

**FIRST CLINICAL RESULTS OF IRIS-ROOT SUPPORTING METHOD OF POSTERIOR CHAMBER INTRAOCULAR LENS FIXATION IN APHAKIC EYES WITH ZONULAR SUPPORT LOSS**

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**ABSTRACT**

*The article presents short-term outcomes of innovative iris-fixation method of posterior chamber intraocular lens for aphakia correction in cases of capsular support loss.*

*Eyes (n=127) with different degrees of zonular support loss underwent surgery: there were 83 intracapsular cataract extractions, 29 complicated phacoemulsifications, 3 cataract extractions combined with trabeculectomy, 8 pseudophakic eyes dislocated intraocular lens repair, 4 aphakic eyes delayed intraocular lens implantations.*

*Posterior chamber intraocular lens's distal parts of haptics were positioned on the anterior surface of iris, while the proximal ones and optic remained in the posterior chamber. One suture was used for pupil reconstruction.*

*Almost all eyes had stable intraocular lens position and intraocular pressure, visual outcomes depended on coexisting eye diseases: in 5-year follow-up representative group the best corrected visual acuity was as follows: in 12% patients it was poor; in 39% it was borderline and in 49% – high. Targeted refraction changed in the range up to -1.00 dioptre.*

*The iris-root support method allows rapid completion of surgery using the same intraocular lens without enlargement of the wound; there is no need for special instruments, and accurate centration of intraocular lens is achieved.*

**Keywords:** *posterior chamber intraocular lens, iris fixation, weak zonular support, complicated cataract surgery.*

**INTRODUCTION**

The choice of intraocular lens (IOL) implantation placement site after cataract surgery complicated with zonular support dehiscence or total loss remains an actual problem for contemporary surgeons. The anterior chamber (ac) placement methods include application of special iris-claw model lenses and lenses for angle support. Both are less preferred due to increased risk of further endothelial cell loss leading to keratopathy formation [Pullen L., 2012], as well as due to aqueous flow violation leading to secondary glaucoma. Nevertheless, angle supported anterior chamber models have good and stable IOL centration.

The majority of cataract surgeons choose poste-

rior chamber (pc) placement of IOL by means of haptics fixation to sclera, as well as iris. By words of Dr. Samuel Masket: “Both iris and the scleral fixation have their respective advantages and disadvantages. Iris fixation avoids blind passage of needles through the vascularised ciliary body and obviates any need for conjunctival dissection. However, iris fixation is inappropriate in cases where trauma from surgery or other causes has destroyed iris tissue, and also in cases that have had total vitrectomies where such an approach may result in an unacceptable amount of irido-pseudophacodonesis. Scleral fixation is not dependent on adequate iris tissue, and any IOL can be fixated to the sclera. It is a very physically stable form of fixation; it is also ideal for patients that have capsule tension rings and segments. The negative is that we pass sharp needles through vascularised tissue in which the vessels are not visible...” [Masket S., 2010]. Scleral

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fixation has many variations depending on episcleral flap formation techniques [Hoffman R. et al., 2006] and IOL haptic suturing [Hayashi K. et al., 2012] or glued fixating methods [Agarwal A., 2013].

Sometimes surgeons encounter the “Sunset syndrome” postoperatively within a week, which requires a second surgery for IOL exchange [Yanoff M., Duker J., 2004] or haptic suturing to iris [Chang D., 2004]. Therefore the contemporary approach is to be sure in reliability of zonular support for leaving pc IOL unsecured; in other words, the final decision must be made in time of the first surgery concerning an IOL type and fixation method choice prior to implantation step. The findings suggest that no significant differences in outcomes exist when comparing ac IOLs to sutured pc IOLs in complicated cataract extraction with poor capsular support [Donaldson K. et al., 2005]. However, sometimes the course of surgery cannot be foreseen, even if everything is going without complication at the first stages of phacoemulsification. The aim of this study was to introduce the first clinical outcomes of the novel method of pc IOL iris fixation which was designed for a case of phacoemulsification of cataract with coexisting pseudoexfoliative syndrome complicated by sudden curling of lens capsule and zonular support loss in time of pc IOL unfolding. In that case the pc IOL was already inside of the eye and there was not any desire for wound enlargement and using another IOL: an innovative iris fixation method was performed by the first author. The procedure was named as “Iris-root support of pc IOL”; afterwards it was registered in the Armenian Intellectual Property Agency as a “Method of fixation of posterior chamber IOL” [Hovsepyan A., 2012]. It should be emphasized that pc IOLs with small overall diameter (11 mm or smaller) must not be followed by this method due to possible decentration.

#### MATERIAL AND METHODS

The study was a Mobile Eye Hospital (MEH) clinic-based case series study of 127 patients, who had preoperative or surgery-induced significant weakening of the zonular support and underwent pc IOL implantation surgery with iris-root support type fixation.

Steps of that surgery were as follows:

- the upper haptic of IOL was pulled out through the main wound and held by forceps to prevent IOL sinking;

- anterior vitrectomy was performed with simultaneous IOL bringing to ac and the miotic agent applied;
- two holes were made on preferred meridian of iris (haptic iridectomies) at the distance from visual axis of eye equal to the radius of IOL optical part;
- upper sphincterotomy was done by scissors (this step might be excluded in cases with traumatic mydriasis);
- the lower haptic was passed through lower hole from posterior chamber to anterior surface of iris root (Figure 1a);
- the upper haptic was placed on opposite sector of iris root (Figure 1b);
- the IOL optic was gently pushed to posterior chamber;
- the pupil was sutured by 10-0 prolene one knot (Figure 1c).

After mentioned interventions at the frontal view of eye with iris-root supported pc IOL haptics are placed on the anterior iris surface, while optic remains in the posterior chamber. Finally, a stable and good centered IOL position was achieved (Figure 2).

All patients were operated at the MEH in a period of 2007-2011, and the specified method of IOL fixation was applied not only to the phaco complication noted above, but also at other complicated phacoses (total 29 cases), at routine cataract surgeries (83 cases of intracapsular cataract extraction (ICCE)) for severe subluxated lenses, at

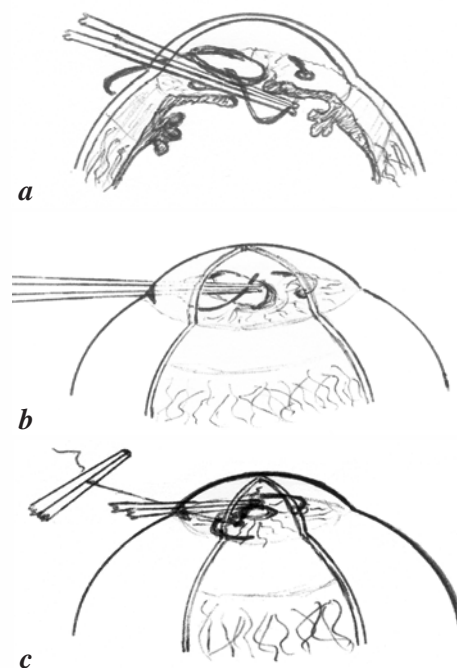


FIGURE 1. Iris-root supported pc IOL fixation stages



FIGURE 2. The view of an eye with the Iris fixation of IOL.

decentrated IOL repositioning (8 cases), at delayed IOL implantations in aphakic eyes (4 cases), as well as at cataract surgeries combined with glaucoma surgery (3 cases).

Examinations included measurement of visual acuity and intraocular pressure (IOP), funduscopy and ultrasonic B-scan, if needed.

The visual acuity in investigated patients was determined in conventional units according to H. Snellen. The IOP was measured with tonometer ("Tonopen Medtronic Solan", USA) according to Goldman and expressed as *mm Hg*.

Funduscopy was performed using the slit lamp ("Topcon SL 7-E", Japan) and ophthalmoscopes: both direct ("Welch Allyn", USA) and indirect ("Heine", Germany).

Ultrasound B-scan was done on the appropriate device ("Quantel Medical", France).

For this report the main category chosen was the Best Corrected Visual Acuity (BCVA), which was subdivided into three levels:

- blindness (BCVA <0.05 or 20/400);
- low vision (BCVA =0.05-0.33 or >20/400 and <20/60);
- high vision (BCVA >0.33 or >20/60).

## RESULTS

A total of 127 eyes were operated; as a result, 125 of them (98.4%) had stable and good centered IOL position ( $p < 0.016$ ); 2 IOLs (1.6%) had sunk: one due to posttraumatic iris tissue atrophy that caused suture dehiscence, and the second due to the improperly far lower iridectomy that caused haptic sliding and dropping. Other intra-operational complications included: one severe choroidal hemorrhage with vision loss and one partial choroidal hemorrhage, which resolved successfully, and the patient had BCVA=0.3

(20/60) in a year after surgery. Two patients with coexisting glaucoma, which was controlled by medications before surgery, underwent trabeculectomy two weeks after surgery due to decreased effectiveness of hypotensive medications. The MEH is working in regions of Armenia and covers the whole country. In about two-year period. In general, the same patient can be examined within the 1st post-surgery week and for the late post-surgery period in 2 and/or 4 years after the intervention (for 2007 patients). Moreover, the visits of those patients to MEH depended on their will; therefore, we collected data of only 45 patients' late post-surgery results. It should be emphasized that we had 3 patients, who even ignored the early post-surgery examination. We hope that the patients, who did not show up, were feeling well or at least not so bad. We consider that those patients did not present due to lack of complaints.

Table 1 presents patients' data distribution according to BCVA levels for all cases of iris-root supported pc IOL fixation.

**TABLE 1.**

Distribution of patients according to visual acuity

Visual acuity	Patients (n)		
	pre-surgery	post-surgery period	
		early	late
blindness	94	41	5
low vision	31	74	17
high vision	2	8	21

The analysis of late post-surgery examination data revealed that about 64% patients did not come to repeated inspection in the late post-surgery period. In the remaining group of patients the high vision was recorded in 21 (49%) patients, low vision – in 17 (39%) patients, while 5 (12%) patients remained blind.

All operated eyes were distributed to five groups according to surgery types and coexisting ocular diseases:

- surgery for cataract without any eye disease diagnosed preoperatively (24 eyes);
- surgery for cataract with coexisting eye disease (88 eyes);
- second intervention for IOL, including delayed IOL implantations in aphakic eyes and IOL repositioning.

sitioning surgeries of pseudophakic eyes with decentrated IOL (12 eyes);

- combined cataract-glaucoma surgery (3 eyes).

The first group represented cataract cases without any coexisting eye disease (Table 2). This group involved 24 eye surgeries, including 16 ICCE and 8 phacoemulsification interventions.

It should be mentioned that about 62% patients of the first group did not come to examination in

TABLE 2.

Distribution of patients according to visual acuity: the first group

Visual acuity	Patients (n)		
	pre-surgery	post-surgery period	
		early	late
blindness	22	12	0
low vision	2	10	2
high vision	0	1	7

the late post-surgery period. In the remaining group of 9 patients the high vision was recorded in 7 (78%) patients, low vision – in 2 (22%) patients, and there were no blind patients. Those 2 patients with low vision had optic nerve subatrophy and atrophic macular degeneration not diagnosed in pre-surgery and early post-surgery periods due to cataract and postoperative corneal edema.

The second group represented cataract cases with coexisting eye disease(s). This group embraced 88 eye surgeries: 67 ICCE and 21 phacoemulsification interventions (Table 3).

It should be noted that about 67% patients of the second group did not come to examination in the late post-surgery period. In the remaining group of 27 patients the high vision was recorded in 11 (41%)

TABLE 3.

Distribution of patients according to visual acuity: the second group

Visual acuity	Patients (n)		
	pre-surgery	post-surgery period	
		early	late
blindness	71	32	4
low vision	17	50	12
high vision	0	5	11

patients, low vision – in 12 (44%) patients, while 4 (15%) patients remained blind. The causes of blindness in these 4 patients were as follows: severe macular degeneration in 1 subject; 2 patients autocratically stopped Timolol; 1 patient had a blunt trauma in a year after surgery. It should be emphasized that among patients with high vision there were two subjects with BCVA of 1.0 (20/20). despite the coexisting pseudoexfoliative glaucoma.

In the third group of patients there were 4 aphakic eyes with delayed IOL implantation and 8 pseudophakic eyes with IOL decentration due to severe zonular dehiscence. In this group, 50% patients did not come to examination in the late post-surgery period. In the remaining group of 6 eyes high vision was recorded in 3 (50%) eyes, in 2 (33.3%) eyes low vision was registered, and 1 (16.67%) patient lost vision due to untreated central retinal vein occlusion that happened 6 months after surgery and brought to severe neovascular glaucoma.

The fourth small group involved 3 patients, who underwent combined glaucoma-cataract surgery. Only one patient of this group came to the late post-surgery examination and had low BCVA (0.2 or 20/100) and normal IOP (17 mm Hg).

## DISCUSSION

The offered method has several advantages in comparison with the existing method of iris suturing [Chang D., 2004]. One suture is needed instead of two. Among the existing technique disadvantages is the fact that IOL haptics are established blindly, and it is impossible to foresee where they will eventually get (ciliary sulcus or ciliary processes zone); this latter may lead to inadequate centration of IOL; the hanging on the small part of iris tissue causes higher amplitude of irido-pseudophakodonesis, and with years it may lead to weakening or even dislocation of IOL [Yen K. et al., 2009]. For obviousness, Figure 4 demonstrates the comparison of supporting forces at conventional (Figure 4a) and the offered methods (Figure 4b) of haptic suturing in patient's eye upergaze position (the position of maximal loading on iris tissue). Thanks to the large area of haptics support, the irido-pseudophakodonesis is less evident than in conventional method [Chang D., 2004] of iris-sutured IOL.

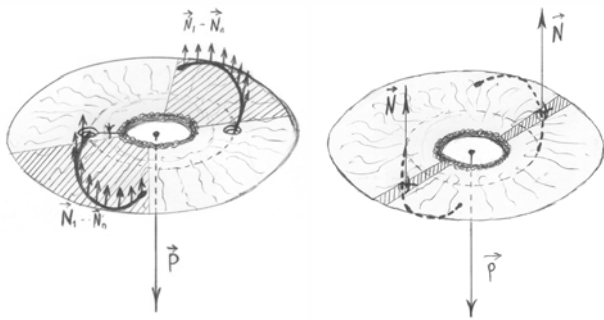


FIGURE 4. The comparison of support forces vectors for IOL weight between the conventional (a) and offered (b) methods of iris suturing in maximal upgaze position of the eye.

In this clinic-based case series study the analysis of results obtained by the authors identified that the offered method can be included in the row of known options of iris-fixation. It might be in the arsenal of surgeons as a variant of choice at decision-making for implantation of already unpacked or even half-implanted pc IOL. Moreover, if the pupil suturing is planned for mydriasis repair combined with the complicated cataract surgery, the offered method becomes an excellent choice thanks to shortening of surgical procedure time: the necessity of sphincterotomy disappears, and one suture for pupil reconstruction might simultaneously serve for haptic capturing.

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