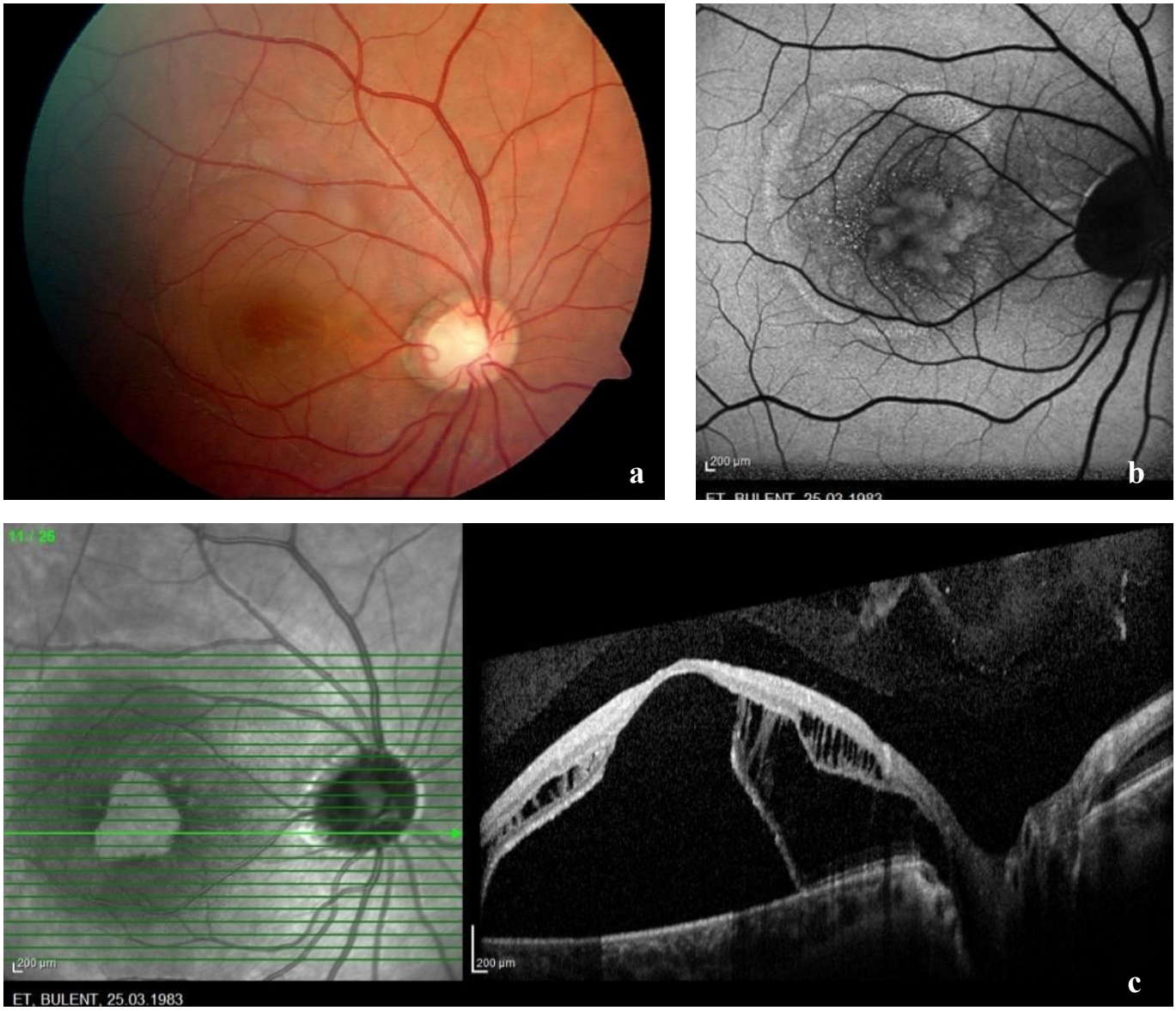

Figure 1: *Colour fundus photography of the right eye showing (a) optic disc pit, cilioretinal artery and macular involvement. Fundus fluorescein angiography showing (b) hyperotofluorescence with granulary appearance within the serous detachment. Preoperative OCT showing (c) serous macular detachment, large schisis cavity and outer layer hole.*

21±3.39 months (range: 17-27 months). The resolution of schisis-like separation of the sensory retina was firstly observed in all OCT images. The attachment of serous detachment followed that.

No intraoperative complication and postoperative endophthalmitis were observed in any cases. Recurrence did not determined in any case.

DISCUSSION

There is no consensus for the optimal management of ODP-M.[5,13-17] In recent years, many studies demonstrated that the best anatomic and functional results have been obtained with vitreoretinal surgery.[17-27] Vitrectomy has been mostly combined with endolaser photocoagulation or ILM peeling and/or gas tamponade. The rationale of performing PPV is based on the vitreous traction over the optic disc and macula that is responsible for development of maculopathy in eyes with ODP.[20,21] Bonnet[12] showed evidence of vitreous traction with high-magnification biomicroscopy and FFA in 25 eyes with ODP-M. He concluded that vitreous traction facilitates the passage of fluid from the vitreous cavity into the subretinal space via the optic disc pit.

There have been numerous reports of treatment with vitrectomy, endolaser photocoagulation, and gas tamponade.[13,16,18,26,27] Endolaser photocoagulation is suggested by some surgeon for barrier effect for fluid transportation. Cox et al.[9] reported prompt and permanent retinal reattachment with improved visual acuity with

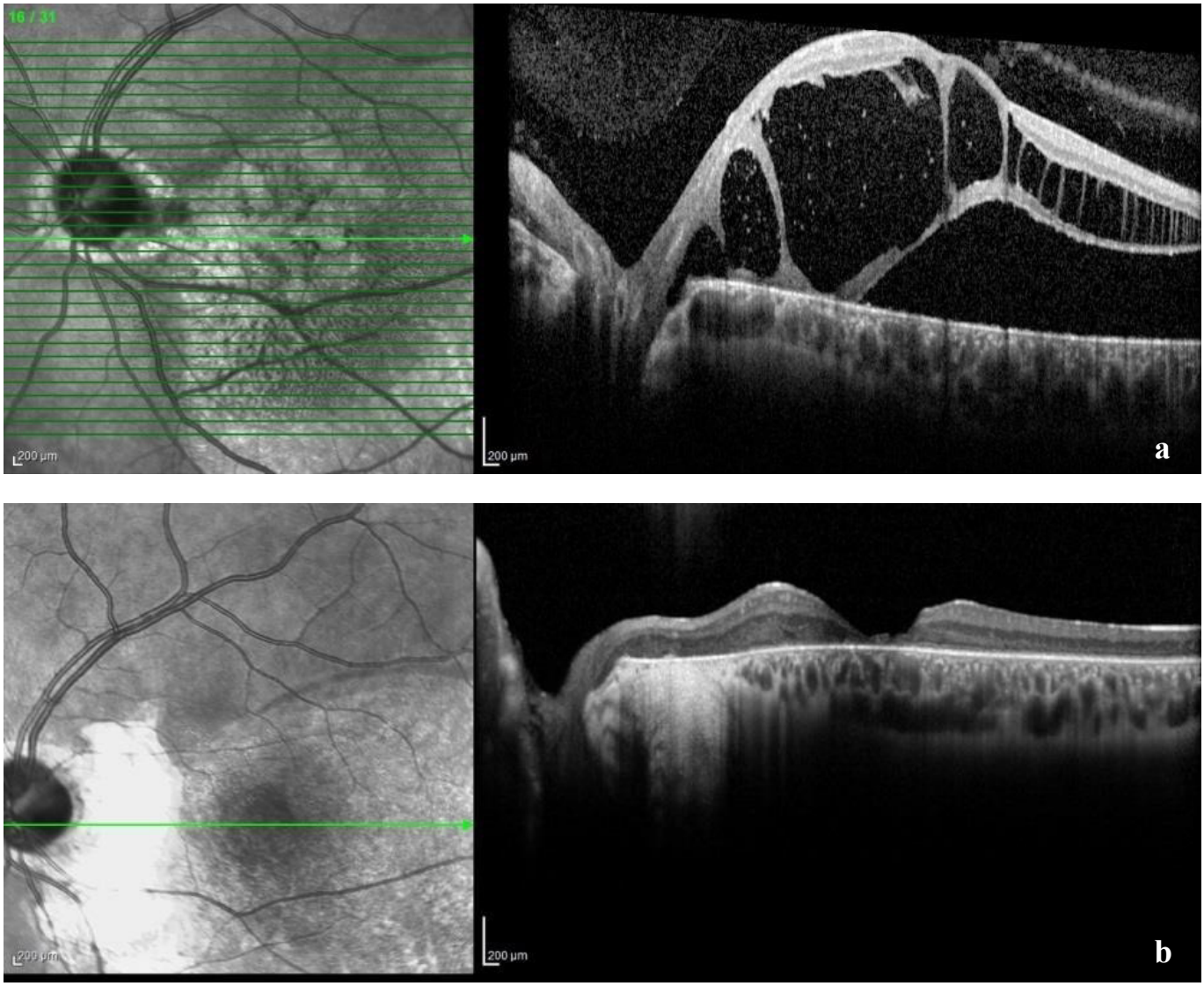

Figure 2: *Preoperative OCT image revealing (a) large elevation with outer retinal layer separation and serous retinal detachment. Post-operative OCT showing (b) complete resolution of subretinal fluid at month 6.*

PPV, photocoagulation and gas tamponade in 8 cases. They concluded that photocoagulation, vitrectomy and gas tamponade was more effective than vitrectomy plus laser or gas tamponade alone. Some studies in contrary to have shown that endolaser does not have additional effect on final outcomes.[18-22] Avcı et al.[16] also performed PPV, PVD induction, endolaser and C3F8 gas tamponade without ILM peel and obtained favourable results. Other recent study was conducted in 11 eyes that vitrectomy, induction of PVD, endolaser and gas tamponade resulted retinal reattachment and improvement of BCVA in all cases.[13] Our study, which presented PPV, posterior vitreous separation, juxtapapiller endolaser and C3F8 gas tamponade in 13 eyes with ODP-M, resulted similar to other recent studies and the anatomical success rate of our series was 92.3 %. Visual acuity improved in 12 out of 13 eyes and nine eyes gained 3 or more lines.

Although intraoperative gas is believed to create a pressure for the passage of fluid away from the macula, there have been several reports without using gas tamponade with various success rate. Hirakata et al.[17] reported in a study that 8 patients treated with vitrectomy without gas and laser, achieving complete resolution and vision improvement in 7 of them. Another similar recent study is that Teke and Citirik[23] compared vitrectomy with PVD induction alone vs PPV, endolaser and gas tamponade. While there was no significant difference between the postoperative visual acuity and central macular thickness, it was found that the resolution of ODP maculopathy was significantly faster in patients with gas tamponade. Whether vitrectomy without gas tamponade is superior to combined surgery needs to be supported by further and large sample studies.

Some authors believe that ILM peeling should be performed to completely remove tangential and anteroposterior

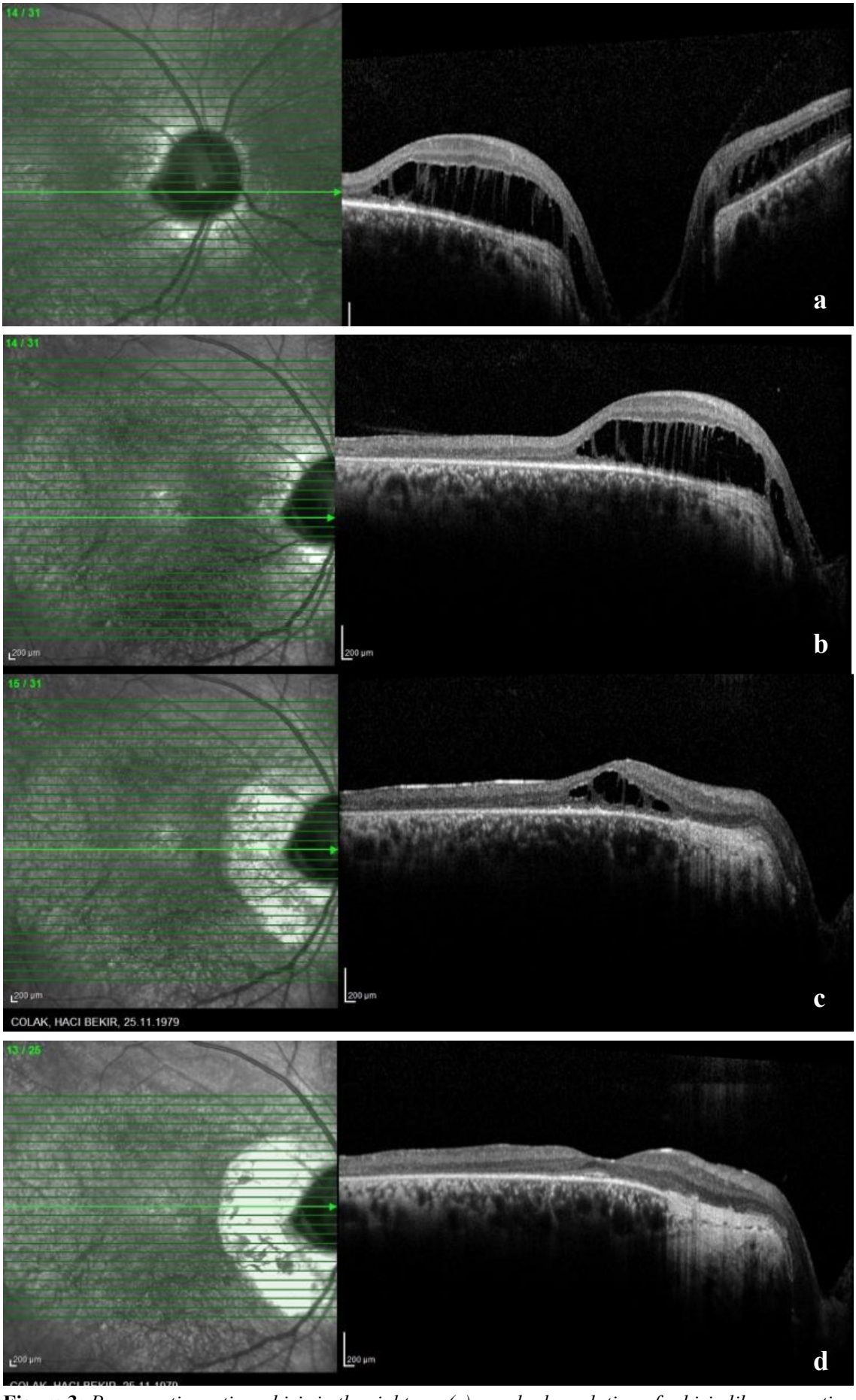

Figure 3: *Preoperative retinoschisis in the right eye (a), gradual resolution of schisis-like separation is seen at month 1 (b), month 6 (c) and month 9 (d).*

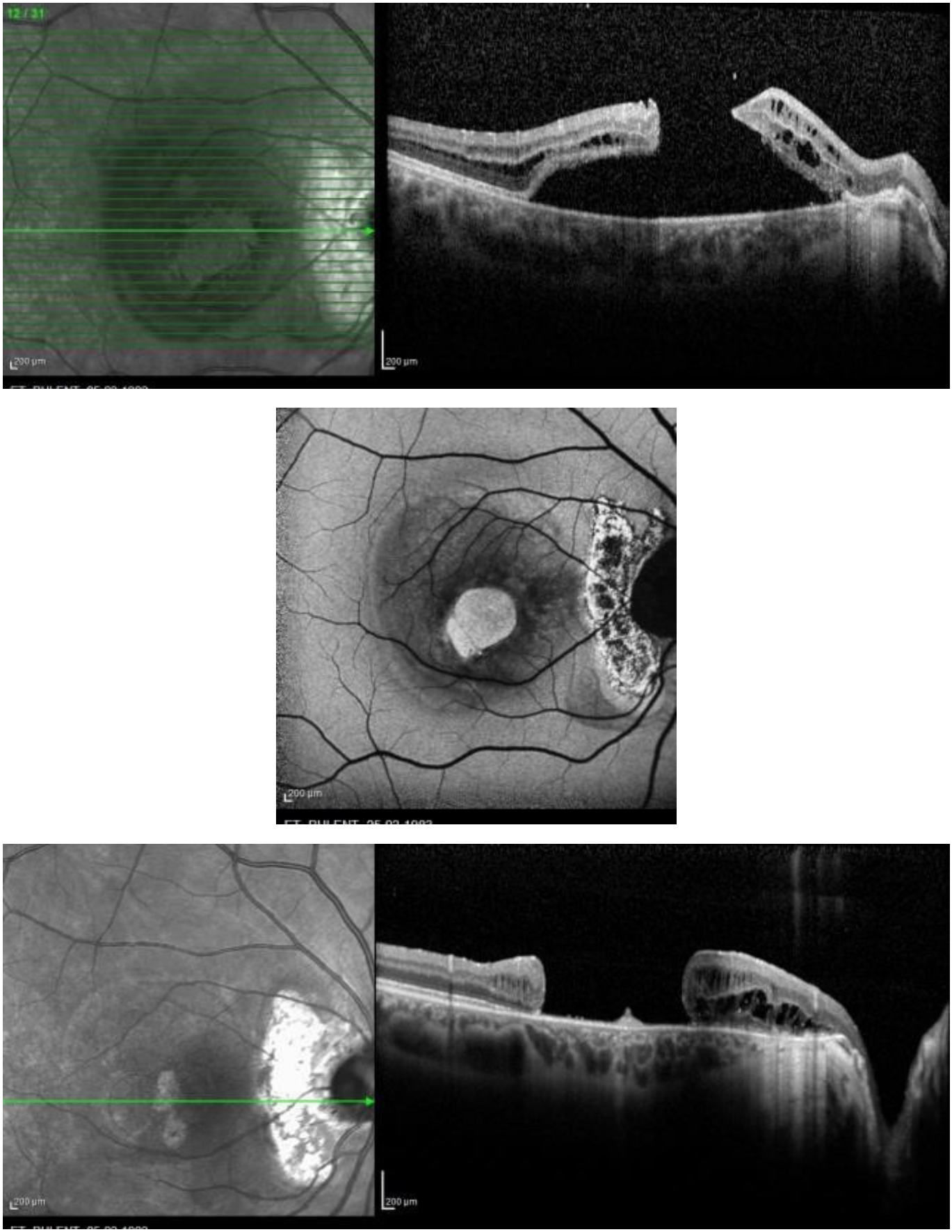

Figure 4: *OCT showing (a) the macular hole formation after optic disc pit maculopathy surgery. FAF image showing (b) hyperotofluorescence corresponding to macular hole. OCT images showing (c) type 2 closure after macular hole surgery.*

tractions.[19,24,25] However, other previous studies compatible with our study proposed that ILM peeling is not essential step with the risk of full-thickness macular hole.[13-18] This issue continues to be contradictory and need te be supported future studies. Recently, reverse ILM flap technique has been used in persistent macular hole surgery and effective results have been obtained. According to a recent study, PPV with ILM peeling alone was compared with inverted ILM flap into the optic disc pit and a faster resolution was obtained in ILM flap technique.[28]

Our limitations were that the case number was small to determine true efficacy and this was retrospective, noncomparative single center study.

In conclusion, we suggest that PPV, the removal of PVD, laser photocoagulation at the temporal margin of optic disc and gas tamponade is safe and effective therapeutic approach for the treatment of ODP-M. However, further prospective reports with larger samples are needed to find out the most effective treatment option of this inexplicable condition.

Statements on compliance with ethical standards

This study was carried out under research program of Ulucanlar Eye Training and Research Hospital.

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This study does not contain animals as subjects.

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Informed consent was obtained from all individual participants included in the study.

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