• Clinical Research •

Surgical intervention versus conservative management in optic disc pit maculopathy

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Abstract

● **AIM:** To assess the functional and anatomical outcomes in patients with maculopathy related to an optic disc pit (ODP-M), managed with or without surgery.

● **METHODS:** This retrospective monocentric study, included 52 patients (52 eyes) with ODP-M. Of these, 52% (n=27) were managed conservatively, while 48% (n=25) underwent surgery. Primary outcomes included changes in best-corrected visual acuity (BCVA) and anatomical parameters [central macular thickness (CMT), sub-foveal choroidal thickness (SFCT)], as well as the rate of fluid resolution.

● **RESULTS:** The mean age was 33.8±22.3y (range: 5–82y), with 27 females and 25 males. Median follow-up duration was 18.0mo [interquartile range (IQR) 7.0–41.5] for the non-surgical group and 15.0mo (IQR 9.0–48.0) for the surgical group. The surgical group demonstrated significantly greater BCVA improvement (mean change: -0.40±0.56 logMAR) compared with the non-surgical group (mean change: -0.03±0.19 logMAR; P=0.006). SFCT remained stable in the non-surgical group (mean change: +4.6±36.4 μm, P=0.74), and showed a greater decrease in the surgical group [mean change: -24.6 μm, 95% confidence interval (CI) -51.4 to +2.2 μm; P=0.06]. CMT decreased significantly in the surgical group (mean change: -392.2±287.9 μm, P<0.001), whereas it remained stable in the non-surgical group (mean change: -79.7±233.4 μm, P=0.09). Spontaneous subretinal fluid reduction was observed in 25.9% (n=7) of non-surgical eyes, compared with 72.0% (n=18) of surgical eyes (P<0.001), including complete fluid disappearance in 40.0% (n=10) of surgical cases.

● **CONCLUSION:** Surgical intervention appears more effective than conservative management in achieving subretinal fluid reduction and BCVA improvement in eyes with ODP-M.

● **KEYWORDS:** optic disk pit; macular edema; vitrectomy; visual acuity; retrospective studies; choroid; subretinal fluid; treatment outcome

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INTRODUCTION

Optic disc pit (ODP) is a rare congenital anomaly characterized by a gray-white oval excavation typically located on the temporal side of the optic nerve head. Its incidence is estimated to be approximately 1 in 10 000, with an equal distribution between genders[1-2]. Approximately 50% of individuals with ODP develop associated optic disc pit maculopathy (ODP-M), which can manifest as retinoschisis/intraretinal fluid (IRF), subretinal fluid (SRF), or a combination of both[3-4], often leading to decreased visual acuity[5]. Although the precise pathogenesis of ODP-M remains debated, several theories have been proposed regarding the source of the macular fluid, including vitreous, cerebrospinal fluid migrating through the pit, or choroidal leakage, with vitreoretinal traction and translaminar pressure gradients also potentially contributing[6-7].

Large cohort studies examining the natural course and management of ODP remain limited. Some studies have documented spontaneous resolution of SRF and stabilization or improvement of visual acuity in patients managed with observation alone[8]. Notably, Bloch *et al*[8] observed that many patients maintain good long-term visual acuity and may exhibit spontaneous fluid resolution. However, other patients may experience progressive decline in visual function, requiring intervention. In light of this, recent studies attempted to assess the contribution of optical coherence tomography (OCT) features in predicting visual outcomes and determining surgical success[9-11].

Several surgical techniques have been proposed for the treatment of ODP-M. Among these, pars plana vitrectomy (PPV) with the induction of posterior vitreous detachment (PVD), gas tamponade, and, in some cases, juxta-papillary laser photocoagulation is a commonly employed approach[12]. Meanwhile, the role of internal limiting membrane (ILM) peeling remains controversial[13-15]. More recent techniques include the use of ILM flaps, scleral plug or human amniotic membrane (hAM) plugs to occlude the pit[14,16-17].

Considering the variability of the natural history of ODP-M and the diverse range of therapeutic options, this single-center retrospective study aims to compare the functional and anatomical outcomes of patients with ODP-M managed surgically versus conservatively. The findings seek to provide additional insights into optimal management strategies and the natural history of this condition.

PARTICIPANTS AND METHODS

Ethical Approval This research adhered to the tenets of the Declaration of Helsinki and was approved by the Foundation Hospital review board (IRB 00012801) under the study number CE_20230328_8_RLX.

Study Design and Patients This single-center retrospective study was conducted at the Retina Department of the Fondation Adolphe de Rothschild Hospital, Paris, France. The medical records of patients diagnosed with ODP between 2010, and November 2023 were reviewed.

All patients with a documented diagnosis of ODP and serous maculopathy (ODP-M) confirmed by OCT were included. The diagnosis of ODP-M was defined by the presence of serous macular detachment or schisis-like IRF accumulation on OCT examination, associated with the presence of ODP at the optic nerve. Exclusion criteria comprised the presence of concurrent macular diseases, such as central serous chorioretinopathy, cystoid macular edema, choroidal neovascular membrane, ODP associated with pathological myopia or glaucoma, insufficient medical records and low-quality OCT scans.

Baseline and follow-up data for all eligible patients were retrospectively collected. Patients were divided into two groups: those who underwent surgical treatment and those managed with observational follow-up only. The decision to proceed with surgery was made at the discretion of the treating physician, without predefined criteria or standardized indications. For both groups, demographic data and best-corrected visual acuity (BCVA) expressed in logarithm of the minimum angle of resolution (logMAR) were recorded at baseline and subsequent follow-up visits. In the surgical group, details of the surgical procedure performed and the anatomical (resolution of SRF and IRF) and functional outcomes, along with possible post-operative complications, were recorded. For patients in the observational group, the spontaneous evolution of the ODP-M and changes in BCVA during the observation period were evaluated.

Image Acquisition Protocol All OCT B-scan acquisitions were performed using the Spectralis HRA software version 5.4.7.0 (Heidelberg Engineering, Inc, Heidelberg, Germany). On OCT scans, the presence of ODP-M was defined by the presence of serous macular detachment or schisis-like IRF accumulation. Longitudinal OCT changes, either spontaneous or after surgical treatment, were monitored. Fluid localization (IRF, SRF, or a combination of both) was assessed. Additional OCT findings, such as outer lamellar holes (OLH) and full thickness macular holes, were also documented. Finally, choroidal thickness (CT) in the macular area was measured manually using the in-built caliper of the Spectralis software. CT was defined as the distance between the outer border of the retinal pigment epithelium and the choroidoscleral border, measured sub-foveal choroidal thickness (SFCT) and at 1000 μm and 2000 μm nasal and temporal to the fovea (1000N, 2000N, 1000T, 2000T CT, respectively). Central macular thickness (CMT) was also collected.

Surgical Procedure All procedures were performed by expert vitreoretinal surgeons, under either local or general anesthesia, based on the patient's request and medical condition.

The surgical technique employed a 25-gauge PPV. Following core vitrectomy, posterior hyaloid detachment was attained if it had not previously occurred. The ILM was stained with Dual Blue dye to improve visualization, and then peeled circumferentially, reaching around 2 papillary diameters from the fovea in each direction (complete peeling, without foveal sparing). At the end of the procedure, a fluid-air exchange was performed, followed by the injection of either 20% sulphur hexafluoride (SF_6) or 14% hexafluoroethane (C_2F_6) gas, based on the surgeon's discretion.

Statistical Analysis Statistical analysis was performed with GraphPad Prism Software, version 10.3 (GraphPad, LaJolla, USA). Numerical variables were expressed as mean±standard deviation, and discrete outcomes as absolute and relative (%) frequencies. Normality of continuous data was assessed with the Shapiro-Wilk test. Continuous outcomes were compared with the unpaired Student's *t*-test, Welch's *t*-test, or Mann-Whitney *U* test according to data distribution, and two-tailed tests were used. Discrete outcomes were compared with the Chi-squared or Fisher's exact test accordingly. Paired comparisons between baseline and final follow-up values were performed using the paired Student's *t*-test or the Wilcoxon signed-rank test, according to data distribution. Univariate and multivariate analysis was performed to identify independent

Table 1 Demographic characteristics

Parameters	Non-surgical (*n*=27)	Surgical (*n*=25)	*P*[a]
Age (y, mean±SD)	37.8±23.5	27.8±19.1	0.07
Sex (F/M)	14/13	13/12	0.79
Laterality (OD/OS)	8/19	12/13	0.13
Baseline BCVA (logMAR, mean±SD)	0.40±0.42	0.83±0.59	0.01
Follow-up duration [mo, median (IQR)]	18.0 (7.0–41.5)	15.0 (9.0–48.0)	0.34
Baseline OCT features			
Baseline CMT (μm, mean±SD)	540.9±235.8	686.5±275.5	0.01
Foveal IRF (%)	15/27 (55.6)	14/25 (56.0)	0.97
Extrafoveal IRF (%)	20/27 (74.1)	21/25 (84.0)	0.38
Foveal SRF (%)	15/27 (55.6)	22/25 (88.0)	0.01
Extrafoveal SRF (%)	14/27 (51.9)	19/25 (76.0)	0.07
Outer lamellar hole (%)	3/27 (11.1)	9/25 (36.0)	0.03

[a]Mann-Whitney *U* test. SD: Standard deviation; F: Female; M: Male; OD: Right eye; OS: Left eye; BCVA: Best-corrected visual acuity; CMT: Central macular thickness; OCT: Optical coherence tomography; IRF: Intra-retinal fluid; SRF: Sub-retinal fluid.

Table 2 Fluid resolution outcomes

Parameters	Non-surgical (*n*=27)	Surgical (*n*=25)	*P*[a]
Fluid reduction (%)	7/27 (25.9)	18/25 (72.0)	<0.001
Complete disappearance (%)	0	10/25 (40.0)	<0.001
Mean CMT change (μm)	-79.7±233.4	-392.2±287.9	<0.001
Time to resolution (mo)	-	14.8±9.8	-

[a]Mann-Whitney *U* test. CMT: Central macular thickness.

predictors of visual and anatomical outcomes A *P*-value <0.05 was deemed statistically significant.

RESULTS

A total of 184 patients were screened for potential ODP. Of these, 91 patients were confirmed to have an ODP diagnosis, and 52 met the criteria for ODP-M and were included in this study. The mean age was 33.8±22.3y (range: 5–82y) and a gender distribution of 27 females (51.9%) and 25 males (48.1%). Patients were divided into two groups: 27 managed conservatively (non-surgical group) and 25 who underwent surgery (surgical group). In the surgical group, 19 eyes (76%) received SF_6, while 6 eyes (24%) received C_2F_6 tamponade. Preoperative characteristics are summarized in Table 1.

Functional Outcomes Baseline BCVA in the non-surgical group was 0.40±0.42 logMAR, reaching 0.38±0.42 logMAR at the final follow-up visit (mean change: -0.03±0.19 logMAR, *P*=0.41). Of these eyes, 12 of 27 (44.4%) demonstrated a significant BCVA improvement (mean gain: +0.23±0.19 logMAR), while only 2 eyes (7.4%) showed a BCVA loss ≤0.20 logMAR. In the surgical group, mean BCVA significant improved from 0.83±0.59 logMAR at baseline to 0.43±0.42 logMAR at the last post-operative visit (mean change: -0.40±0.56 logMAR, *P*=0.001). Overall, 18 of 25 (72.0%) eyes showed a BCVA improvement (mean gain: +0.63±0.49 logMAR), with 56% of eyes showing an improvement ≥0.3 logMAR. The between-group difference in BCVA improvement was significant (*P*=0.006) in favor of surgical treatment.

Structural Outcomes

Central macular thickness In the non-surgical group, CMT non significantly decreased from 540.9±235.8 μm at baseline to 461.2±208.5 μm at final follow-up (mean change: -79.7±233.4 μm, *P*=0.09), while in the surgical group, CMT showed a marked decrease from 686.5±275.5 μm at baseline to 313.3±140.7 μm at final follow-up [mean change: -392.2±287.9 μm, 95% confidence interval (CI): -526.5 to -257.9 μm, *P*<0.001]. A significant between-group difference was reported (*P*<0.001; Table 2).

Fluid resolution Spontaneous fluid reduction was observed in 7 of 27 (25.9%) non-surgical eyes (CMT change: -243.8±127.7 μm in these cases), while 18 of 25 (72.0%) surgical eyes showed fluid reduction (*P*<0.001, Chi-square test), with complete fluid disappearance in 10 of 25 (40%). The mean time to complete fluid resolution following surgery was 14.8±9.8mo. The time to resolution ranged from 4 to 40mo, with a median of 12.5mo. Most cases demonstrated a progressive decrease in fluid over successive follow-up visits (Table 2). One patient in the surgical group developed a full-thickness macular hole 4mo after the initial surgery.

Subfoveal choroidal thickness In the non-surgical group, SFCT remained stable from 261.7±71.2 μm at baseline to 266.3±70.5 μm at final follow-up (mean change: +4.6±36.4 μm, *P*=0.74), while in the surgical group, SFCT decreased non-

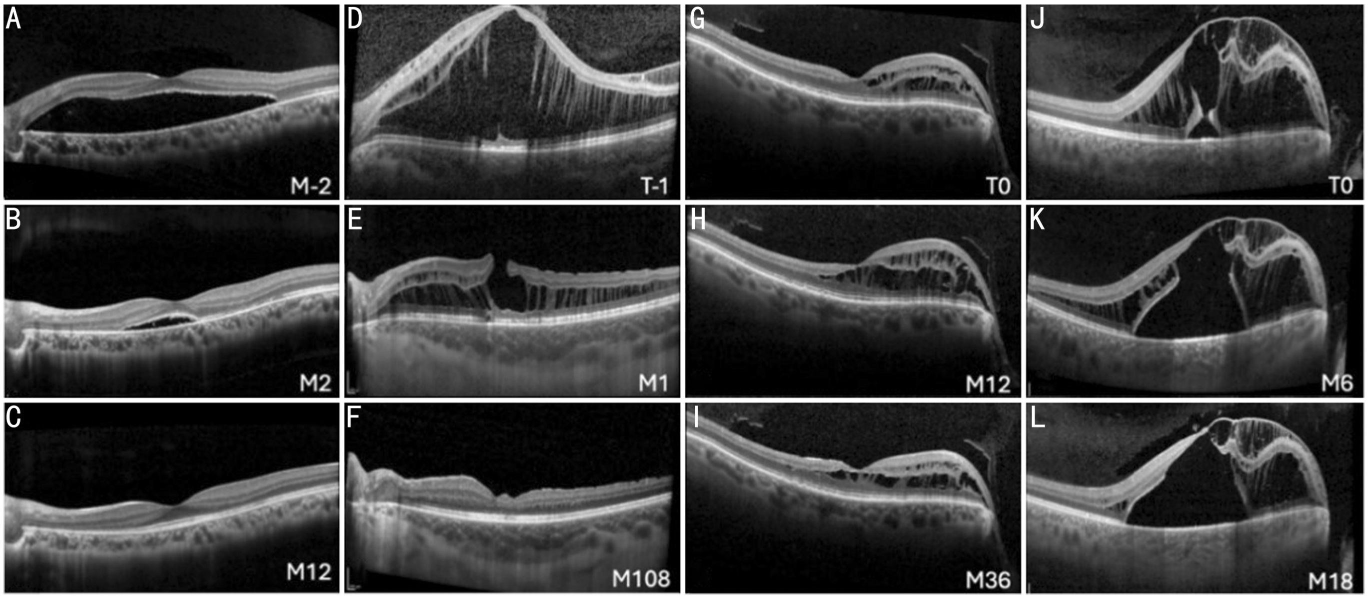

Figure 1 Optical coherence tomography follow-up of four cases of optic disc pit maculopathy A–F: Two patients treated surgically. A–C (Patient 1, 10 years old): After vitrectomy with posterior vitreous detachment induction and SF_6 tamponade, subretinal fluid progressively resolved over 1y, with visual acuity improving from 20/100 preoperatively to 20/20; D–F (Patient 2, 15 years old): Following vitrectomy with membrane peeling and C_2F_6 tamponade, intraretinal fluid (IRF) decreased and visual acuity improved from 20/100 to 20/40 at 1mo. G–L: Two patients managed conservatively. G–I (Patient 3, 72 years old): Over 3y, IRF gradually extended to the fovea with visual decline, from 20/20 to 20/32; J–L (Patient 4, 30 years old): Progressive foveal detachment and enlargement of a lamellar hole were observed over 1.5y, with visual acuity decreasing from 20/40 to 20/50. SF_6: Sulphfur hexafluoride; C_2F_6: Hexafluoroethane.

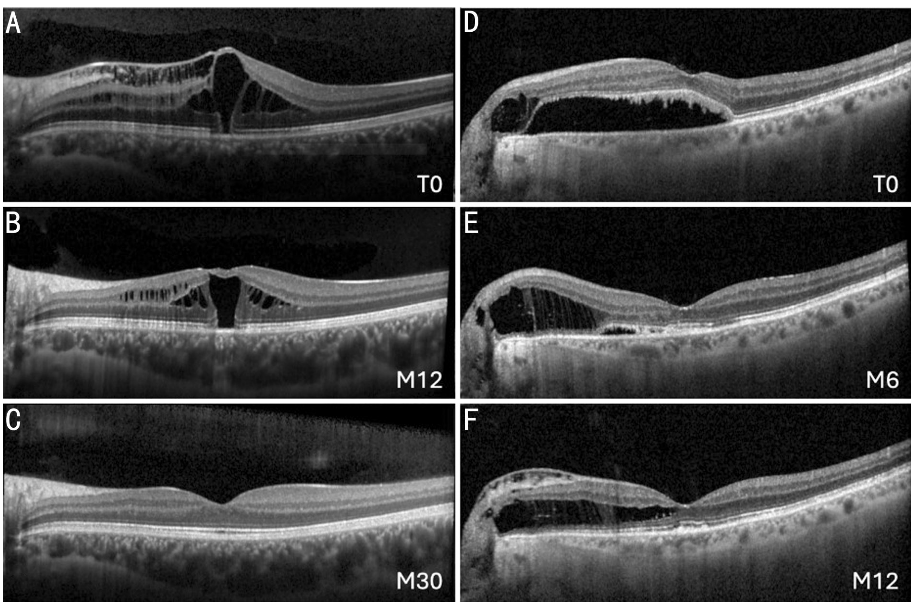

Figure 2 Optical coherence tomography follow-up of two cases of spontaneous fluid resolution in optic disc pit maculopathy A–C: A 16-year-old patient initially presented with intraretinal fluid and an outer lamellar hole (BCVA: 20/50), showing complete anatomical recovery of the fovea and improvement in visual acuity to 20/16 over 2.5y. D–F: A 64-year-old patient presented with subretinal and intraretinal fluid (BCVA: 20/25), showing partial improvement with subretinal fluid resolution and increased extrafoveal intraretinal fluid, while visual acuity remained stable at 20/25. BCVA: Best-corrected visual acuity.

significantly from 300.9±94.4 μm at baseline to 270.9±98.9 μm (mean change: -24.6 μm, 95%CI: -51.4 to +2.2 μm, P=0.06; Figure 1). Similar trends were reported in all sectors, as shown in Table 3.

Spontaneous resolution cases In the non-surgical group, 7 of 27 (25.9%) patients experienced spontaneous fluid reduction during the follow-up period. The mean follow-up duration for this subgroup was 21.3±12.8mo (range: 5–38mo; Figure 2).

At baseline, these patients presented with a mean BCVA of 0.46±0.38 logMAR and a mean CMT of 542.1±186.3 μm. By

Table 3 CT at baseline and follow-up across all sectors mean±SD

Sector	Baseline (μm)[a]	*P* (Baseline inter-groups)	Final (μm)	*P* (Final inter-groups)	*P* (Baseline *vs* final)
SFCT					
Non-surgical (*n*=27)	261.7±71.2	0.11	266.3±70.5	0.85	0.74
Surgical (*n*=25)	300.9±94.4		270.9±98.9		0.06
1000T CT					
Non-surgical (*n*=27)	280.0±74.3	0.40	274.1±70.8	0.85	0.41
Surgical (*n*=25)	300.6±93.6		278.2±88.4		0.20
2000T CT					
Non-surgical (*n*=27)	286.2±82.6	0.85	278.4±75.4	0.70	0.34
Surgical (*n*=25)	290.6±95.2		270.2±82.5		0.08
1000N CT					
Non-Surgical (*n*=27)	236.0±58.7	0.10	225.6±75.2	0.52	0.13
Surgical (*n*=25)	272.4±94.5		239.9±90.0		0.11
2000N CT					
Non-surgical (*n*=27)	187.6±60.5	0.40	192.4±77.1	0.76	0.56
Surgical (*n*=25)	202.2±69.4		186.6±68.3		0.29

[a]Mann-Whitney *U* test. CT: Choroidal thickness; SD: Standard deviation; SFCT: Sub-foveal choroidal thickness; 1000T CT: Choroidal thickness 1000 μm temporal to the fovea; 2000T CT: Choroidal thickness 2000 μm temporal to the fovea; 1000N CT: Choroidal thickness 1000 μm nasal to the fovea; 2000N CT: Choroidal thickness 2000 μm nasal to the fovea.

the end of follow-up, mean BCVA improved to 0.33±0.21 logMAR (mean change: -0.13±0.22 logMAR, *P*=0.18), and mean CMT decreased to 298.3±124.5 μm (mean change: -243.8±127.7 μm, *P*=0.002).

Regarding choroidal thickness measurements, these patients showed variable responses. The mean SFCT was 271.3±105.8 μm at baseline and 282.7±83.6 μm at final follow-up (mean change: +11.4±42.5 μm, *P*=0.52). Analysis of individual cases revealed heterogeneous patterns: 3 patients showed SFCT reduction (mean -19.3±23.4 μm), while 4 showed SFCT increase (mean +33.5±23.7 μm).

Baseline OCT characteristics in this subgroup are summarized in Table 4. Comparison of baseline characteristics between patients with and without spontaneous resolution revealed no significant differences in terms of age (*P*=0.28), baseline BCVA (*P*=0.53), baseline CMT (*P*=0.63), or presence of OLH (*P*=0.77).

Table 4 Characteristics of patients with spontaneous fluid resolution *n* (%) or mean±SD

Parameters	Baseline	Final follow-up	*P*
Baseline characteristics			
Foveal IRF	4 (57.1)		
Extrafoveal IRF	5 (71.4)		
Foveal SRF	3 (42.9)		
Extrafoveal SRF	4 (57.1)		
Outer lamellar hole	1 (14.3)		
Evolution			
BCVA (logMAR)	0.46±0.38	0.33±0.21	0.18
CMT (μm)	542.1±186.3	298.3±124.5	0.002
SFCT (μm)	271.3±105.8	282.7±83.6	0.52
SFCT reduction	3/7 (42.9)	-19.3±23.4	
SFCT increase	4/7 (57.1)	+33.5±23.7	

IRF: Intra-retinal fluid; SRF: Sub-retinal fluid; BCVA: Best-corrected visual acuity; CMT: Central macular thickness; SFCT: Sub-foveal choroidal thickness; SD: Standard deviation; logMAR: Logarithm of the minimum angle of resolution.

Correlation Analysis Univariate correlation analyses revealed that surgical intervention strongly correlated with fluid resolution (*r*=0.61, *P*<0.001) and CMT reduction (*r*=0.53, *P*<0.001). Baseline central SFCT and CMT showed a weak correlation in the non-surgical group (*r*=0.21, *P*=0.27) and a moderate correlation in the surgical group (*r*=0.45, *P*=0.04). BCVA improvement correlated with CMT reduction in both the surgical group (*r*=0.43, *P*=0.04), and non-surgical group (*r*=0.35, *P*=0.04). In the surgical group, the presence of pre-operative OLH was not associated with worse visual gain post-operatively (*P*=0.83).

After adjusting for potential confounders (baseline BCVA, CMT, age, and presence of OLH), surgical intervention remained significantly associated with both BCVA improvement (*β*=0.37, *P*=0.02) and CMT reduction (*β*=-301.5, *P*<0.001). Baseline CMT was independently associated with final CMT reduction (*β*=-0.42, *P*=0.01), while baseline BCVA was a significant predictor of final visual acuity improvement (*β*=-0.39, *P*=0.01). The presence of OLH at baseline did not independently affect visual outcomes in the multivariate model (*P*=0.39; Table 5).

DISCUSSION

The optimal management of ODP-M is still a matter of debate. In this study, we compared the outcomes of conservative and surgical management of ODP-M, providing insights into

Table 5 Multivariate analysis of factors associated with visual and anatomical outcomes

Outcome	Predictor	Unstandardized coefficient (β)	95% confidence interval	*P*
BCVA improvement (logMAR)	Surgical intervention	0.37	0.07 to 0.67	0.02
	Baseline BCVA (logMAR)	-0.39	-0.62 to -0.16	0.01
	Baseline CMT (μm)	0.0002	-0.0001 to 0.0005	0.21
	Presence of OLH	-0.11	-0.36 to 0.14	0.39
	Age (y)	-0.002	-0.007 to 0.003	0.41
CMT reduction (μm)	Surgical intervention	-301.5	-430.2 to -172.8	<0.001
	Baseline CMT (μm)	-0.42	-0.71 to -0.13	0.01
	Baseline BCVA (logMAR)	-25.4	-89.7 to 38.9	0.43
	Presence of OLH	-31.8	-112.3 to 48.7	0.44
	Age (y)	-0.76	-2.96 to 1.44	0.50

BCVA: Best-corrected visual acuity; CMT: Central macular thickness; OLH: Outer lamellar hole; logMAR: Logarithm of the minimum angle of resolution.

the natural course of the disease and the efficacy of surgical intervention. Notably, we observed a spontaneous reduction of fluid in 25.9% of non-surgically managed patients, with a mean CMT reduction of -243.8 μm in these eyes with a mean follow-up of 21.3mo. By contrast, surgical intervention with PPV and ILM peeling resulted in fluid reduction in 72% of eyes and complete fluid disappearance in 40% of cases, accompanied by a significant decrease in CMT and BCVA improvement.

The rate of spontaneous fluid resolution in our conservatively managed group is in line with those reported in similar cohorts. Bloch *et al*[8], in their retrospective case series, highlighted that many patients with ODP-M maintain good long-term visual acuity and may demonstrate resolution of SRF without surgical intervention. Specifically, they found that 19% of observed patients with foveal SRF demonstrated spontaneous complete resolution over a mean follow-up of 37mo. However, data regarding CMT were not available in this study, therefore an effective comparison with our investigation regarding macular fluid resorption rates was hampered. In terms of visual outcomes, Bloch *et al*[8] similarly reported that in their monitored group, the mean change in visual acuity was minimal (0.01 logMAR over a mean follow-up of 6.4y), with 77% maintaining visual acuity ≤0.30 logMAR without treatment. Taslipinar Uzel *et al*[18] reported similar outcomes in natural study on 22 eyes with ODP-M. Consistently, the overall visual acuity in the non-surgical group of our study remained stable (-0.03 logMAR), as only a minority of our non-surgical patients experienced spontaneous fluid reduction. However, a significant correlation was found between CMT reduction and visual acuity improvement in either surgical or non-surgical groups, suggesting that anatomical improvement might effectively translate to significant visual gain, even in non-operated cases. Meanwhile, we confirmed that a considerable proportion of patients can maintain relatively stable vision even with persistent fluid, since only 7.4% of eyes in our study lost more than 0.20 logMAR during the follow-up.

The results obtained in the observational group were indeed significantly worse when compared to the surgical one. In the latter, we observed a significant rate of fluid reduction (72%), accompanied by a significant improvement in visual acuity in 72% of cases, 56% of which achieving ≥0.3 logMAR improvement. These outcomes are consistent with the general trends reported in the literature for surgical intervention in ODP-M. The EVRS study[19] analyzed a large multicenter cohort and found that preoperative BCVA, the presence of SRF, and the presence of an OLH were predictive of postoperative visual acuity at 12mo. Nevertheless, in our smaller cohort the correlation between baseline OLH and final visual gain was not confirmed. Other studies have also reported varying success rates with different surgical approaches. For instance, Hirakata *et al*[20] reported 90.9% complete resolution with PPV and gas tamponade, with visual acuity improving in 63.7% of cases. A subsequent investigation by the same group demonstrated that PPV with induction of PVD, without laser photocoagulation or gas tamponade, could also achieve effective anatomical and functional recovery[21]. The long-term efficacy of vitrectomy with PVD induction was further supported by Bottoni *et al*[22], who reported complete macular reattachment in 80% of cases over extended follow-up. Avci *et al*[15] achieved complete resolution in 92.3% of eyes with PPV, juxta-papillary laser, and gas tamponade, with visual improvement in 84.6%. In our research, the ILM peeling technique combined with SF_6 or C_2F_6 tamponade without juxta-papillary laser offered comparable anatomical and functional outcomes.

More recently, Chakraborty and Sheth[23] introduced fovea-sparing ILM peeling combined with ILM plug placement for ODP-M associated with retinal detachment, achieving a 100% rate of retinal reattachment and a significant reduction in CMT. Moreover, BCVA improved in 85.7% of their patients by 12mo, and the complete resolution of retinoschitic lesions was observed in 71.4% of eyes. Comparing the fovea-sparing ILM peeling with other surgical approaches, Babu *et al*[24] investigated vitrectomy with ILM peeling alone versus inverted ILM flap plug versus autologous scleral plug. They found that plugging the pit (either with ILM flap or scleral plug) resulted in better anatomical success (85.7% and 87.5% respectively) compared to ILM peeling alone (25.0%). Visual success rates (defined as ≥2 Snellen line gain) were 28.6% for ILM flap plug and 12.5% for both ILM peeling alone and scleral plug. The high anatomical success with pit plugging is consistent with the results reported by Caporossi *et al*[17] who effectively managed ODP-M employing hAM patches and gas tamponade.

Regarding choroidal changes, a recent study by Carlà *et al*[25] highlighted that the subfoveal choroid may thicken and remodel in response to ODP-M, and these changes tend to return to physiological values after surgical treatment. Furthermore, they observed that the presence of SRF was associated with submacular dilated choroidal vessels, which reduced in caliber after SRF resolution post-operative. In our study, the surgical group showed a trend toward choroidal thinning post-operatively (mean change -24.6 μm), but these results did not reach statistical significance. Conversely, eyes within the non-surgical group showed relatively stable SFCT values with a slight increase of +4.6 μm. However, the smaller cohort of surgical patients and the variable follow-up in our study may have accounted for this difference. Consistent with the study of Carlà *et al*[25], baseline CMT showed a linear correlation with baseline SFCT in both the surgical and non-surgical groups in our series, suggesting a dynamic choroidal response to SRF or IRF accumulation, enhancing its homeostatic role. The precise mechanism underlying the postoperative choroidal thinning observed in the surgical group remains to be elucidated. It may reflect the regression of the fluid-driven choroidal congestion previously described in ODP-M, with normalization of the dilated submacular choroidal vessels once SRF is reabsorbed; a reduction in localized choroidal exudation following restoration of the outer retinal barrier; or, to a lesser extent, vascular changes related to vitrectomy and gas tamponade. As no dedicated study has yet investigated the whole-choroid response to surgery in ODP-M, these hypotheses warrant confirmation in larger prospective series. In this regard, OCT angiography may provide further insight. Akıdan *et al*[26] recently reported that eyes with ODP-M display reduced superficial and deep capillary plexus vascular density compared with healthy fellow eyes, with partial recovery of macular perfusion after vitrectomy, suggesting that both structural and microvascular remodeling contribute to the postoperative course of these eyes.

Our study is subject to several limitations. The retrospective nature, limited sample size, and lack of detailed baseline characteristics are important considerations. Moreover, our cohort lacks intermediate follow-ups, which may have significantly hindered the assessment of possible recurrences and remission of the ODP-M. The comparison with other studies is also limited by variations in surgical techniques, outcome measures, and follow-up durations. In addition, there was a significant baseline imbalance between groups, with the surgical cohort presenting worse baseline BCVA and higher CMT compared to the non-surgical group. This reflects an inherent selection bias, where patients with more severe maculopathy were preferentially selected for surgical intervention. Although multivariate analysis was performed to adjust for these confounders and confirmed the independent effect of surgery on anatomical and functional outcomes, this imbalance may influence the interpretation of the natural history group, which represents a relatively milder disease spectrum. Consequently, comparisons between groups should be interpreted with caution.

In conclusion, our findings contributed to the understanding of ODP-M natural history by highlighting a modest rate of spontaneous fluid reduction with limited overall visual change in conservatively managed eyes, compared to a significantly higher rate of anatomical resolution and visual improvement following surgical intervention. Moreover, we also confirmed that the choroid may be subject to specific thickness changes following effective surgical intervention, probably related to the reduction of macular fluid. Further prospective studies with longer follow-up are warranted to definitively establish the best surgical approach to manage ODP-M and the role of choroidal changes in this subset of patients.

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REFERENCES

1 Wang Y, Xu L, Jonas JB. Prevalence of congenital optic disc pits in adult Chinese: The Beijing Eye Study. *Eur J Ophthalmol* 2006;16(6):863-864.

2 Brown GC, Shields JA, Goldberg RE. Congenital pits of the optic nerve head. *Ophthalmology* 1980;87(1):51-65.

3 Lincoff H, Lopez R, Kreissig I, *et al*. Retinoschisis associated with optic nerve pits. *Arch Ophthalmol* 1988;106(1):61-67.

4 Imamura Y, Zweifel SA, Fujiwara T, *et al*. High-resolution optical coherence tomography findings in optic pit maculopathy. *Retina* 2010;30(7):1104-1112.

5 Wan R, Chang A. Optic disc pit maculopathy: a review of diagnosis and treatment. *Clin Exp Optom* 2020;103(4):425-429.

6 Jain N, Johnson MW. Pathogenesis and treatment of maculopathy associated with cavitary optic disc anomalies. *Am J Ophthalmol* 2014;158(3):423-435.

7 Uzel MM, Karacorlu M. Optic disk pits and optic disk pit maculopathy: a review. *Surv Ophthalmol* 2019;64(5):595-607.

8 Bloch E, Georgiadis O, Lukic M, *et al*. Optic disc pit maculopathy: new perspectives on the natural history. *Am J Ophthalmol* 2019;207:159-169.

9 Chatziralli I, Theodossiadis G, Brouzas D, *et al*. Incidence and evolution of subretinal precipitates in optic disc pit maculopathy. *Eur J Ophthalmol* 2017;27(6):769-773.

10 Steel DH, Williamson TH, Laidlaw DA, *et al*. Extent and location of intraretinal and subretinal fluid as prognostic factors for the outcome of patients with optic disk pit maculopathy. *Retina* 2016;36(1):110-118.

11 Maertz J, Mohler KJ, Kolb JP, *et al*. Intrapapillary proliferation in optic disk pits: clinical findings and time-related changes. *Retina* 2017;37(5):906-914.

12 Zheng A, Singh RP, Lavine JA. Surgical options and outcomes in the treatment of optic pit maculopathy: a meta-analysis and systematic review. *Ophthalmol Retina* 2020;4(3):289-299.

13 Wagner H, Pielen A, Agostini H, *et al*. Surgical outcomes in patients with optic disc pit maculopathy: does peeling the ILM lead to better outcomes? *Int Ophthalmol* 2020;40(12):3363-3376.

14 Ravani R, Kumar A, Karthikeya R, *et al*. Comparison of inverted ILM-stuffing technique and ILM peeling alone for optic disc pit-associated maculopathy: long-term results. *Ophthalmic Surg Lasers Imaging Retina* 2018;49(12):e226-e232.

15 Avci R, Yilmaz S, Inan UU, *et al*. Long-term outcomes of pars Plana vitrectomy without internal limiting membrane peeling for optic disc pit maculopathy. *Eye* (*Lond*) 2013;27(12):1359-1367.

16 Khatri A, Shrestha SM, Prasai G, *et al*. Minimally invasive procedure for optic disc pit maculopathy: vitrectomy with scleral plug and analysis on pattern of resolution. *Sci Rep* 2023;13(1):15724.

17 Caporossi T, D'Amico G, Tartaro R, *et al*. Optic disk pit maculopathy treatment using a human amniotic membrane patch: one-year results. *Am J Ophthalmol* 2022;240:30-36.

18 Taslipinar Uzel AG, Gelisken F, Bartz-Schmidt KU, *et al*. Natural course of optic disc pit maculopathy: an optical coherence tomography study. *Ophthalmologica* 2022;245(6):563-569.

19 Iros M, Parolini B, Ozdek S, *et al*. Management of optic disc pit maculopathy: the European Vitreo Retinal society optic pit study. *Acta Ophthalmol* 2022;100(6):e1264-e1271.

20 Hirakata A, Okada AA, Hida T. Long-term results of vitrectomy without laser treatment for macular detachment associated with an optic disc pit. *Ophthalmology* 2005;112(8):1430-1435.

21 Hirakata A, Inoue M, Hiraoka T, *et al*. Vitrectomy without laser treatment or gas tamponade for macular detachment associated with an optic disc pit. *Ophthalmology* 2012;119(4):810-818.

22 Bottoni F, Cereda M, Secondi R, *et al*. Vitrectomy for optic disc pit maculopathy: a long-term follow-up study. *Graefes Arch Clin Exp Ophthalmol* 2018;256(4):675-682.

23 Chakraborty S, Sheth JU. Fovea-sparing internal limiting membrane (ILM) peeling and ILM plug: a novel approach for managing optic disc pit maculopathy. *Clin Ophthalmol* 2024;18:3343-3351.

24 Babu N, Kohli P, Ramasamy K. Comparison of various surgical techniques for optic disc pit maculopathy: vitrectomy with internal limiting membrane (ILM) peeling alone versus inverted ILM flap 'plug' versus autologous scleral 'plug'. *Br J Ophthalmol* 2020;104(11):1567-1573.

25 Carlà MM, Boselli F, Giannuzzi F, *et al*. Choroid involvement secondary to optic disc pit maculopathy: OCT analysis and evolution after surgical treatment. *Am J Ophthalmol* 2025;270:120-130.

26 Akıdan M, Erol MK, Gedik B, *et al*. Changes in outcomes of macular optical coherence tomography angiography following surgery for optic disc pit maculopathy. *Diagnostics* (*Basel*) 2024;14(9):874.