In four of these five eyes, the full-thickness macular hole associated with the retinal detachment appeared before (Patients 13 and 14) or after the vitrectomy (Patients 8 and 9), as described above. In the other eye (Patient 4), a macular hole was found in the reattached retina after vitrectomy with ILM peeling and C_3F_8 gas tamponade. All 5 of these eyes had severe preoperative FD associated with RS and a poor VA.

Patient 5 developed a peripheral retinal break in the right eye intraoperatively during PVD induction that was treated successfully with laser photocoagulation.

Discussion

We confirmed that OCT is a very important tool for observing the pathological appearance of highly myopic eyes, as concluded in previous reports.[2-10] These previous reports also noted that RS and FD were not uncommon. Baba and associates reported that none of seven patients with foveal retinal detachment complained of recent, progressive visual impairment.[8] In addition, one case report described the spontaneous resolution of a myopic foveal retinoschisis.[13] Benhamou and associates reported that this condition is fairly stable, in terms of visual acuity and retinal thickness, and changes slowly over time.[9] In the present study, we studied eyes with RS and/or FD and progressive visual impairment. Fourteen of the 16 eyes exhibited a symptomatic visual impairment at the time of the initial patient visit, and 2 other eyes were noted to have asymptomatic RS during routine follow-ups for the other eye, with subsequent visual impairment in a following few years. Two of the 11 eyes associated with FD developed macular hole retinal detachment during the preoperative follow-up period. The patients noticed an acute decrease in VA after the development of macular hole retinal detachment. In one eye, OCT revealed changes in the macular appearance during a follow-up examination, with no accompanying visual disturbance. This change detected by OCT and the symptomatic visual impairment associated with RS and/or FD may reflect the high risk of developing a macular hole.

A high incidence of macular hole retinal detachment in the opposite eye (in 3 out of 14 patients) and the preoperative progression leading to the development of macular hole retinal detachment in 2 out of the 16 eyes support the hypothesis of Takano et al., who suggested that RS and FD in highly myopic eyes may precede macular hole retinal detachment.[2]

In this study, OCT examination revealed various macular profiles of myopic RS and FD, similar to the description by Benhamou et al.[9] RS involving the entire posterior pole connected to the conus of the optic disc was observed in all 16 cases; thus, we would like to propose that the term "posterior retinoschisis" is more appropriate than "macular retinoschisis" or "foveal retinoschisis". Although the VA in eyes with FD seemed to be poorer than that in eyes without FD, 6 eyes had a VA of better than 0.2, and the presence of FD could not be determined based only on the visual acuity.

In 7 of the 16 eyes, OCT revealed the presence of a detached posterior hyaloid surrounding the macula, which may have widely stretched the posterior pole. The appearance of posterior vitreous adhesions over the macula was consistent with our experience of performing vitrectomies for retinal detachment associated with a macular hole[14] and a previous clinicopathological report,[15] which suggested that the posterior hyaloid might remain tightly attached to the macula, despite the presence of PVD in highly myopic eyes. Although PVD was not observed in the other 9 eyes preoperatively, OCT examinations may be limited at detecting preretinal structures in highly myopic cases. In the present study, final reattachment was obtained in all 16 eyes, and no recurrence occurred during a mean follow-up period of 23.3 months. This result suggests that the release of vitreous traction at the posterior pole may have an important role in the treatment of myopic RS and FS.

We performed vitrectomy including vitreous cortex removal in all eyes and internal limiting membrane (ILM) peeling in 6 eyes. All 5 eyes with RS and without FD achieved retinal reattachment after the initial vitrectomy. However, 3 out of 11 eyes with RS and FD required reoperation after the initial vitrectomy. In 2 of these 3 eyes, a full-thickness macular hole associated with posterior retinal detachment occurred about one month after vitrectomy with or without ILM peeling. The incidence of the development of macular hole retinal detachment seems to be higher than in previous reports,[3-7] in which most cases received ILM peeling. Kuhn suggested that ILM may be responsible for macular detachment in highly myopic eyes.[6] We also observed the proliferation of glial cells, which caused an abnormal ILM figure in highly myopic eyes.[14] ILM peeling may be highly beneficial for reducing the traction of the detached retina. However, the side effects of ILM peeling remain unknown. In addition, ILM peeling is technically difficult in highly myopic eyes, and ICG may be toxic to the neural retina as well as the retinal pigment epithelium.[16,17] The number of surgical reports remains insufficient, and we were able to obtain retinal reattachment in most of the eyes without ILM peeling. Thus, we were unable to conclude whether ILM peeling leads to a better anatomical prognosis. However, current techniques, like TA-assisted vitrectomy or viscodissection, may be useful to avoid ILM peeling.

The role of gas tamponade in treatment is also uncertain. Gas tamponade can induce pneumatic displacement of outer layer detachments and improve vision in retinoschisis associated with optic disc pits.[18] We expected intravitreal tamponade to have a similar effect in myopic eyes with RS and FD. However, intravitreal tamponade may push the subretinal fluid inside the limited area of the posterior staphyloma toward the weak point of the fovea, causing the formation of a macular hole. In 2 eyes with RS but without FD, retinal reattachment was obtained without using gas tamponade. Further study is needed to optimize surgical techniques.

Progression to a macular hole occurred preoperatively in 2 out of 16 eyes and post-operatively in 3 out of 14 eyes. These eyes had relatively severe FD with posterior staphyloma prior to the development of a macular hole, and the VA of these eyes was worse than that of the others. These cases may have been at an advanced stage following the early development of a macular hole, similar to the two cases reported by Ikuno and Tano.[17] Patients and surgeons should regard this probable advanced stage with severe FD and poor vision as being equivalent to the early stage of macular hole retinal detachment when treating this condition.

Visual acuity improved or remained stable in all the eyes in the present study. Considering the poor prognosis of macular hole retinal detachment, vitrectomy using modern surgical techniques to induce PVD or to perform ILM peeling may be effective for the treatment of RS and/or FD in highly myopic eyes. However, further study is needed to select surgical indications and optimize surgical techniques to avoid complications, including macular hole.

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Figure Legends

Figure 1. Fundus photograph of the right eye of Patient 1. (A) A photograph taken at presentation in an eye with a VA of 0.5 and metamorphopsia shows a shallow macular detachment over the posterior staphyloma. (B) An optical coherence tomography (OCT) examination confirmed the foveal detachment and posterior retinoschisis (scan length, 5.0 mm). (C) About 4 years after the operation, the VA had improved to 0.7. An OCT image shows complete reattachment (scan length, 5.0 mm).

Figure 2. Fundus photograph and OCT images of the right eye of Patient 2. (A) During a routine follow-up for macular hole retinal detachment in the left eye, the VA of the right eye was found to have decreased from 0.8 to 0.5. A fundus photograph shows a shallow macular detachment. (B) A preparative OCT image shows a shallow elevation of the macula without splitting of the fovea, creating the appearance of a lamellar hole (scan length, 5.0 mm). (C) Two months after the vitrectomy, an OCT image shows a marked resolution of the retinoschisis (scan length, 3.5 mm). (D) At 6 years postoperatively, the retina had completely reattached (scan length, 5.0 mm).

Figure 3. Fundus photograph and OCT images of the right eye of Patient 11. (A) A preoperative fundus photograph shows a shallow retinal elevation over a posterior staphyloma in an eye with a VA of 0.4. (B-[1], B-[2]) A preoperative OCT image shows an inner layer separation that appears to be connected to the conus of the optic disc, as well as to a large outer layer detachment at the macula. A partial posterior hyaloid separation surrounding the posterior retinoschisis is visible (scan length, 5.0 mm). (C) At 6 months after the vitrectomy, an OCT image shows a marked improvement of the retinal detachment (scan length, 5.0 mm).

Figure 4. Fundus photograph and OCT images of the left eye of Patient 5. (A) A preoperative fundus photograph shows a shallow retinal elevation over a posterior staphyloma. The VA of the eye was 0.06. (B) An OCT image shows a posterior retinoschisis over the posterior staphyloma, with a partial separation of the posterior hyaloid. Outer layer detachment is not visible (scan length, 10.0 mm). (C) Two weeks after the vitrectomy, the retina had completely reattached (scan length, 5.0 mm).

Figure 5. Fundus photograph and OCT images of the left eye of Patient 10. (A) A preoperative fundus photograph shows a shallow macular detachment in an eye with a VA of 0.3. (B) A preoperative OCT image shows a marked elevation of the posterior retina. A posterior retinoschisis is visible from the edge of the conus of the optic disc to the edge of the posterior staphyloma. The outer layer detachment is remarkable. A partial separation of the posterior hyaloid is visible between the fovea and the conus of the optic disc (scan length, 9.0 mm).
(C) Two months after the vitrectomy, the posterior retina elevation was remarkably reduced (scan length, 10.0 mm). (D) Fifteen months postoperatively, the retina had completely reattached (scan length, 10.0 mm).

Figure 6. Fundus photograph and OCT images of the left eye of Patient 13. (A, B) A 66-year-old man with a history of macular hole retinal detachment surgery in the right eye was noted to have posterior retinoschisis of the asymptomatic left eye during a routine follow-up examination. The VA of the left eye was 0.5. (C) After observation for 20 months, an OCT examination revealed the development of a foveal detachment associated with the posterior retinoschisis. The VA had decreased to 0.3, but the patient had not noticed the development of

any visual disturbance. (D) After observation for 30 months, he complained of reduced vision and scored a VA of 0.1. An OCT examination revealed a posterior retinal detachment associated with a macular hole, and vitrectomy was performed. (E) Ten months postoperatively, the retina had completely reattached, but the macular hole persisted.

Figure 7. Fundus photograph and OCT images of the right eye of Patient 14. (A) A fundus photograph taken at presentation shows a shallow posterior detachment over a posterior staphyloma in an eye with a VA of 0.5. (B) An OCT image taken at presentation shows a foveal detachment with posterior retinoschisis (scan length, 9.0 mm). (C) Three months after presentation, the VA had decreased to 0.06; an OCT image shows macular hole retinal detachment. A vitrectomy was performed (scan length, 10.0 mm). (D) Three months after the operation, an OCT image shows complete retinal reattachment, but the macular hole remains visible. (scan length, 5.0 mm).

Figure 8. Fundus photograph and OCT images of the left eye of Patient 9. (A) A preoperative fundus photograph shows a shallow posterior detachment over a posterior staphyloma in an eye with a VA of 0.2. (B) A preoperative OCT image shows posterior retinoschisis and foveal detachment (scan length, 2.8 mm). (C) Two weeks after the vitrectomy, the posterior retinoschisis elevation has decreased, but foveal detachment has increased (scan length, 5.0 mm). (D) One month after the vitrectomy, the patient noticed a reduced VA. An OCT image shows the development of macular hole retinal detachment (scan length, 5.0 mm). (E) About 1.5 years postoperatively, the retina had completely reattached, but the macular hole remained visible (scan length, 5.0 mm).

Table 1. Clinical Characteristics

Patient	Age	Sex	Eye	Ref (D)	Axial Length (mm)	Symptom	Pre-op VA	OCT Finding RS/FD	OCT Finding PVD	Intra Operative finding PVD Ind.	Intra Operative finding ILM peel	Intra Operative finding Gas Tamp	Final Attachment	Final VA	Complications	Follow-up#	Fellow Eye
1	59	M	L	-8.75	26.7	decreased VA	0.06	RS	-	+	-	C_3F_8	+	0.2	-	66	FD
			R	-11.00	27.0	decreased VA	0.5	RS,FD	-	+	+	C_3F_8	+	0.6	-	54	RS
2	53	F	R	-19.25	28.7	metamorphopsia	0.4	RS	-	+	+	C_3F_8	+	0.8	-	52	MHRD
3	72	F	R	-9.75	27.9	metamorphopsia	0.4	RS	-	+	+	-	+	0.8	-	45	-
4	75	F	R	IOL	26.2	VF defect	0.01	RS,FD	-	+	+	C_3F_8	+	0.07	MH	17	-
5	68	F	L	-15.00	27.5	decreased VA	0.06	RS,FD	Part	+	-	SF_6	+	0.06	RRD	16	RS
			R	-17.75	30.0	metamorphopsia	0.2	RS	Part	+	-	SO	+	0.6	Retinal Break	10	RS,FD
6	63	F	L	-12.5	29.2	metamorphopsia	0.4	RS	-	+	-	-	+	0.4	-	27	-
7	63	M	L	-6.0	24.9	decreased VA	0.1	RS,FD	-	+	+	SF_6	+	0.5		27	Gla
8	54	F	R	-15.00	27.0	metamorphopsia	0.01	RS,FD	Part	+	+	SF_6	+	0.1	MHRD	22	-
9	56	F	L	-14.00	29.2	decreased VA	0.2	RS,FD	Part	+	-	SF_6	+	0.1	MHRD	17	RS,FD
10	77	F	L	IOL	27.4	metamorphopsia	0.3	RS,FD	Part	+	-	SO	+	0.3	-	15	MHRD
11	70	F	R	IOL	30.2	metamorphopsia	0.4	RS,FD	Part	+	-	SF_6	+	0.7	-	13	-
12	74	F	R	IOL	29.9	VF defect	0.06	RS,FD	Part	+	-	SF_6	+	0.2	-	6	RS
13	66	M	L	-15.00	29.6	decreased VA	0.3 → 0.1	RS,FD→ MHRD	-	+	-	C_3F_8	+	0.2	MH	11	MHRD
14	59	F	R	-19.00	30.4	decreased VA	0.2 → 0.06	RS,FD→ MHRD	-	+	-	C_3F_8	+	0.4	MH	12	-

duration in months

C_3F_8 = perfluoropropane; D = diopter; F = female; FD = foveal detachment; Gla = glaucoma; ILM = internal limiting membrane; Ind. = induction; IOL = intraocular lens; L = left; M = male; MH = macular hole; MHRD = macular hole retinal detachment; Part = partial detachment; PVD = posterior vitreous detachment; R = right; Ref = refractive error; RRD = rhegmatogenous retinal detachment; RS = retinoschisis; SO = silicone oil; SF_6 = sulfer hexafluoride; VA = best corrected visual acuity; VF = visual field.

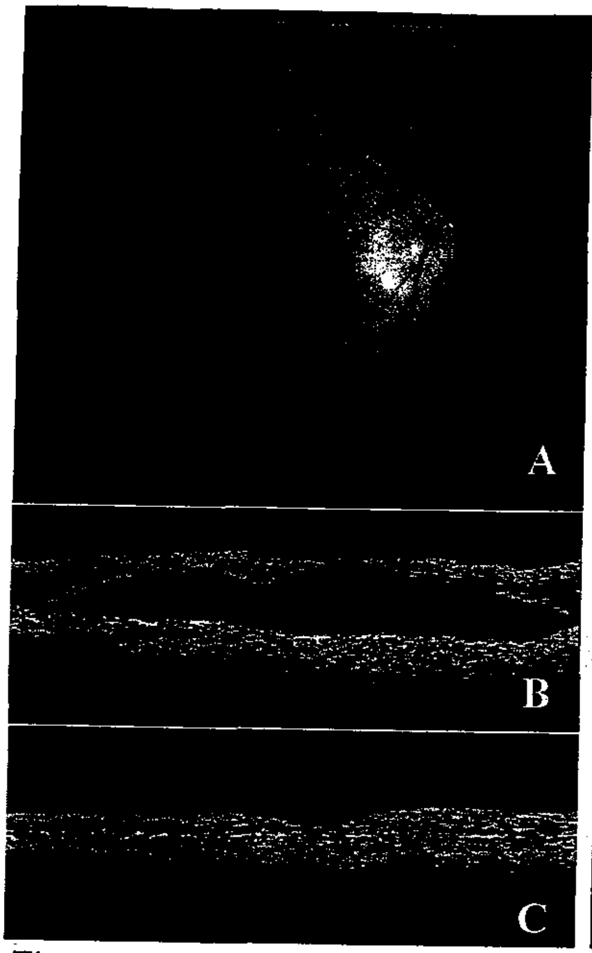
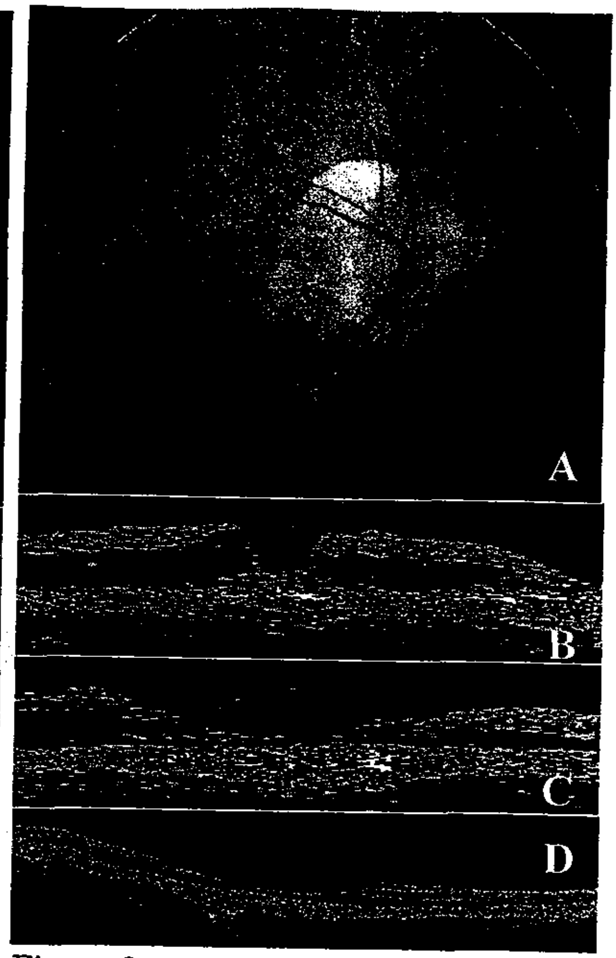


Figure 1.



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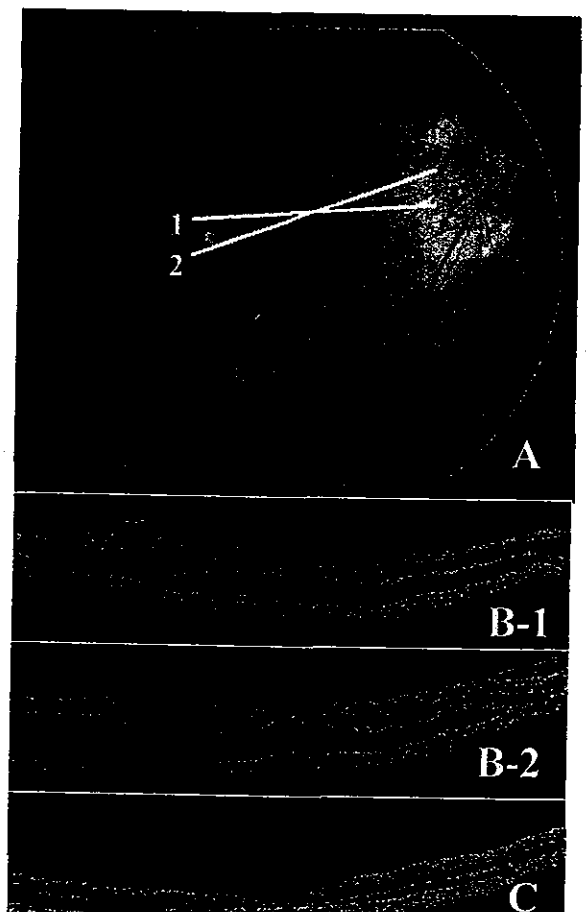
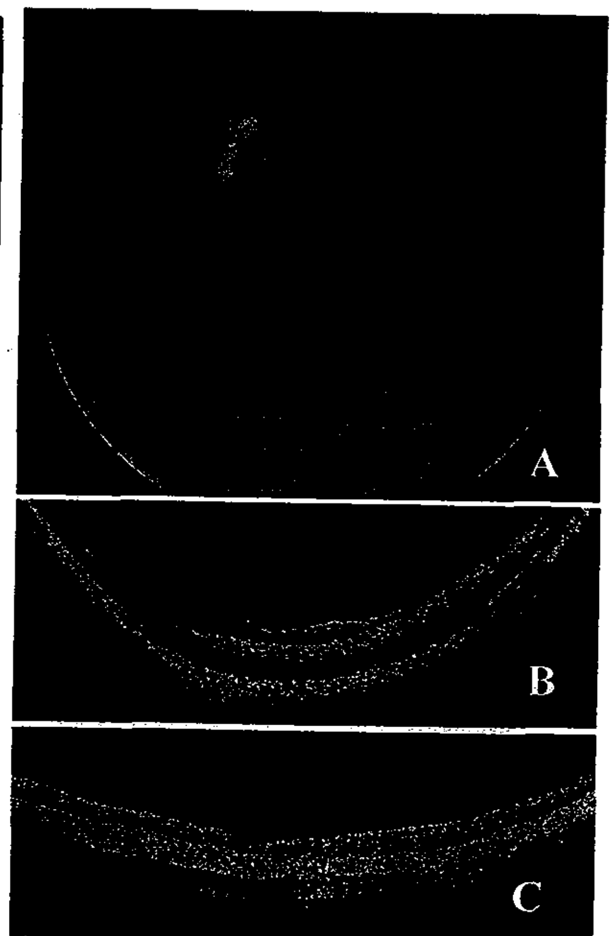


Figure 3.



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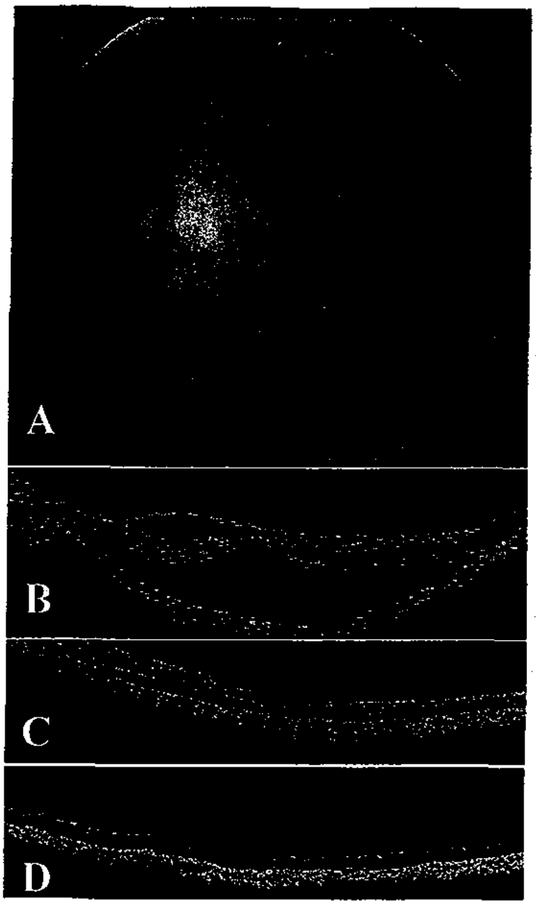

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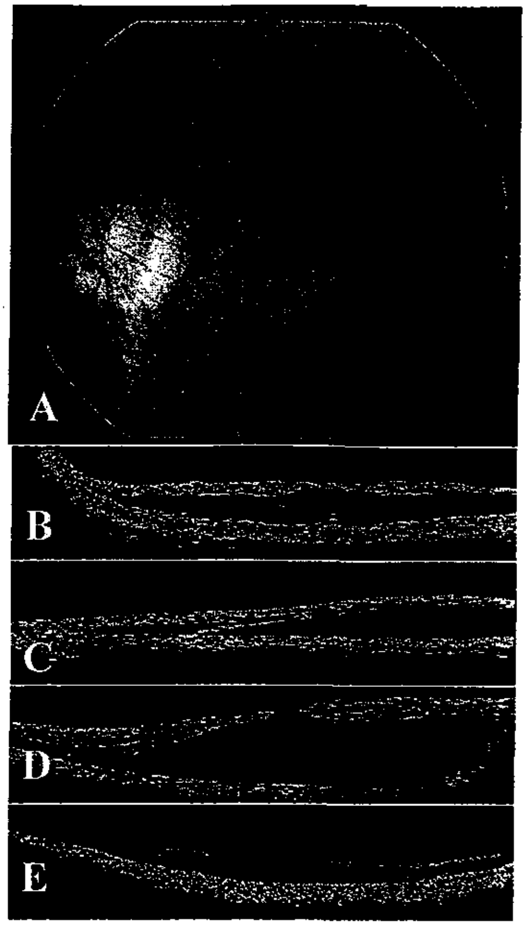

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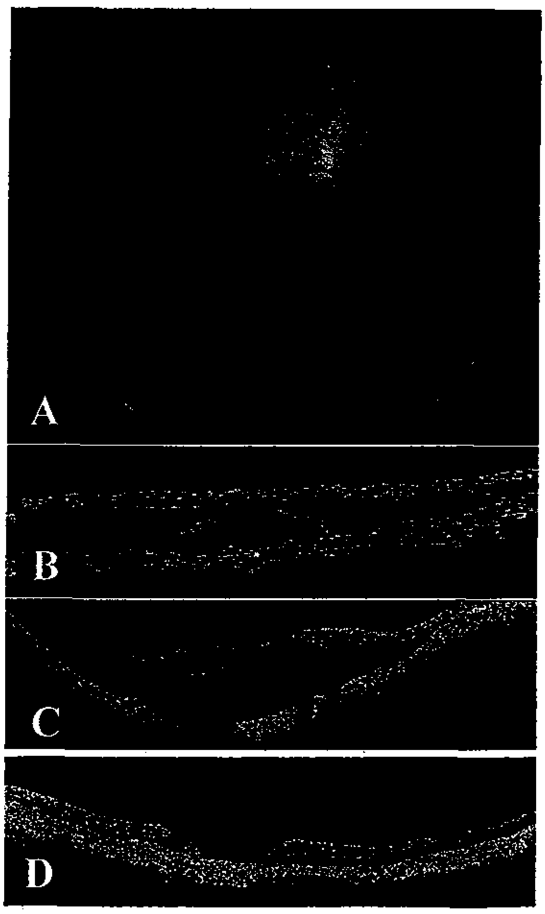

Figure 7.

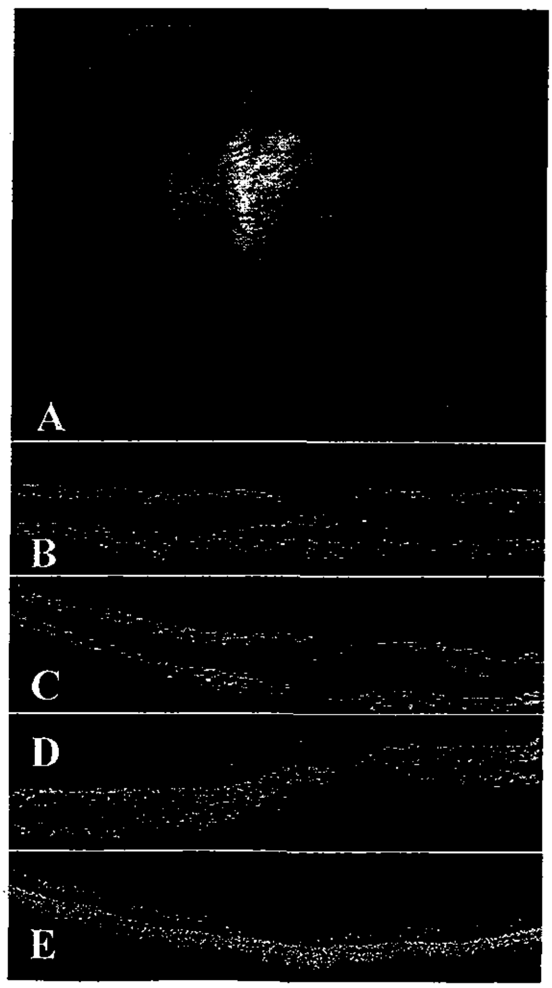

Figure 8.

Manuscript

Longterm Results of Vitrectomy Without Laser Treatment for Macular Detachment Associated with Optic Disc Pit

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Running head: Vitrectomy for Optic Disc Pit Maculopathy

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Structured Abstract

Purpose: To evaluate the efficacy of vitrectomy and gas tamponade, without laser photocoagulation to the margin of the optic nerve, for the treatment of macular detachment associated with optic disc pit.

Design: Noncomparative interventional case series.

Participants: Eleven consecutive patients (8 to 47 years of age) who presented with unilateral macular detachment associated with optic disc pit.

Intervention: Pars plana vitrectomy, induction of posterior vitreous detachment and gas tamponade were performed, with postoperative face down positioning for 1 week. The presence of a double layer detachment consisting of an inner layer separation and an outer layer detachment was observed in 10 of 11 eyes either pre- or postoperatively. Patients were followed for 10 to 98 months (mean 47 months) after surgery.

Main Outcome Measures: Anatomic outcome and visual acuity were retrospectively analyzed for all eyes. Optical coherence tomography was used to observe anatomic changes in the macula in some eyes.

Results: Complete retinal reattachment was achieved in 10 of 11 eyes, although these eyes required nearly 1 year to reach this state. The one eye with persistent retinal detachment was observed to have a marked reduction of the detachment by 10 months postoperatively. No recurrences were observed. Visual acuity improvement was documented in 7 of 11 eyes.

Conclusions: These results suggest that vitrectomy with induction of posterior vitreous detachment and gas tamponade, without additional laser treatment, is successful in reattaching the macula and improving central vision in most patients with optic disc pit maculopathy.

Congenital pit of the optic nerve head is a rare anomaly first described by Wiethe in1882.[1] Approximately two-thirds of patients have a concurrent or previous associated serous retinal detachment of the macula.[2-4] The age at onset of the retinal detachment is variable, with the mean being 30 years. The pathogenesis of optic disc pit maculopathy is unknown. In 1988, based on a study of stereoscopic transparencies and visual fields, Lincoff and colleagues proposed that fluid from the optic disc pit creates a schisis-like inner layer separation of the retina.[5] The outer layer detachment centered over the macula was suggested to be a secondary phenomenon. More recently, several authors have confirmed the two-layer structure of optic disc pit maculopathy using optical coherence tomography (OCT).[6-8]

The treatment of serous retinal detachment associated with optic disc pit is still controversial. The use of laser therapy to produce a barrier of chorioretinal adhesions at the optic disc border is often unsuccessful and repeated treatments are needed.[9-11] Several reports suggest that vitrectomy combined with laser photocoagulation and gas tamponade may be more effective than external laser therapy alone, particularly in eyes with severe visual loss.[12-15] Theodossiadis reported that macular scleral buckling can yield favorable anatomical and functional results.[16] Lincoff and colleagues reported that intravitreal gas injection alone can induce pneumatic displacement of the outer layer detachment and improve central vision.[17] However, the effect may only be temporary, since recurrence caused by fluid movement from the remaining inner layer separation was found by OCT.[8]

Bonnet reported that all of 25 eyes with macular detachment associated with optic disc pit did not have a posterior vitreous detachment (PVD), and that two of the eyes had spontaneous reattachment of the macula following development of PVD.[18] Gordon and Chatfield[19] and Gass[10] found no evidence of PVD in their cases, and suggested that vitreous traction on the macula may cause passive migration of fluid into the submacular space via the pit. Recent experience with the surgical treatment of macular hole and macular edema has shown the importance of vitreous tangential traction in the pathogenesis of these diseases.[20-22] Similar tangential vitreous traction at the pit, an area of abnormal configuration of the optic disc, may cause migration of fluid into intraretinal spaces. We believe that posterior vitreous traction on the margin of the optic disc pit may be playing an important role in the pathogenesis of this disease. There have been several reports regarding the efficacy of vitrectomy and gas tamponade with conflicting results, some reporting the recurrence of macular detachment with longterm follow-up after surgery.[8, 12-14] However, most of these reports did not specify whether PVD induction was performed, and some stated that only core vitrectomy permitting space for a 60% to 70% gas tamponade was performed.

The purpose of this study was to examine longterm clinical outcomes in 11 eyes that underwent vitrectomy with PVD induction and gas tamponade, *without* laser application, for the treatment of optic disc pit maculopathy.

Patients and Methods

Eleven eyes of 11 consecutive patients who presented to the Kyorin Eye Center with optic disc pit associated with macular detachment were included in this study. Institutional Review Board approval was not required and records were retrospectively reviewed. Best-corrected visual acuity (VA) was recorded and indirect funduscopy, slit-lamp biomicroscopy using a contact lens and Goldman visual fields were performed pre- and postoperatively. Scanning laser ophthalmoscopy and fluorescein angiography (FA) were examined preoperatively to confirm the optic disc pit and macular abnormalities in some patients. OCT (Zeiss-Humphrey, San Leandro, CA) was used to observe posterior retinal changes in cases with follow-up from 1999 on.

Surgery was performed for the indication of worsening visual acuity or for macular detachment persisting for 3 months or longer. All surgeries were performed by the same surgeon (A.H.) between July 1994 and October 2003, and patients were followed postoperatively for 10 to 98 months (mean 47 months). Vitrectomy was performed with the intention of releasing vitreous traction at the optic disc pit. Posterior vitreous detachment was initiated by suction over the optic disc or near areas of retinal schisis using the vitreous cutter. In order to limit retinal damage secondary to surgical manipulation, special attention was given to separating the posterior hyaloid gently over schisis areas. Triamcinolone acetonide[23,24] was used intraoperatively in two eyes (Patients 10 and 11) and fluorescein dye[25,26] in 1 eye (Patient 2) to highlight the posterior hyaloid membrane. After removal of the posterior hyaloid over the posterior pole, fluid-air exchange was performed followed by gas tamponade with either 15-20% sulfur hexafluoride (SF_6) or 14% perfluoropropane (C_3F_8) and postoperative face-down positioning for approximately 1 week.

Cataract surgery was not performed except for in Patient 3, who underwent lens extraction and intraocular lens implantation during a second vitrectomy procedure to close a macular hole.

Results

Clinical Characteristics

The clinical characteristics of all 11 patients are shown in Table 1 and clinical photographs of representative patients are shown in Figure 1. Six of the patients were women and 5 were men, with ages ranging from 8 to 47 years (mean 30.4 years). All patients were of Japanese ethnicity except for Patient 7 who was Caucasian. All patients complained of a central scotoma or metamorphopsia in the affected eye for several months. None of the affected eyes had severe refractive errors and the preoperative VA ranged from 0.08 to 1.0 (mean 0.3). Patient 7 had received previous treatment for the optic disc pit maculopathy consisting of laser photocoagulation to the edge of the optic disc pit, but no other patients had received any prior treatment. Nine of the 11 patients had no pertinent past medical or ocular history. Patient 10 was referred to our hospital for visual disturbance after blunt ocular trauma by a volleyball, at which time macular detachment associated with optic disc pit was diagnosed in the injured eye. Patient 8 had a history of retinal detachment surgery in the fellow eye.

The presence of a double layer detachment, consisting of both an inner layer separation and an outer layer detachment, was confirmed either before or after surgery in 10 of 11 eyes. The outer layer detachment did not appear to communicate with the optic disc in 8 eyes, but did appear to do so in 2 eyes. An irregularly-shaped outer layer break and outer layer detachment was observed to develop following schisis-like inner layer separation in Patients 1 (Fig 1A) and 4 preoperatively, and in Patient 8 postoperatively. An outer layer break in the macula was present or developed sometime during the clinical course in a total of 9 of the 11 eyes. One eye (Patient 3) had a full thickness macular hole preoperatively. Neither PVD nor vitreomacular or vitreopapillary traction were observed in any eyes preoperatively by fundus biomicroscopy; OCT performed preoperatively in 5 eyes also did not reveal vitreomacular or vitreopapillary traction.

Anatomic Results

Complete retinal reattachment was achieved in 10 of 11 eyes, although these eyes required nearly 1 year to reach this state (Fig 1). Interestingly, after surgery, the outer layer break appeared to enlarge temporarily in most cases (Fig 1B). One eye had persistent retinal detachment after surgery, but was documented by OCT to have marked reduction of the detachment by 10 months postoperatively. No recurrences were observed in any eyes.

Observation by OCT showed slow absorption of the inner layer separation and outer layer detachment after surgery, with complete absorption of fluid after 2-15 months (Fig 1E-G, I). The macular hole present preoperatively in Patient 3 remained open after surgery, but without surrounding retinal detachment (fluid cuff) or retinal edema. However, 3 years postoperatively, a fluid cuff appeared around the macular hole with corresponding decrease in vision, and a second vitrectomy procedure with ILM peeling and gas tamponade successfully closed the hole.

Two patients (Patients 5 and 11) also had an optic disc coloboma with the optic disc pit present within the area of coloboma. The pits were not obvious preoperatively however postoperatively, as the retina reattached, the pits were easily observed as being darker and deeper compared to the surrounding colobomatous areas.

Visual Acuity Results

Preoperative and final VA are shown in Table 1. Despite evidence of residual shallow inner layer separation and outer layer detachment, the VA started to improve within a few months in most eyes. Improvement in VA of 0.2 logMAR or greater was documented in 7 of 11 eyes. Nine of 11 eyes had a postoperative visual acuity of 0.8 or better.

Complications

Intraoperative or postoperative complications were observed in 3 patients. Patient 1 developed a dense scotoma in the inferotemporal quadrant with a nerve fiber layer defect between 12 and 3 o'clock at 2 weeks postoperatively (Fig 1B). At final examination 1 year postoperatively, the VA was 1.0 with the macula was reattached and no change in the nerve fiber layer defect (Fig 1C).

Patient 2, a 15-year-old girl, underwent vitrectomy and fluorescein dye-assisted PVD induction followed by 15% SF_6 tamponade. The surgeon noted difficulty in inducing the PVD, resorting to the use of a retinal pick and forceps in addition to cutter suction. A few drops of 2% fluorescein dye was introduced to the infusion line to highlight the posterior hyaloid membrane.[25,26] A tiny hemorrhage was noted at the superior margin of the optic disc after complete vitreous separation. On the second postoperative day, the patient complained of darkened vision and whitening of the retina was observed around the optic disc in a gas-filled eye. FA showed normal arm-to-retina circulation times. Oral prednisolone at a dose of 40 mg tapered to 30 mg was administered for a total of 9 days for the possibility of inflammation related to the surgical manipulation or phototoxicity, but the retinal findings remained unchanged. Electoretinography performed on the fifth postoperative day showed a negative b wave and a reduced a wave. Pigmented atrophy of the peripapillary area developed over 6 months.

Patient 4 developed an iatrogenic peripheral retinal break intraoperatively during PVD induction that was treated successfully with laser photocoagulation.

Discussion