

# A Phacovitrectomy with a Clear Corneal Incision for a Full-Thickness Macular Hole

Nam Ju Kim, MD<sup>1,2</sup>, Hyeong Gon Yu, MD<sup>1</sup>

*Department of Ophthalmology, Seoul National University College of Medicine<sup>1</sup>, Seoul, Korea  
Department of Ophthalmology, Seoul National University Bundang Hospital<sup>2</sup>, Seongnam, Korea*

**Purpose:** To describe the results of a pars plana vitrectomy, combined with phacoemulsification, using a sutureless, superotemporal, clear corneal incision for patients with a macular hole.

**Methods:** This study reviewed the records of 22 patients (22 eyes) who underwent a phacoemulsification with the insertion of an acrylic intraocular lens, using a 3.2 mm superotemporal clear corneal incision and a pars plana vitrectomy with an internal limiting membrane peeling in one session, for the treatment of a macular hole.

**Results:** All 22 patients had their macular holes closed using the combined surgical procedures. The mean preoperative visual acuity was 0.086, and the mean postoperative visual acuity was 0.173. This improvement was statistically significant (paired Student's t-test,  $p < 0.05$ ). No patients developed posterior capsular opacity, retinal detachment, or a cystoid macular edema. The surgically induced astigmatism (SIA) was 0.808 diopters ( $0.808 \pm 0.761$ ) two months after surgery.

**Conclusions:** Combining cataract surgery with vitrectomy can achieve visual rehabilitation in the early postoperative period without requiring post-vitrectomy cataract surgery. A sutureless clear corneal incision, used in this procedure, can minimize the SIA and promote postoperative wound healing. If sutureless, transconjunctival, pars plana vitrectomy can be used more widely in the future, then the simplified, combined cataract surgery using a small clear corneal incision will also become more common, hence decreasing operation time, and hastening postoperative recovery. *Korean Journal of Ophthalmology 20(3):147-150, 2006*

**Key Words:** Cataract surgery, Clear corneal incision, Macular hole, Vitrectomy

Pars plana vitrectomy with an intravitreal gas injection is the treatment of choice for a macular hole.<sup>1</sup> It is shown to be effective in closing a macular hole and is widely performed. However, phakic patients frequently develop a rapidly progressive nuclear sclerosis after the surgery, which delays visual recovery.<sup>2,3</sup> Therefore, combined cataract surgery with a vitrectomy for a macular hole is now recommended.<sup>4,5</sup>

Sutureless transconjunctival pars plana vitrectomy is now emerging as a new surgical method,<sup>6-8</sup> and the results reported have been favorable without significant complications. The short operation time, rapid recovery rate, and lack of significant surgical trauma using this procedure should result in its widespread use in the future.

Cataract surgery, combined with a vitrectomy, is generally performed using a scleral tunnel incision and a rigid

intraocular lens (IOL) implant.<sup>4,5</sup> However, rigid intraocular lens (IOL) implantation with a large scleral tunnel incision is a time-consuming procedure and induces a relatively large, surgically induced astigmatism (SIA).<sup>9</sup> Even though some investigators<sup>10</sup> have reported a clear corneal incision during a phacovitrectomy for a macular hole, the size of their clear corneal incision was 5.5 mm, and the corneal wound was closed using sutures which prolonged the operation time and induced a large SIA. In cataract surgery, foldable intraocular lens implantation with a self-sealing, clear corneal incision can minimize the operation time and postoperative rehabilitation time. Therefore, it seems more efficient to use a clear corneal incision and a foldable intraocular lens during the phacoemulsification in combination with a vitrectomy, using the above-mentioned sutureless transconjunctival pars plana vitrectomy.

There have been many suggestions to minimize the SIA during cataract surgery using a self-sealing clear corneal incision. It is known that a superotemporal clear corneal incision leads to less SIA than an anatomically superior incision<sup>11,12</sup> and it has also been reported that a corneal incision placed at the 10:30 o'clock position yields the least

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Reprint requests to Hyeong Gon Yu, MD, Department of Ophthalmology, Seoul National University Hospital, #28 Yongon-dong Chongno-gu, Seoul 110-744, Korea. Tel: 82-2-2072-2438, Fax: 82-2-741-3187, E-mail: hgonyu@snu.ac.kr

SIA.<sup>13</sup> However, there is no report on cataract surgery with a sutureless clear corneal incision combined with a vitrectomy to treat macular hole patients.

This study evaluated the surgical outcomes and complications of a phacovitrectomy using a self-sealing clear corneal incision in patients with a macular hole.

### Materials and Methods

All patients who sought treatment from the retinal service at the Seoul National University Hospital and who had a stage 2, 3, or 4 macular hole, in addition to a cataract, were considered for participation in this study. Cataracts were scored using the LOCS (lens opacities classification system) III which uses standard reference photographs. The cataract was classified as nuclear sclerotic (NS) if the cortical and posterior subcapsular (PSC) scores were each less than 1.5 and the nuclear opalescence (NO) score was greater than 2.0. The cataract was classified as cortical if the NO and PSC scores were less than 1.5 and the cortical score was greater than 2.0. The cataract was classified as mixed with PSC if the cortical and NO scores were greater than or equal to 1.5 and the PSC score was greater than 1.5.

Only patients with macular holes that met the following criteria were included in this study: an unequivocal, full-thickness macular hole, as determined by contact lens biomicroscopy; a desire for surgery to close the hole; and the ability to understand and sign an Institutional Review Board-approved informed consent document. The exclusion criteria were: a monocular status, corneal endothelial dystrophy, and previous intraocular surgery.

All the procedures were performed by a single, experienced surgeon (HG Yu) under monitored anesthetic care with a retrobulbar block induced by 2% lidocaine. A 2.75 mm-sized clear corneal incision was made at the 10:30 o'clock position for both left and right eyes. The lens was removed by phacoemulsification, and the corneal wound was enlarged to 3.2 mm. A foldable, acrylic lens (MA60BM, AcrySof<sup>TM</sup>, Alcon) was inserted into the capsular bag, and the wound was left unsutured. Then, all eyes underwent a conventional three-port pars plana vitrectomy with the sclerotomies (20 gauge) placed 3.5 mm posterior to the limbus, including elevation and removal of the posterior hyaloid if still attached. Subsequently, 0.1 to 0.2 mL of an ICG solution (5.2 mg/mL) was instilled directly into the posterior vitreous cavity, where it frequently settled over the macula, and was left for 3 to 5 minutes. After removing the intravitreal ICG with active suction, internal limiting membrane (ILM) peeling was initiated with a bent, micro-vitreoretinal blade. Diamond-dusted, intraocular forceps were used to complete the peeling throughout the posterior pole. An air-fluid exchange was followed by gas-air exchange, using 14% C3F8 gas. At the conclusion of surgery, the sclerotomies and conjunctival wounds were repaired using 8-0 vicryl sutures, followed by subconjunctival injection of dexamethasone and

gentamicin. All patients were instructed to lie face down as much as possible for 1 to 2 weeks. The patients were examined on postoperative day 1, 2, 3, week 1, week 2 or 3, and monthly thereafter.

The data collected included: the pre- and postoperative best-corrected visual acuity, using the Early Treatment Diabetic Retinopathy Study chart, astigmatism and refractive error at 1 and 2 months after surgery, the duration and the type of macular hole, the anatomic outcome or closure of the macular hole, and the surgical or postoperative complications. A paired t-test was used to compare the log of the minimum angle of resolution (logMAR) at each measurement.

### Results

Twenty-two consenting patients (22 eyes) were enrolled, including 6 men and 16 women (Table 1). The average age of the patients was 62.7 years, and ranged from 41 to 80 years. The types of cataract were distributed as follows: nuclear sclerosis (NS) (12 eyes), cortical cataract (7 eyes), and mixed with posterior subcapsular cataract (PSC) (3 eyes). The grades of NS and cortical cataract were 3 or 4, while those of PSC were 2 or 3. Seven eyes had an idiopathic, stage 2 macular hole, 12 eyes had an idiopathic, stage 3 macular hole, 2 eyes had an idiopathic, stage 4 macular hole, and 1 eye had a stage 2 myopic macular hole. Seven eyes had a visible epiretinal membrane (ERM) on the macula, 1 eye had a macular detachment, and 4 eyes had peripheral

Table 1. Descriptions of the study population

Mean age (years)	62.7 (41-80)
Male : Female	6 : 16
Mean duration of symptoms (Months)	33.6 (1-120)
Cataract classification	No (eyes)
NS*	12
Cortical cataracts	7
Mixed cataracts with PSC <sup>†</sup>	3
Macular hole : cause and stage	No (eyes)
Idiopathic	
Stage 2	7
Stage 3	12
Stage 4	2
myopic	1

\*: nuclear sclerosis, †: posterior subcapsular cataract.

Table 2. Pre- and post-operative comparison of ECC in patients undergoing phacovitrectomy to treat a macular hole and cataract

	Preoperative	Postoperative	p-value*
ECC <sup>†</sup>	2697±371.0	2773±401.4	0.610

\*: paired t-test, †: endothelial cell count.

retinal holes, 3 of which were found during the vitrectomy. A partial removal of the central posterior capsule was performed in 2 eyes to remove the pre-existing posterior capsular opacity.

The time until the final follow-up examination ranged from 2 to 8 months, with a mean of 4.0 months. Upon postoperative examination, all 22 holes were found to be closed. The preoperative endothelial cell count (ECC) ranged from 2299 to 3183, and the mean ECC was 2697. The postoperative ECC ranged from 2062 to 3336, and the mean ECC was 2733 (Table 2).

The preoperative visual acuity (ranged from 0.6 to seeing only hand motions), and the mean preoperative visual acuity was 0.086. The final postoperative visual acuity ranged from 0.9 to 0.005, and the mean final visual acuity was 0.173. This visual improvement was statistically significant. (Paired Student's t-test,  $p < 0.05$ ) The final postoperative visual acuity was better than the preoperative visual acuity in 17 eyes, unchanged in 2 eyes, and worse in 3 eyes (Table 3). An equal or better visual acuity was noted in 19 out of the 22 (86.4%) patients. At the final visit, 31.8% (7 of 22 eyes) had a postoperative visual acuity of 0.5 or better.

The SIA was calculated, using the Jaffe vector method. The mean SIA was 0.808 diopter ( $0.808 \pm 0.761$ ) one month after surgery and 0.874 diopter ( $0.874 \pm 0.665$ ) two months after surgery. The SIA was largely stabilized four weeks after surgery (Table 4).

Though there were no intraoperative complications, several postoperative complications were encountered. Posterior capsule opacity developed to a mild degree in two eyes six months after surgery, but vision was not impaired. A partial posterior synechia occurred postoperatively in one eye, but it was not associated with an increased IOP or a visual disturbance. One postoperative corneal erosion was encountered, which improved with a therapeutic lens and frequent artificial tear application. Thirteen patients (59.1%) experienced an immediate postoperative IOP elevation on the day after surgery, which normalized within one week without medication. No postoperative complications, such as a retinal

tear or detachment, a cystoid macular edema, or secondary glaucoma, were observed throughout the follow-up period.

## Discussion

This study shows that the hole closure rate of a phacovitrectomy via a clear corneal incision is comparable to that of a vitrectomy alone or a phacovitrectomy via a scleral tunnel incision.<sup>4,5,10</sup> This favorable result may be related to a complete removal of the ILM or ERM using ICG dye. Combined cataract and vitreous surgery can lead to a more complete excision of the peripheral vitreous and a greater volume of intravitreal gas. This procedure also allows the removal of lens opacities, leading to easier visualization and treatment of peripheral retinal lesions, such as a retinal break, with a scleral depression and an endolaser photocoagulation.

A pars plana vitrectomy is significantly correlated to the postoperative cataract progression.<sup>14</sup> Cataract surgery in a previously vitrectomized eye has more technical difficulties due to the lack of vitreous support.<sup>15</sup> In patients with a macular hole and a cataract, a combined cataract and vitrectomy procedure is recommended. Combined surgery may be encouraged if the patient is old enough to have lost his or her accommodative capacity even if such patients have no or minimal cataracts but intend to receive a vitrectomy to treat a macular hole.

A sutureless, clear corneal incision in a phacovitrectomy is feasible and easy, and it assists the early postoperative visual rehabilitation by reducing the SIA. As mentioned above, the SIA after a phacovitrectomy with a sutureless, clear corneal incision had stabilized by four weeks after surgery. Recently, some investigators reported a transconjunctival sutureless pars plana vitrectomy method in various disease entities, including a macular hole.<sup>6-8</sup> If this sutureless procedure can be used more widely, a self-sealing, clear corneal incision in cataract surgery would prevail in a combined phacovitrectomy. It is expected that combining both sutureless procedures will hasten the postoperative recovery by simplifying the surgical procedure and shortening the operation time, thereby minimizing the surgically induced trauma and postoperative inflammation, and shorten the rehabilitation period.

There are several choices of sites for the sutureless clear corneal incision in cataract surgery. There have been some reports showing that the extent of SIA depends, in part, upon the location of the incision. A temporal, clear corneal incision tends to cause a lesser SIA than an anatomically superior incision of the same size.<sup>12</sup> This might be due to the greater distance of the incision from the visual axis in a temporal incision than in a superior incision and to the continuous stroking of the upper eyelid which increases the pressure on the superior wound. However, when combined with a vitrectomy, a temporal incision is technically difficult in cataract surgery because the operator is usually at the 12 o'clock position. On the other hand, a corneal incision at the 10:30

**Table 3.** Distribution of the visual acuities in patients who underwent phacovitrectomy to treat a macular hole

	Preoperative No (%)	Final visual acuity No (%)
≥0.5	1 (4.5)	7 (31.8)
<0.5 to ≥0.1	13 (59.1)	11 (50)
<0.1	8 (36.4)	4 (18.2)

**Table 4.** Post-surgical SIA\* change

	At 1 month after surgery	At 2 month after surgery
SIA*	0.808±0.761	0.874±0.665

\*surgically induced astigmatism.

o'clock position is easy to make when the operator sits over the patient's head. In addition, this position is known to induce less SIA than a superior incision.<sup>13</sup> Therefore, this study selected the 10:30 o'clock position as the corneal incision site. The result shows that a combined phacovitrectomy with a 10:30 o'clock corneal incision induces a SIA comparable to that encountered after cataract surgery using a temporal or superotemporal incision.<sup>12,16-18</sup>

There is some controversy as to whether a minimal SIA with a superotemporal corneal incision in cataract surgery could remain unchanged in a combined procedure for a macular hole in which a sclerotomy incision is made, gas is injected intravitreally, and after which the prone position is required for one to two weeks. However, it was reported that the corneal surface measurements in the eyes that received a pars plana vitrectomy returned to the preoperative values within one month postoperatively and remained stable.<sup>19,20</sup> These results also showed that the SIA induced by a vitrectomy itself is negligible in a phacovitrectomy.

No patient in the study had postoperative complications resulting in permanent vision loss. Despite elevations of IOP that were frequently encountered after the phacovitrectomy, all were controlled within one week postoperatively without medication. A posterior capsular opacity developed in two eyes which needed to be followed-up to assess the progression. Although, no corneal incision-related complications, such as corneal decompensation or recurrent erosion, were experienced, long-term follow-up is needed.<sup>21,22</sup> It is acknowledged that there are other permutations of the phacovitrectomy techniques, that may be preferable for certain surgeons. Some surgeons, for example, may wish to implant the foldable IOL using a small scleral tunnel incision.

In conclusion, the safety and success of a phacovitrectomy support the use of clear corneal incision as a routine procedure for treating patients with cataracts undergoing a macular hole repair. In addition, this study shows that a clear corneal incision at the 10:30 o'clock position is convenient and minimizes postoperative astigmatism when combined with a pars plana vitrectomy.

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