Tokai J Exp Clin Med., Vol. 29, No. 1, pp. 17-22, 2004

A Method Using Sutures for Extraction of Subluxated Posterior Chamber Intraocular Lens and Transscleral Fixation : Spider Technique

Kenji KAWAI

Department of Ophthalmology, Tokai University School of Medicine

(Received January 14, 2004; Accepted January 26, 2004)

We experienced 5 cases with intraocular lens (IOL) subluxation in which IOL extraction was safely conducted using two 10-0 polypropylene sutures through pars plana and proceeded with secondary IOL implantation using the same sutures. This is a report on our study of this safe method for IOL extraction and fixation method. The method is developed from ab externo sulucus fixation. Usage of two 10-0 polypropylene sutures originally placed for the second fixation enables a surgeon to hold subluxated IOL and prevents it from falling into the vitreous body cavity. A 6-mm incision is made in the corneal limbus, and the IOL is removed. Using the two 10-0 sutures that are already in place, secondary IOL implantation can be conducted at one time. There were no cases of postoperative retinal detachment. Postoperative visual acuity was improved in all cases. No dislocation was seen in any of the cases with the pupils dilated.

Key words : Intraocular lens (IOL), subluxation, 10-0 polypropylene suture, IOL extraction

INTRODUCTION

Today, with the consideration of patient's quality of life, implantation of a intraocular lens (IOL) has been a major method in performing cataract surgery. Whilst there are not so many cases of IOL subluxation occurring as postoperative complications, various methods have been used to treat this complication. The methods include vitrectomy surgery and simple extraction methods [1-10]. This is a report of 5 cases in which we successfully conducted lens subluxation and secondary IOL implantation using two 10-0 polypropylene sutures through sclerocorneal pars plana behind the subluxed IOL.

CASES AND METHODS

Cases:

After obtaining the patients' consent, the study was conducted on 5 eyes in 5 subjects requiring extraction of subluxated IOLs during the 4-year period from 1998 through 2002 at either Ohgaki Municipal Hospital or Tokai University Hospital. The age of the patients ranged from 55 to 76 years old, with an average age of 65.80 ± 7.95 years. The time from cataract surgery until IOL extraction ranged from 3 days to 11 years and 6 months. From the findings on eye examinations, it was possible to confirm IOL dislocation and the extent of subluxation in 3 cases and, for the remaining 2 cases, we had to use three mirrors to confirm the IOL due to severe subluxation.

Among these cases, subluxation originated from a rupture of Zinn's zonule in 4 eyes in 4 subjects, and in one eye in one subject, it originated from a posterior capsule rupture. The surgical method used was phacoemulsification in 3 eyes and planned extracapsular cataract extraction in 2 eyes (Table 1).

Methods:

Spider Technique - an IOL extraction method using 10-0 polypropylene for fixation suture:

1. Subluxated IOLs are extracted using the

Kenji KAWAI, Department of Ophthalmology, Tokai University School of Medicine, Bohseidai, Isehara-shi, Kanagawa 259-1193, Japan TEL: 81-(0463)-90-1535 FAX: 81-(0463)-91-9328 E-mail: k-kawai@is.icc.u-tokai.ac.jp

Table 1 Findings before the Spider Technique

Case	Sex	Age (Years)	Symptoms	Methods of cataract surgery prior to IOL subluxation	Findings taken as a reference to IOL subluxation	Time until spider Technique
1	F	66	Decreased visual acuity	PEA	Post-vitrectomy rupture of Zinn's zonule	4 years 3 months
2	M	70	Decreased visual acuity	PECCE	Rupture of Zinn's zonule	7 years 7 months
3	F	76	Decreased visual acuity	PEA	Bag rupture	3 days
4	M	55	Floaters	PEA	Rupture of Zinn's zonule	2 years
5	M	62	Decreased visual acuity	PECCE	Rupture of Zinn's zonule	11 years 6 months

PEA: Phacoemulsification/aspiration

PECCE: Planned extracapsular cataract extraction

3-port vitrectomy technique. Infusion tube is fixed with a 5-0 suture 3 mm from the corneal limbus.

2. A viscoelastic material (Healon) is injected from behind the subluxated IOL 3 mm from the limbus at 10 o'clock using a needle (Healon needle) in order to shift the IOL as far into the anterior chamber as possible.
3. Method of grasping subluxated IOL: After confirming the haptic part of subluxated IOL that was put forward, a 25G needle attached to a 1-ml injection tube is inserted 1.5 mm from the corneal limbus where the haptic part was confirmed. The needle is then moved into the position at the base of the optic and haptic of the subluxated IOL. Inserting a 10-0 polypropylene suture needle, either a long straight needle or long curved needle, through the sclera on the opposite site from the corneal limbus that pallalels, the 10-0 polypropylene needle is then inserted into the hole of the 25G needle in the central eyeball. After attaching the suture at the haptic of subluxated IOL and taking out the 25G needle, the polypropylene suture is put through the posterior chamber. This suture is positioned in the lower part of the subluxated IOL, and the IOL stays on top of the suture. This procedure is repeated twice to attach two sutures between the haptic and optic of the subluxated IOL. Tension is applied to the suture in order to lift the subluxated IOL into a position in parallel with the iris, causing it to move upward near the anterior chamber (Fig. 1).
4. Method of extracting the subluxated IOL: Because the subluxated IOL is made of polymethylmethacrylate (PMMA) with a 6-mm optic, an incision 6 mm in length is made in the corneal limbus, and the IOL is removed through this wound using a 10-0 suture and forceps, after which the suture is removed from the IOL, and then repositioned inside the eye. (Fig. 2)
5. Anterior vitrectomy: In order to prevent the vitreous body from both forwarding to the incision and being caught at the haptic to be sutured, the vitreous should be removed as close as possible to the pars plana of the ciliary body.
6. The 2 ports other than the infusion port were sutured into place with a 7-0 suture thread.

Transscleral fixation of posterior chamber intraocular lenses:

1. The two 10-0 polypropylene sutures that are already thread through at the time of

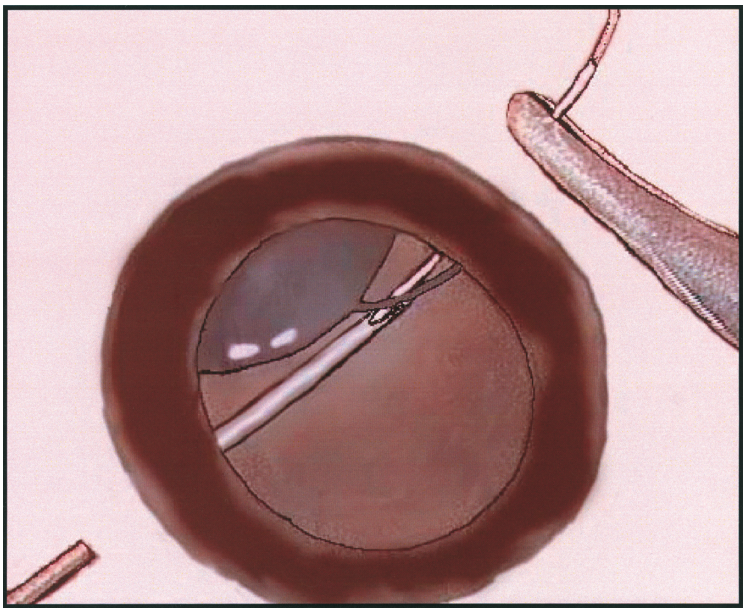

Fig. 1 A 25 G needle is inserted 1.5 mm from the corneal limbus and moved into a position at the base of the optic and haptic of the subluxated IOL. A 10-0 Prolene (polypropylene suture) needle, either a long straight needle or long curved needle, is inserted for suturing use through the sclera on the opposite site into the hole of the 25 G needle from the corneal limbus, and the suture is attached to the IOL with "the spider" as the target. This procedure is repeated twice, and two sutures are attached to the subluxated IOL. Tension is applied to the suture by tightening the thread, and the subluxated IOL is lifted in parallel to the iris and let float up into the anterior chamber.

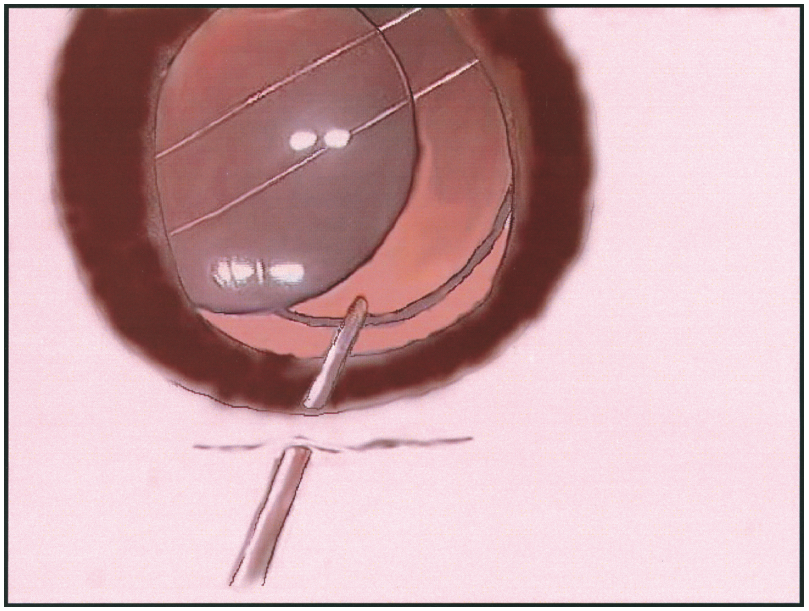

Fig. 2 The subluxated IOL is shown. A long curved needle is inserted between the haptic and optic of the IOL. Two 10-0 polypropylene sutures are seen below the subluxated IOL. An incision 6 mm in length is made in the corneal limbus, and the IOL is removed through this wound using a 10-0 suture and forceps.

the subluxated IOL extraction are used. The sutures are taken out, cut in the middle, and each piece of the sutures is attached to both the haptics of a new IOL, a PMMA IOL having optic size of 6-mm and the haptic with a curve for fixation, that is to be secondarily implanted. This procedure allows total of 4 sutures attached to the haptics of suturing IOL.

2. By asking an assistant surgeon to gently pull each one of the 2 sets of sutures that are both thread through 1.5 mm from both sides of the corneal limbus, the IOL is inserted using intraocular lens forceps, and suturing is performed by adjusting the IOL to be positioned in the center of dilated pupil. This new IOL is regarded as sulcus fixation.
3. The 6- mm wound where the IOL was inserted is closed with a 10-0 nylon suture thread.
4. The infusion is removed, and the resulting wound is sutured with a 7-0 thread.
5. The conjunctiva is sutured with an 8-0 thread, intraocular pressure is adjusted with BSS solution, and the surgery is completed.

RESULTS

In 4 out of 5 cases with IOL suluxation, IOL luxation was not recognized until 2 years after cataract surgery. Among the 4 cases, 3 cases had spontaneous dislocation of IOL without any trauma and pseudoexfoliation syndrome, and the remaining was a case of dislocation after vitrectomy surgery. In 1 out of 5 cases, IOL was implanted in the posterior capsule rapture.

As shown in Table 2, the fixation site of the subluxated IOL was in the bag in 2 eyes (40 %) and out of the bag in 3 eyes (60 %).

The material used in the extracted IOL was 1 piece of PMMA in 1 eye and 3 pieces of PMMA in 4 eyes.

The secondary insertion IOL type used was a IOL PMMA manufactured by NIDEK.

The secondarily implanted new IOL was fixed using two 10-0 polypropylene sutures. After this procedure, there have been no subsequent cases of re-dislocation of the IOL from the suture for 24.6 ± 20.0 months.

Vitreous hemorrhaging was observed in two cases (40 %) during surgery. However, no additional postoperative hemorrhage was observed.

There was 1 case of an eye with post-surgical retinal detachment (20 %) and 3 cases of lattice degeneration during surgery (60 %). However, photocoagulation was performed during surgery (Table 2).

As shown in Table 3, postoperative visual acuity was improved in all cases.

Postoperative intraocular pressure was 20 mmHg or less in all cases.

The mean preoperative corneal curvature was 3.12 ± 2.53 D, and the mean corneal curvature one month postoperatively was 2.4 ± 1.78 D. Wilcoxon non-parametric test resulted in $P = 0.7874$, with no statistical significance.

No dislocation was observed with the pupils dilated. Neither postoperative vitreous hemorrhaging nor retinal detachment was found (Table 3).

DISCUSSION

Extraction of dislocated/subluxated IOLs:

Reported methods for safe extraction of the IOL in patients with severe subluxation of IOLs include the method of extracting a completely luxated IOL by causing the IOL to float upward close to the anterior chamber using perfluorocarbon liquids with a specific gravity greater than that of water [4] and the method, used in vitrectomy since 1986, of using lens foreign body forceps to directly grasp the IOL and then reposition it by suturing it to the ciliary sulcus [1, 5-10].

Our method is based on ab externo sulcus fixation by Hu [11] and developed to have our its advantage that we can continue to utilize the 10-0 polypropylene sutures that are used for IOL extraction. Our method prevents the subluxated IOL from falling into the vitreous body by moving the subluxated IOL forward with a viscoelastic material, and attaching the 10-0 sutures to the haptic of complete luxation. Also, the two threaded sutures put the IOL upward as well as prevent it from falling down. This is a safe method in that because of fixation with 2 sutures, IOL never falls down to the vitreous cavity even in the event that the lens is completely luxated at the time of extraction. In extracting IOLs, we always use the method of vitrectomy and, after removing the clouded vitreous and confirming the presence or absence of abnormal findings in the peripheral retina, we extract the IOL from the corneal limbus, taking care to prevent the collapse of the eyeball. It is important to use three

Table 2 Findings with the Spider Technique

Case	IOL status during surgery	Fixation status of subluxated IOL	IOL Type subluxated	Suturing IOL Type (1 piece PMMA)	Complications during surgery	History of retinal symptoms	Photocoagulation during surgery
1	Severe subluxation	in the bag	1piece PMMA	NR 84 K	None	Post-retinal detachment	None
2	Dislocated	out of the bag	3pieces PMMA	NR 81K	None	Equatorial lattice degeneration	Conducted
3	Dislocated	out of the bag	3pieces PMMA	NR 81K	Vitreous hemorrhaging	None	None
4	Dislocated	in the bag	3pieces PMMA	NR 81K	None	Equatorial lattice degeneration	Conducted
5	Dislocated	out of the bag	3pieces PMMA	NR 81K	Vitreous hemorrhaging	Equatorial lattice degeneration	Conducted

Table 3 Preoperative and Postoperative Change in VA/IOL/K-Value

Case	Preoperative VA	Postoperative VA	Preoperative IOP (mmHg)	Postoperative IOP (mmHg)	Pre/Post operative K-value (Absolute value of horizontal axis – vertical axis) |H − V| (Corneal curvature)		IOL dislocation
1	Counting fingers	0.02	18	14	2.62	3.75	None
2	0.5	1.2	12	11	3.5	4.75	None
3	0.3	0.6	9	12	7.25	1.25	None
4	1.2	1.2	25	16	1.5	1.75	None
5	0.9	1.0	12	12	0.75	0.5	None
Average			15.2 ± 6.4	13 ± 2	3.12 ± 2.53	2.4 ± 1.78	

VA: Visual acuity
IOP: Intraocular pressure
IOL: Intraocular lens
K: Keratometer
H: Horizontal
V: Vertical

port vitrectomy system in extracting the IOL in order to prevent complications such as vitreous prolapse, retinal detachment, and vitreous hemorrhage [12, 13].

Ciliary sulcus suturing of IOLs (transscleral fixation of posterior chamber intraocular lenses; connection with complications):

The transscleral fixation technique was described in 1986 by Malbran [14]. Possible complications of transscleral fixation include vitreous hemorrhaging, retinal detachment, postoperative intraocular hypertension and glaucoma, as well as IOL dislocation and infection [12, 13, 15].

We also recognized vitreous hemorrhage in 2 cases at the time of transscleral insertion of a 25G needle. However, this complication was corrected during surgery. As equatorial lattice degeneration was observed in 3 subjects during surgery, and endophotocoagulation was carried out in the course of vitrectomy.

Proceeding to secondary IOL implantation without conducting peripheral vitrectomy can sometimes induce retinal detachment due to the sticking of the existing vitreous with sutures and to the traction being caught by the retina [12]. However, retinal detachment has not been observed in our 5 cases for the 24.6 ± 20.0 months period. Postoperative intraocular pressure was also normal in all subjects at 20 mmHg or below, and none of the eyes progressed to glaucoma [2].

In "Spider Technique" our method of IOL extraction and suturing, the two 10-0 polypropylene sutures that are threaded through 1.5 mm from the pars plana bring the subluxated IOL up toward the posterior chamber. Since the sutures are threaded between the optic and haptic, IOL extraction can be safely conducted, and the use of the remaining sutures for subsequent suturing of a new IOL is very unique.

Because this procedure is relatively simple and there are few complications, we plan to conduct future studies on larger groups of patients in order to establish a safe operating technique.

ACKNOWLEDGMENTS

The author thanks Dr. Saburo Hayano, Professor Emeritus of Gifu University, and Associate professor Masayasu Bando, Ph.D., of Tokai University.

REFERENCES

1) Chan CK, Agarwal A, Agarwal S, *et al*: Management of dislocated intraocular implants. Ophthalmol Clini North America 314: 681-693, 2001.
2) Lim MC, Doe EA, Vroman DT, *et al*: Late Onset Lens Particle Glaucoma as a Consequence of Spontaneous Dislocation of an Intraocular Lens in Pseudoexfoliation Syndrome. Am J Ophthalmol 132: 261-263, 2001.
3) Boke WRF, Kruger HCA: Causes and management of posterior chamber lens displacement. AM Intra-Ocular Implant Soc J 11: 179-184, 1985.
4) Lewis H, Sanchez G: The Use of Perfluorocarbon Liquids in the Repositioning of Posteriorly Dislocated Intraocular Lenses. Ophthalmology 100: 1055-1059, 1993.
5) Sternberg P, Michels RG: Treatment of Dislocated Posterior Chamber Intraocular Lenses. Arch Ophthalmol 104: 1391-1393, 1986.
6) Campo RV, Chung KD, Oyakawa RT: Pars Plana Vitrectomy in the Management of Dislocated Posterior Chamber Lenses. Am J Ophthalmol 108: 529-534, 1989.
7) Maguire AM, Blumenkranz MS, Ward TG, *et al*: Scleral Loop Fixation for Posteriorly Dislocated Intraocular Lenses, Operative Technique and Long-term Results. Arch Ophthalmol 109: 1754-1758, 1991.
8) Chan CK: An Improved Technique for Management of Dislocated Posterior Chamber Implants. Ophthalmology 99: 51-57, 1992.
9) Lawrence II PC, Hubbard WA: "Lens Lasso" Repositioning of Dislocated Posterior Chamber Intraocular Lenses. RETINA 14: 47-50, 1994.
10) Oshika T: Transscleral suture fixation of a subluxated posterior chamber lens within the capsular bag. J Cataract Refract Surg 23: 1421-1424, 1997.
11) Hu BV, Shin DH, Gibbs KA, *et al*: Implantation of posterior chamber lens in the absence of capsular and zonular support. Arch Ophthalmol 106: 416-420, 1988.
12) Sarrafizadeh R, Ruby A., Hassan TS, *et al*: A Comparison of Visual Results and Complications in Eyes with Posterior Chamber Intraocular Lens Dislocation Treated with Pars Plana Vitrectomy and Lens Repositioning or Lens Exchange, Ophthalmol l108: 82-89, 2001.
13) Smiddy WE, Ibanez GV, Alfonso E, *et al*: Surgical management of dislocated intraocular lenses, J cataract Refract Surg 21: 64-69, 1995.
14) Malbran ES, Malbran EJ, Negri I, *et al*: Lens guide suture for transport and fixation in secondary IOL implantation after intracapsular extraction. Int Ophthalmol 9: 151-160, 1986.
15) Heilskov T, Joondeph BC, Olsen KR, *et al*: Late Endophthalmitis After Transscleral Fixation of a Posterior chamber Intraocular Lens. Arch Ophthalmol 107: 1427, 1989.