

# Phacoemulsification of Dislocated Lens and Suture Fixation of Intraocular Lens Using a Perfluorocarbon Liquid

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**Abstract:** The objective was to describe a new surgical technique to manage a posteriorly dislocated crystalline lens. Four patients with posteriorly dislocated lenses were studied. Two patients had dislocated lenses secondary to trauma, 1 had undergone retinal detachment surgery, and 1 had an idiopathic lens dislocation. Pars plana vitrectomy was carried out on all 4 eyes, followed by an injection of perfluoro-n-octane to float the lens off the retina. The lens was phacoemulsified through a limbal incision, and an intraocular lens was positioned in the ciliary sulcus with suture fixation. Perfluoro-n-octane was replaced by a balanced salt solution. Postoperative visual acuity ranged from 1.0–1.5. Transient choroidal detachment and hypotony were observed in 3 eyes in the early postoperative period. Postoperative ocular hypertension was noted in 2 eyes and was well-controlled with topical antiglaucoma agent. These results indicate that limbal lensectomy of a posteriorly dislocated lens using perfluorocarbon liquids is a beneficial and relatively safe method. **Jpn J Ophthalmol 1998;42:471–475** © 1998 Japanese Ophthalmological Society

**Key Words:** Lens dislocation, perfluorocarbon liquid, phacoemulsification, suture fixation of intraocular lens.

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## Introduction

Luxation and subluxation of the crystalline lens occur as a consequence of trauma, as an ocular manifestation of systemic hereditary disorders, and as an idiopathic phenomenon.<sup>1,2</sup> Subluxation of the lens may induce intermittent phakic and aphakic refractive disorders and lead to marked visual disturbance. Dislocation of the lens into the vitreous cavity may cause phacolytic uveitis and retinal detachments.

Management of the posteriorly dislocated lens has improved with the advance of vitreous surgery.<sup>3–5</sup> A vitrectomy probe and an ultrasonic fragmentation probe can be used safely to remove soft to moderately hard lenses. If the lens is hard, a bimanual technique is used to crush it between the endoilluminator

and the ultrasonic fragmentation probe.<sup>6,7</sup> During intravitreal lens fragmentation, perfluorocarbon liquid has been used recently to avoid retinal damage from the falling lens fragments or from the high energy of the ultrasonic fragmentation probe.<sup>8–11</sup> A very hard lens can be delivered through a limbal corneal incision using a cryoprobe.<sup>12</sup>

However, the current management of the dislocated lens has several drawbacks. First, preexisting vitreous hemorrhage and corneal opacity may hamper the preoperative estimate of the lens hardness, which may determine the operative procedure. Second, the use of the ultrasonic fragmentation probe can lead to thermal damage of the sclerotomy sites. Finally, the larger incision size necessary to deliver a whole lens may cause postoperative astigmatism. Recently, we successfully used perfluorocarbon liquids to float the posteriorly dislocated lens, performed phacoemulsification through a limbal sclerocorneal incision, and implanted an intraocular lens (IOL) in the sulcus with suture fixation. This report describes the surgical procedures and the results in 4

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consecutive patients with posteriorly dislocated lenses managed by this technique.

### Patients and Methods

Between October 1995 and February 1996, 4 patients with posteriorly dislocated lenses were referred to us (Table 1). Patient age ranged from 55 to 63 years. Two patients had dislocated lenses secondary to trauma, 1 had undergone retinal detachment surgery, and 1 had an idiopathic lens subluxation. All 4 patients had a history of glaucoma secondary to the lens dislocation. Vitreous hemorrhage was observed in the 2 patients with traumatic lens dislocation. Retinal detachment was not a complication in these patients. Preoperative best corrected visual acuity ranged from hand motion to 1.2.

#### *Surgery Was Performed After Retrobulbar Anesthesia*

First, a 6-mm limbal sclerocorneal incision was made parallel to the limbus. Next, partial thickness scleral flaps were made at 3 and 9 o'clock. We then performed pars plana vitrectomy with removal of as much of the basal gel as possible. Once the vitreous gel was removed, perfluoro-n-octane (approximately 5.5 mL, Infinitect, Chesterfield, MO, USA) was injected over the optic nerve head to float the lens off of the retina and into the anterior vitreous cavity. When the lens was behind the pupillary plane, the phacoemulsifier (Legacy, Alcon Laboratories, Fort Worth, TX, USA) was introduced through the limbal wound to phacoemulsify the lens floating on the perfluorocarbon bubble. No capsulorrhexis was necessary. A high aspiration level (400 mmHg) was useful. A nucleofractis hook was used to divide and stabilize the hard lens. Small lens fragments often fell on the surface of the perfluorocarbon, and could be detected with an endoscope (Tokyo Denshi Hanbai, Tokyo) and easily removed. Following removal of the lens, an IOL was positioned in the sulcus using a 10-0 polypropylene suture, which was buried under

the scleral flaps. Thereafter, the perfluoro-n-octane was replaced by a balanced salt solution through a silicone-tipped canula.

Patients were followed after surgery. Visual acuity (decimal function), intraocular pressure (IOP), and slit-lamp and funduscopic examination results were recorded. Follow-up ranged from 20–23 months.

#### *Case Reports*

**Case 1.** A 55-year-old man was struck in the left eye by an object on December 19, 1995, and immediately developed severe ocular pain with noticeable floaters and a decrease in visual acuity. Ophthalmic examination 4 days after the injury showed a visual acuity of 1.5 in the right eye and 0.1 ( $1.2 \times +11$  D) in the left eye. Intraocular pressure was 16 mmHg in the right eye and 30 mmHg in the left eye. Slit-lamp examination of the anterior segment of his left eye revealed an inferior subluxation of the lens into the anterior vitreous cavity.

Fundus examination of the left eye revealed a mild vitreous hemorrhage in the inferior fundus. Gonioscopic examination of the left eye disclosed a mild angle recession. Surgery was performed, and following pars plana vitrectomy with removal of basal vitreous gel, liquid perfluoro-n-octane was injected over the optic nerve head to float the lens anteriorly. When the lens was behind the pupillary plane, it was removed with a phacoemulsifier through the limbal sclerocorneal wound. Thereafter, an IOL was positioned in the sulcus with scleral fixation. The perfluorocarbon was replaced by a balanced salt solution through a silicone-tipped canula.

After surgery, IOP decreased to below 5 mmHg with moderate choroidal detachment, which disappeared on the 6th postoperative day. The patient's best corrected vision in the left eye was 0.9 one month after surgery; the IOP was 13 mmHg without antiglaucoma agent and the choroidal detachment resolved. Postoperative complications, including corneal edema and macular edema, were not observed during the follow-up period.

**Table 1.** Summary of Patients With Dislocated Crystalline Lens

Patient No.	Age/Sex	Diagnosis	Best Corrected Vision		Follow-up (Months)	Complications
			Preoperative	Postoperative		
1	55/Male	Traumatic	1.2	0.9	7	CD
2	59/Male	Traumatic	Hand motion	1.0	25	CD
3	63/Male	Postoperative	0.2	1.5	26	CD
4	59/Male	Idiopathic	1.2	1.2	29	ERM

CD: choroidal detachment, ERM: epiretinal membrane.

**Case 2.** A 59-year-old man was injured in the right eye by a hook on February 22, 1996, and immediately developed severe ocular pain with loss of vision. Examination soon after the injury showed a best corrected visual acuity of hand motion in the right eye and 1.5 in the left eye. In addition, examination revealed a lens dislocation with vitreous hemorrhage and a raised IOP (62 mmHg). When the patient was referred for treatment on the next day, slit-lamp examination of the right eye disclosed moderate hyphema, iris sphincter damage, and a dislocated lens in the anterior vitreous cavity. The IOP was 34 mmHg in the right eye with topical 0.5% timolol and oral acetazolamide (50 mg) medication. Fundus examination of the right eye demonstrated a severe vitreous hemorrhage obscuring the details of the fundus. Surgery, including removal of the dislocated lens and IOL implantation, was performed as in the above case. After surgery, the IOP decreased to below 5 mmHg with mild choroidal detachment, which resolved on the 13th postoperative day. Slit-lamp examination of the right eye disclosed small droplets of perfluorocarbon in the anterior chamber without any other complications. The patient's best corrected vision in the left eye was 1.0 three months after surgery, and IOP was 20 mmHg with topical timolol treatment. Postoperative complications including corneal edema and macular edema were not observed during the follow-up period.

**Case 3.** A 63-year-old man was referred with dislocation of the lens and glaucoma in the left eye. In 1987, he had undergone successful retinal detachment surgery in the left eye. On January 3, 1996, he noticed a sudden decrease in visual acuity in the left eye and was referred to the glaucoma clinic. His visual acuity was 1.0 ( $1.5 \times +0.5$  D) in the right eye and 0.1 ( $0.7 \times -1.5$  D) in the left eye. The IOP was 15 mmHg in the right eye and 78 mmHg in the left eye. Slit-lamp examination revealed a deep anterior chamber in the right eye, and corneal epithelial edema with very shallow anterior chamber and slightly dilated pupil in the left eye. Gonioscopic evaluation of the left eye disclosed a total angle closure. Angle-closure glaucoma was diagnosed and laser iridotomy was performed in the left eye. On January 5, IOP was 10 mmHg in the right eye and 15 mmHg in the left eye with topical timolol medication. Gonioscopic re-evaluation of the left eye showed that the angle was wide open. On January 27, the patient noticed a sudden onset of floaters and a decrease in visual acuity in the left eye. Lens dislocation was diagnosed and he was referred for treatment. On our first examination on January 29, his visual acuity was 0.01

( $0.2 \times +12$  D) in the left eye. The IOP was 12 mmHg in the right eye and 14 mmHg in the left eye with topical timolol. Slit-lamp examination revealed mild nuclear sclerosis in the right eye, and in the left eye, there was mild flare and cells as well as herniated vitreous into the normal depth anterior chamber. The iridotomy in the left eye was found to be open. Results of the fundus examination in the right eye were unremarkable. In the left eye, there was a dislocated cataractous lens situated in the inferior fundus. The left retina was attached and demonstrated a chorioretinal scar with protrusion in the temporal fundus. Surgery, including removal of the dislocated lens and IOL implantation, was performed as in the above cases. After surgery, the IOP decreased to below 5 mmHg with mild choroidal detachment, which resolved on the 5th postoperative day. The patient's best corrected vision in the left eye was 1.5 one week after surgery, and the IOP was 16 mmHg with topical timolol. Other complications such as corneal decompensation and cystoid macular edema were not observed, and the visual acuity was maintained at 1.5 at the end of the follow-up.

**Case 4.** On October 2, 1995, a 59-year-old man noticed a sudden decrease in visual acuity and presented at a local ophthalmologist with a high IOP (33 mmHg). The patient was treated with topical timolol. On October 26, he was found to have lens dislocation and was referred to us for treatment. On our examination the next day, his visual acuity was 0.02 ( $1.2 \times +12$  D) in the right eye and 0.8 ( $1.5 \times +1.25$  D) in the left eye. IOP was 21 mmHg in the right eye and 17 mmHg in the left eye. Slit-lamp examination of the right anterior segment disclosed a slightly cataractous lens with an inferonasal subluxation into the anterior vitreous cavity, bisecting the center of the pupil. The right retina was attached and demonstrated several areas of lattice degeneration without retinal breaks. Ocular history was unremarkable, and no systemic hereditary disorders were diagnosed. Surgery, including removal of the dislocated lens and IOL implantation, was performed as in the cases reported above. The patient's best corrected vision in the right eye was 1.2 one month after surgery, and the IOP was 19 mmHg without antiglaucoma agent. Fundus examination of the right eye 3 months postoperatively disclosed an epiretinal membrane in the posterior fundus. Other ocular complications associated with phacoemulsification, including corneal decompensation and retinal cystoid macular edema, did not occur by the end of follow-up.

## Discussion

The use of perfluorocarbon liquids has facilitated the safe removal of a posteriorly dislocated crystalline lens. First, lens fragments float on the surface of the perfluorocarbon bubble, preventing potential retinal trauma, especially to the macula.<sup>7</sup> Second, retinal damage from the high energy of the ultrasonic fragmentation device can be avoided.<sup>11</sup> Third, the perfluorocarbon bubble keeps the retina attached in eyes with retinal breaks and detachments.<sup>8</sup> Finally, the perfluorocarbon liquids facilitate the fixation of the lens haptics into the ciliary sulcus prior to transscleral suturing.<sup>13</sup> Several recent reports described the results of pars plana vitrectomy with perfluorocarbons to remove dislocated lenses. Greve and associates<sup>9</sup> operated on 3 cases with posteriorly dislocated crystalline lens (not associated with surgery) using perfluoroperhydrophenanthrene and obtained excellent postoperative vision (20/40 to 20/20). Lewis and associates<sup>8</sup> treated 3 eyes with luxated lens and concurrent retinal detachment (not associated with surgery) using perfluoro-n-octane or perfluoroperhydrophenanthrene and reported remarkable visual results (20/80 to 20/30). Perfluoro-n-octane has low viscosity, high specific gravity, high refractive index, and high vapor pressure, which allows easier injection and aspiration, excellent intraoperative visualization, and rapid postoperative clearance of residual droplets. For these reasons, we evaluated the use of perfluoro-n-octane for the management of posteriorly dislocated lenses. The excellent visual results obtained in all 4 eyes are encouraging.

The surgical method described in this report has several potential advantages, as compared with the method using the ultrasonic fragmentation probe or the cryoprobe. Phacoemulsification through the limbal incision can remove the lens very effectively and easily. Postoperative astigmatism, which may be seen after a large sclerocorneal incision, was minimized, facilitating early and rapid visual rehabilitation. Thermal damage of sclerotomy sites, which may be caused by the ultrasonic fragmentation, was also avoided.

Transient choroidal detachment and hypotony were observed in 3 eyes (75%) in the early postoperative period. Verma and associates<sup>14</sup> reported that only 6% of 700 operated eyes using perfluoroperhydrophenanthrene manifested transient or persistent hypotony as a postoperative complication. Adile and associates,<sup>15</sup> however, showed that low postoperative IOP was significantly associated with preoperative trauma. The mechanism is unclear, but traumatic damage of the ciliary body was suspected to cause

the ocular hypotension due to the reduced aqueous production. Alternatively, it is possible that postoperative inflammation and venous congestion lead to choroidal detachment, reducing the IOP by suppressing aqueous production and possibly by increasing uveoscleral outflow.

Postoperative ocular hypertension was also noted in 2 eyes (50%) in our series. One eye had undergone ocular surgery and the other had experienced ocular trauma, and both eyes had severe ocular hypertension preoperatively. A recent study reported that chronically elevated postoperative IOP was significantly associated with high preoperative IOP and hyphema or vitreous hemorrhage.<sup>16</sup>

Intraocular perfluorocarbon liquids remaining postoperatively are known to cause several ocular complications, such as corneal edema, glaucoma, inflammation, and retinal degeneration.<sup>17</sup> It is important to avoid overfilling the eye with perfluorocarbon liquids to minimize the possibility of entrapment of lens particles and perfluorocarbon droplets in the residual vitreous base during lens fragmentation. For the same reason, we removed as much of the basal vitreous gel as possible, which also reduces the risk of creating retinal breaks during phacoemulsification and aspiration. Residual droplets of perfluorocarbon, however, may sometimes remain, even with maximum efforts. Chang and associates<sup>18</sup> reported that very small residual droplets of perfluorocarbon liquids can be clinically tolerated.

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