Original Article

Optical coherence tomography findings and retinal changes after vitrectomy for optic disc pit maculopathy

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Purpose: To study the optical coherence tomography (OCT) patterns in optic disc pit maculopathy and retinal changes after vitreous surgery. **Materials and Methods**: Retrospective review of consecutive cases with optic disc pit maculopathy seen at two tertiary eye institutes from January 2005 to June 2009. **Results**: Twenty-four eyes of 23 patients are included. The presenting visual acuity ranged from 20/400 to 20/20 (median:20/80). The median age at presentation was 24 years (range, 6-57 years). Optical coherence tomography demonstrated a combination of retinoschisis and outer layer detachment (OLD) in 19 (79.17%) eyes, OLD only in 3 (12.5%) eyes and retinoschisis only in 2 (8.33%) eyes. An obvious communication (outer layer hole) between the schisis and OLD was seen in 14 (73.68%) of the 19 eyes with both features. Of the 21 eyes with retinoschisis, schisis was present in multiple layers in 15 (71.43%) and single layer in 6 (28.57%) eyes. Eleven eyes underwent pars plana vitrectomy including creation of posterior vitreous detachment (PVD), fluid-air exchange, low intensity laser photocoagulation at the temporal edge of the optic disc pit and non-expansile perfluoropropane gas (14%) injection. Five (45.45%) of 11 eyes undergoing vitrectomy had complete resolution and 4 (36.36%) eyes had partial resolution of maculopathy. Visual acuity improved in 8 (72.72%) of 11 eyes. **Conclusion**: Optical coherence tomography demonstrates multiple layer schisis and outer layer detachment as main features of optic disc pit maculopathy. Vitrectomy with PVD induction, laser photocoagulation and gas tamponade results in anatomical and visual improvement in most cases with optic disc pit maculopathy.

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Congenital pit of the optic nerve head is a rare anomaly first described by Wiethe in 1882.[1] It can remain asymptomatic or cause reduction in vision due to serous maculopathy.[2] The exact pathogenesis of the optic disc pit maculopathy is unknown. It has been hypothesized that submacular fluid originates either from the vitreous or the cerebrospinal fluid.[2-4] Lincoff *et al.* examined patients with optic disc pit maculopathy and proposeda bilaminar structure of optic disc pit maculopathy with formation of inner retinal schisis–like cavity and an outer layer detachment.[5] Although the origin of sub macular fluid remains debatable, the clinical observations of Lincoff have been supported by various optical coherence tomography (OCT) studies.[6-11] A variable success rate has been reported for a variety of modalities to treat optic disc pit maculopathy including laser photocoagulation, pneumatic displacement, macular buckling and vitrectomy with or without laser barrage along with gas tamponade.[6,10-14] The present study analyzes the OCT characteristics of optic disc pit maculopathy on high definition spectral domain OCT and report the structural alterations in the retina following vitreous surgery in a large series of patients.

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Materials and Methods

Consecutive cases of optic disc pit maculopathy seen at two tertiary eye institutes from January 2005 to June 2009 were retrieved through review of medical case records. All patients underwent complete ocular examination, fundus photography and OCT imaging as a part of routine analysis. Optical coherence tomography images were initially obtained by using the time domain OCT (Stratus^{Tm} OCT, Carl Zeiss Meditec, Dublin, CA, USA) and for subsequent cases by high definition spectral domain OCT (Cirrus^{Tm} OCT, Carl Zeiss Meditec, Dublin, CA, USA). The various parameters retrieved from review of case records and OCT images included: presenting visual acuity, baseline OCT pattern, details of vitreous surgery, postoperative OCT pattern and postoperative visual acuity at last follow-up visit. The data obtained was analyzed by frequency and descriptive statistics.

Results

Twenty–four eyes of 23 patients are included. There were 11 males and 12 females. The median age at presentation was 24 years (range, 6-57 years). The presenting visual acuity ranged from 20/400 to 20/20 (median: 20/80).

Three patterns of maculopathy were noted on OCT. A combination of retinoschisis and outer layer detachment (OLD) was seen in 19 (79.17%) eyes, OLD only in 3 (12.5%) eyes and retinoschisis only in 2 (8.33%) eyes. [Figs. 1-3]. An obvious communication (outer layer hole) between the schisis and OLD was seen in 14 (73.68%) of the 19 eyes with both the

Table 1: Outcome of eyes undergoing vitrectomy for optic disc pit maculopathy

Case No.	Age (years)	Pre-op BCVA	Pre-op OCT	Follow up (months)	Postop BCVA (last FU)	Postop OCT (last FU)
1	25	20/80	RS OLD	12	20/30	RS:resolved OLD:resolved
2	6	20/60	OLD	36	20/20	OLD:resolved
3	32	20/80	RS OLD	6	20/200	RS:persistent OLD:persistent
4	17	20/120	RS OLD	18	20/120	RS:persistent OLD:persistent
5	37	20/80	RS OLD	13	20/60	RS:resolved OLD:resolved
6	26	20/80	RS OLD	6	20/60	RS: decreased OLD:resolved
7	35	20/120	RS OLD	3	20/120	RS:minimal OLD:Decreased
8	18	20/200	RS OLD	10	20/120	RS:minimal OLD:resolved
9	12	20/200	RS OLD	14	20/40	RS:resolved OLD: resolved
10	22	20/200	RS OLD	3	20/100	RS:decreased OLD:decreased
11	16	20/400	RS OLD	3	20/125	RS:resolved OLD:resolved

BCVA: Best corrected visual acuity, FU: Follow-up, OCT: Optical coherence tomography, OLD: Outer layer detachment, RS: Retinal schisis

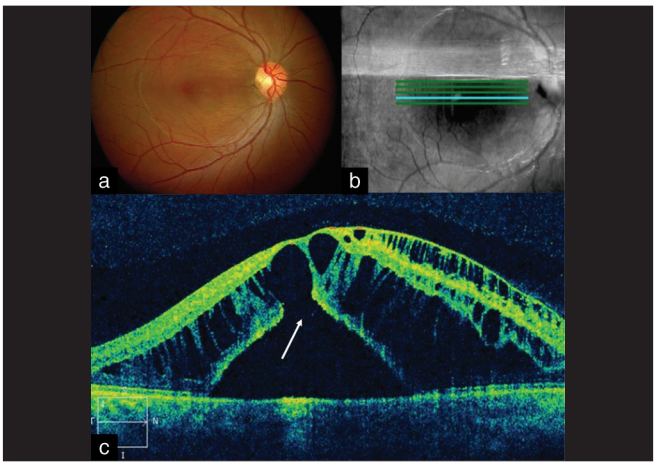

Figure 1: (a) Color fundus image shows the macula of a 24-year-old male with optic disc pit maculopathy. (b) OCT fundus image shows the position of horizontal raster line scan. (c) OCT shows intraretinal fluid splitting the retina at multiple levels (both the inner and outer retinal layers).An outer layer detachment communicates with the intraretinal fluid through an outer layer hole (arrow)

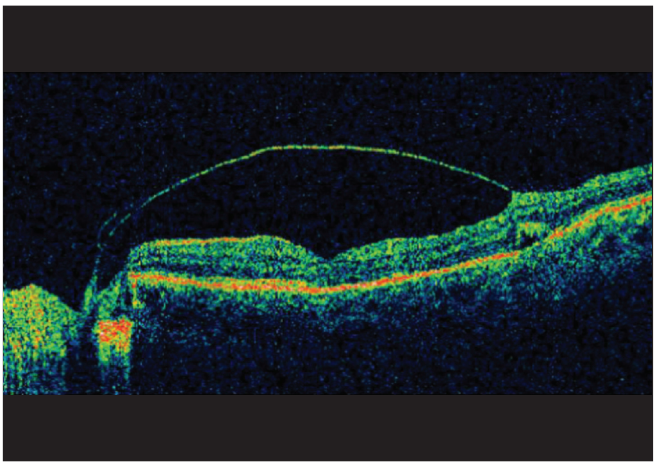

Figure 2: Horizontal raster line scan at the fovea in a 14-year-old female with optic disc pit maculopathy shows a splitting of the ILM by intraretinal fluid

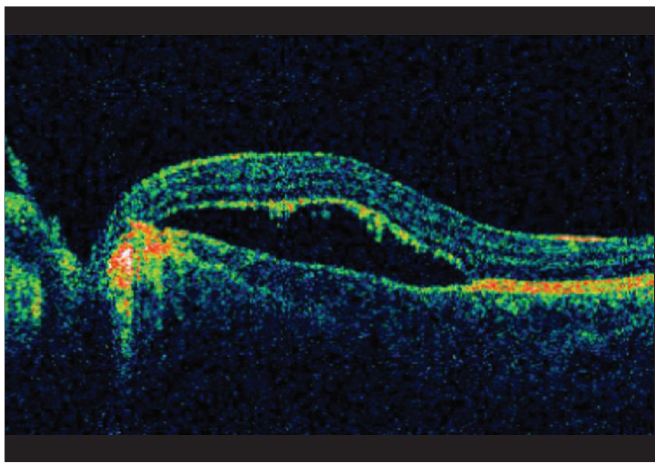

Figure 3: Horizontal raster line scan at the fovea in a 6-year-old male with optic disc pit maculopathy shows sub-retinal fluid

features [Fig. 1]. Of the 21 eyes with retinoschisis, schisis was present in multiple layers in 15 (71.43 %) and single layer in 6 (28.57%) eyes. [Figs 1 and 2] Posterior vitreous detachment was not seen in any of the eyes. Eleven of 24 eyes underwent pars plana vitrectomy. In all cases, the surgery consisted of vitrectomy including creation of posterior vitreous detachment, fluid-air exchange, low intensity laser photocoagulation at the temporal edge of the optic disc pit and non-expansile perfluoropropane gas (14%) injection. This was followed by instruction for head down and prone posture for 10 days to 2 weeks.

Five (45.45%) of 11 eyes undergoing vitrectomy had complete resolution and 4 (36.36%) eyes had partial resolution of maculopathy [Table 1]. Two (18.18%) eyes did not respond to vitrectomy. Of 11 eyes, OLD resolved completely in 7 (54.54%) eyes, decreased in 2 (18.18%) eyes and did not respond in 2 (18.18%) eyes [Figs. 4 and 5]. Of 10 eyes with retinoschisis, it resolved completely in 4 (40%) eyes, decreased in 4 (40%) eyes and did not respond in 2 (20%) eyes [Figs. 4 and 5].Visual acuity improved in 8(72.72%) of 11 eyes.

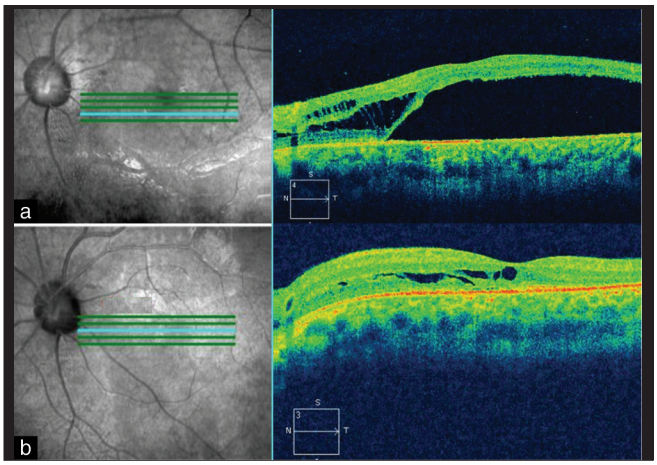

Figure 4: (a) OCT shows intraretinal fluid (schisis) and outer layer detachment in a 18-year-old female with optic disc pit maculopathy (Case 8). (b) OCT 10 months after vitreous surgery shows minimal residual schisis and complete resolution of outer layer detachment

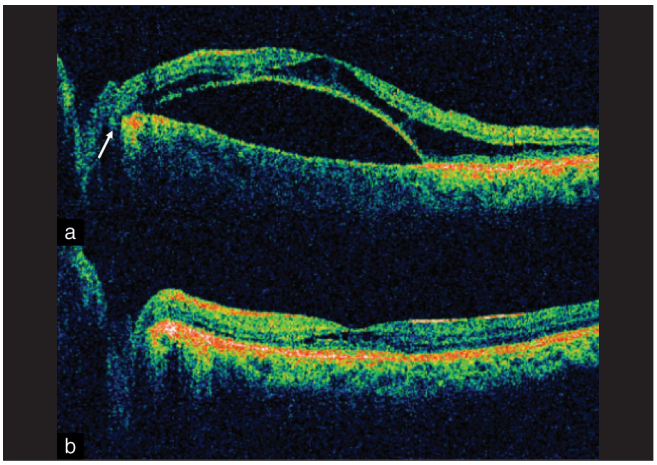

Figure 5: (a) OCT shows intraretinal fluid (schisis) and outer layer detachment in a 25-year-old female with optic disc pit maculopathy (Case 1). A conduit between the optic disc pit and intraretinal fluid is visible (arrow). (b) OCT 12 months after vitreous surgery shows complete resolution of maculopathy

Discussion

The present study highlights that schisis-like separation of retinal layers at multiple levels is the main feature of optic disc pit maculopathy. This corroborates with a recently published study which suggests that fluid may enter the retinal layers at multiple levels from the optic disc pit.[15] As the intraretinal fluid does not cleanly split the retina into two layers, it may not appropriate to call it schisis.[15] However, the term has been commonly used to describe optic disc pit maculopathy. Lincoff *et al.* suggested a bilaminar structure of optic disc pit maculopathy consisting of an inner layer separation and an outer layer detachment.[5] However, the present study suggests that a term like inner layer separation may not be appropriate as intraretinal fluid may split any of the inner and outer retinal layers.

An outer layer detachment due to sub-retinal fluid (SRF) was present in 22 of the 24 cases in the present series. The present series suggests that SRF may originate due to various mechanisms. The commonest mechanism could be an extension of fluid from the intraretinal schisis like cavities into the sub-retinal space. This theory is supported by the fact that an outer layer hole could be demonstrated in 73.68% of cases with both schisis and an outer layer detachment. This is in contrast to a recent series, which could demonstrate an outer layer hole in only 27% cases with retinal detachment.[15] An alternative explanation for SRF could be a direct extension from the optic disc pit into the sub-retinal space, as observed in 3 cases in present series. In some cases, we could not explain the origin of SRF. We believe that the SRF originated in these cases by one of the above described mechanism, but could not be demonstrated as OCT sections were not performed over the entire extent of the schisis.

Laser photocoagulation has limited success rate in optic disc pit maculopathy.[12] In the present study, 9 of the 11 eyes had anatomical improvement after vitreous surgery, which is comparable to previous reports.[10,11] There are various ways to explain the success of vitreous surgery. Previous studies have hypothesized the role of broad based vitreo-retinal and vitreo-papillary traction in pathogenesis of optic disc pit maculopathy.[11,16] However, none of the surgical series including the present one has demonstrated these features on OCT. Induction of posterior vitreous detachment along with gas tamponade without laser photocoagulation has been shown to be effective for treatment of the optic disc pit maculopathy.[11] The plausible explanation could be a release of continued vitreo-retinal traction by PVD induction.[11] The same mechanism may also explain the success of a macular buckling procedure advocated by Theodossiadis *et al*.[14] In the present study, we also used laser photocoagulation. Laser photocoagulation helps to create a full thickness retinal scar creating an effective barrier to flow of fluid from the pit into the retinal layers. Gas tamponade in addition is likely to keep the space adjacent to the pit dry for a sufficient time to allow laser to act. Once a scar is formed, the resolution of residual intraretinal and sub-retinal fluid will depend on the RPE function. The plausible reasons for failure of vitreous surgery in two cases in the present study could be either an incomplete removal of posterior hyaloid or failure to create a good laser adhesion.

The present series is the first study of vitreous surgery for optic disc pit maculopathy in Asian eyes. As the retina is heavily pigmented in these eyes, the laser take may be better. Vitrectomy combined with laser photocoagulation is likely to have a better or comparable outcome as compared to Caucasians and oriental eyes. However, this hypothesis needs further investigation.

The present study is limited by its retrospective nature. We have not used objective measurements to assess the anatomical impact of the vitreous surgery. However, all cases subjected to vitreous surgery had gross accumulation of intraretinal fluid preoperatively which decreased in all cases with successful response to surgery.

Outer layer detachment tended to resolve in most of the cases resulting in visual improvement. However, intraretinal schisis like cavities persisted to a variable extent. A previous study has shown that intraretinal changes may require a year

to resolve after surgery.[11] The cases presented in the present study are likely to show complete resolution if followed for a longer duration.

In conclusion, splitting of retinal layers by intraretinal fluid at multiple levels is the main feature of optic disc pit maculopathy. Outer layer detachment seems to be a secondary phenomenon. However, OLD may arise directly from the optic disc pit in some cases. Vitrectomy with PVD induction, laser photocoagulation and gas tamponade results in anatomical and visual improvement in most cases with optic disc pit maculopathy.

References

1. Wiethe T. Em fall von angeborener Difformitat der Sehnervenpapille. Arch Augenheilkd 1882;11:14-9.
2. Gass JD. Serous detachment of the macula secondary to congenital pit of the optic nerve head. Am J Ophthalmol 1969;67:821-41.
3. Sugar HS. An explanation for the acquired macular pathology associated with congenital pits of the optic disc. Am J Ophthalmol 1964;57:833-5.
4. Regenbogen L, Stein R, Lazar M. Macular and juxtapapillar serous retinal detachment associated with pit of optic disc. Ophthalmologica 1964;148:247-51.
5. Lincoff H, Lopez R, Kreissig I, Yannuzzi L, Cox M, Burton T. Retinoschisis associated with optic nerve pits. Arch Ophthalmol 1988;106:61-7.
6. Lincoff H, Kreissig I. Optical coherence tomography of pneumatic displacement of optic disc pit maculopathy. Br J Ophthalmol 1998;82:367-72.
7. Rutledge BK, Puliafito CA, Ducker JS, Hee MR, Cox MS. Optical coherence tomography of macular lesions associated with optic nerve head pits. Ophthalmology 1996;103:1047-53.
8. Krivoy D, Gentile R, Liebmann JM, Stegman Z, Rosen R, Walsh JB, *et al*. Imaging congenital optic disc pits and associated maculopathy using optical coherence tomography. Arch Ophthalmol 1996;114:165-70.
9. Karacorlu SA, Karacorlu M, Ozdemir H, Burumcek E, Esgin H. Optical coherence tomography in optic pit maculopathy.Int Ophthalmol 2007;27:293-7.
10. Garcıa-Arumı J, Guraya BC, Espax AB, Castillo VM, Ramsay LS, Motta RM. Optical coherence tomography in optic pit maculopathy managed with vitrectomy-laser-gas. Graefes Arch Clin Exp Ophthalmol 2004;242:819-26.
11. 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;112:1430-5.
12. Schatz H, McDonald HR. Treatment of sensory retinal detachment associated with optic nerve pit or coloboma. Ophthalmology 1988;95:178-86.
13. Snead MP, James N, Jacobs PM. Vitrectomy, argon laser, and gas tamponade for serous retinal detachment associated with an optic disc pit: A case report. Br J Ophthalmol 1991;75:381-2.
14. Theodossiadis GP, Theodossiadis PG. Optical coherence tomography in optic disk pit maculopathy treated by the macular buckling procedure. Am J Ophthalmol 2001;132:184-90.
15. Imamura Y, Zweifel SA, Fujiwara T, Freund KB, Spaide RF. High-resolution optical coherence tomography findings in optic pit maculopathy. Retina 2010;30:1104-12.
16. Theodossiadis PG, Grigoropoulos VG, Emfietzoglou J, Theodossiadis GP. Vitreous findings in optic disc pit maculopathy based on optical coherence tomography. Graefes Arch Clin Exp Ophthalmol 2007;245:1311-8.

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