



## Prevention of Late Dislocation of the IOL in the Lens Capsule as a Stage of Anti-Glaucoma Surgery

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### Abstract

Patients with pseudoexfoliation syndrome after cataract phacoemulsification are at risk of delayed dislocation of the IOL (Intraocular Lens) into the vitreous, which requires the development of preventive measures.

**Aim:** Development of a surgical method for the prevention of IOL dislocation in patients with decompensated open-angle glaucoma and zonular weakness, and analysis of its clinical, functional, and refractive results.

**Material and Methods:** Our prospective, uncontrolled study included 35 patients (45 eyes) with uncompensated pseudoexfoliation glaucoma, pseudophakia and zonular weakness with the possibility of the Intraocular Lens - Capsular Tensor Rings – Lens Capsule (IOL-CTR-LC) complex dislocating into the vitreous. Intraocular Pressure (IOP) higher than 28 mmHg in all patients eyes who were on maximum antihypertensive therapy were recorded, which served as the indication for urgent anti-glaucoma intervention, called sinus-trabeculectomy. During surgery, the position of the IOL was stabilized by the method we propose. The observation period ranged from 6 months to 1 year.

**Results and Discussion:** The IOL-CTR-LC complex took a stable position in the plane of the iris in all eyes. IOP was normal on the first day after surgery. All previously prescribed antihypertensive drugs were stopped for all patients. Visual functions improved, fields of vision expanded, and overall threshold sensitivity and visual acuity improved without correction in 40 eyes (88.9%).

**Conclusions:** The proposed method of stabilization of the IOL-CTR-LC complex, as a stage of anti-glaucoma surgery, was effective and safe, and can be used as a novel type of surgery for the prevention of IOL dislocation in the long term. Patients with pseudoexfoliation syndrome after cataract phacoemulsification are at risk of delayed dislocation of the IOL into the vitreous body, which requires the development of preventive measures.

The ongoing continuous development of cataract surgery is aimed at minimizing surgical trauma, optimizing materials and design of implants, reducing incision size, reducing the surgical procedure time and energy exposure to other structures of the eye, and minimizing complications during and after surgery.

Cataract surgery performed in patients with zonular weakness has a high risk of tearing off the lens capsule from the ciliary body, dislocation of the lens fragments into the vitreous cavity, as well as the risk of dislocation of the IOL at the time of implantation and in the late postoperative period.

According to various authors, the recorded number of late dislocations of posterior chamber IOLs with intracapsular fixation were between 0.05% to 3.0% of patients [1-5].

To stabilize the capsular bag during cataract phacoemulsification, various fixation devices and methods are used: Intracapsular rings with fixation in the ciliary sulcus, or with fixation with sutures to the sclera [3,5-7]. Despite this, zonular fibers continue to be destroyed and even a small injury can lead to the complete dislocation of the IOL complex into the vitreous cavity, which requires emergency subtotal vitrectomy with reposition of the IOL or removal of the IOL.

Intraocular pressure rises and secondary glaucoma appears even before the dislocation of the IOL complex from the lens capsule. In this situation, medications are not effective and surgical treatment

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is required.

**Keywords:** Pseudophakia; Intraocular lens dislocation; Secondary glaucoma; Intraocular lens fixation; Cataract; Complications; Pseudoexfoliation syndrome; Sinus trabeculectomy

## Material and Methods

The study included 35 patients (45 eyes) with uncompensated pseudoexfoliation glaucoma, pseudophakia and zonular weakness.

The age of patients ranged from 60 years to 82 years (average - 76.6 years  $\pm$  3.5 years). The number of female patients was 23 people (29 eyes - 64.4%); the number of male patients was 12 people (16 eyes - 36.6%).

Of these patients, four had one of their eyes previously removed due to failed surgery. In most patients the surgery was performed on one eye apart from 5 patients in whom we operated on both eyes.

In all cases, IOP was higher than 28 mmHg during maximum antihypertensive therapy, which served as an indication for emergency anti-glaucoma surgery - Sinus-Trabeculectomy (STE).

All patients had pseudoexfoliation syndrome and zonular weakness therefore, during phacoemulsification; Capsular Tensor Rings (CTR) were implanted into the Lens Capsule (LC) to fix it to the ciliary sulcus.

Primary surgery was performed in patients between 3 years to 7 years ago and at the time of examination some patients were at risk of a complete dislocation of the IOL-CTR-LC complex into the vitreous body. We then stabilized the position of the IOL-CTR-LC complex with the additional step that we proposed during the prospective filtering surgery in order to prevent the complete dislocation of the complex into the vitreous body [2].

All patients underwent a standard ophthalmological examination on the day of surgery, 1 day post-op, 1 week post-op, 3 months post-op and 6 months post-op. Examinations included the following: Perimetry, autorefractometry, tonography, pneumotometry, computer static perimetry, biomicroscopy, ophthalmoscopy, gonioscopy, laser biometry, optical coherence tomography of the anterior eye segment and keratotopography. The observation period ranged from 6 months to 1 year.

### Surgical process

After retrobulbar anesthesia, the surgical site was sterilized with 10% Betadine solution. A puncture was made at 2 o'clock 2 mm from the limbus using a needle with a prolene filament 9:0, and a second puncture was made using a guide needle at 7 o'clock 2 mm from the limbus in the same way. The needle was then inserted in the episclera at 5 o'clock and again a puncture was made in the eye membranes within 2 mm from the limbus and taken out at 10 o'clock using a needle guide. The conjunctiva was then separated from the limbus from 11 o'clock to 13 o'clock resulting in episcleritis and hemostasis. A square-shaped flap, 3 mm  $\times$  3 mm, reaching the scleral spur was formed. A tissue strip 1 mm  $\times$  3 mm was excised in the area of trabeculae and venous sinus which formed the basal coloboma. The volume of the anterior chamber was filled with sterile air through paracentesis formed previously at 9 o'clock. The anterior chamber of the eye was sealed using dosed tension prolene filament 10:0 at the corners of the episcleral flap. The associated free edges of the prolene filament 9:0 which were under the IOL-CTR-LC complex in ciliary furrow in the iris plane were positioned under the episclera

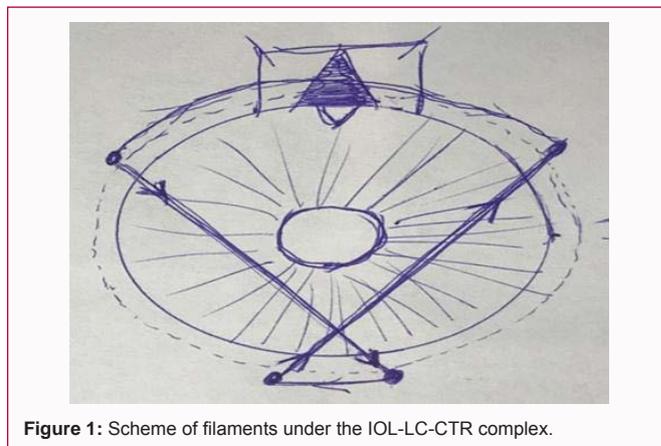


Figure 1: Scheme of filaments under the IOL-LC-CTR complex.

flap (Figure 1).

Once the surgery had been completed, gentamicin and dexamethasone solution were administered subconjunctivally. Hermetic seal of the conjunctival incision and filtration of chamber moisture was tested by the administration of normal saline through paracentesis during hydro-adaptation.

Postoperative patients received eye drops of moxifloxacin 1 drop 4 times a day, 1 drop of nepafenac 3 times a day and dexamethasone 1 drop 4 times a day. They were also prescribed amoxiclav 500 mg 1 tablet 2 times a day for 5 days and nimesulide powder 2 times a day.

## Results and Discussion

All surgeries were performed without the development of infections and severe complications. In 3 eyes (6.7%), a small hyphema up to 1 mmHg was observed, which resolved without treatment within 3 days to 4 days after surgery.

During the early post-operative period and after the STE, there was a mild inflammatory response from the conjunctiva in addition to subconjunctival hemorrhages. IOP returned to normal after the first day post-surgery and all previously prescribed antihypertensive drugs were stopped for all patients.

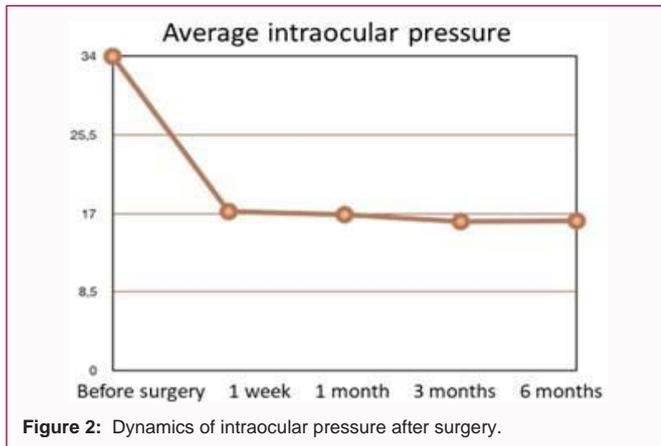
In all patients, IOP did not exceed 20 mmHg during the follow-up periods. The dynamics of the average IOP (P0, mmHg) before surgery, 1 week, 1, 3 and 6 months after surgery are shown in Figure 2.

The IOL-CTR-LC complex took a stable position in the plane of the iris in all eyes. The formed filtration zone was not obstructed, and outflow of aqueous humor occurred in the subconjunctival space.

In 2 patients (2 eyes - 4.4%), 1 month after the operation, the formation of cystic filtration cavities was noted, which required an additional surgical procedure, which had no adverse effects on the quality of vision and eye pressure.

The quality of vision had a positive trend in the form of an expansion of the fields of vision, an improvement in the overall threshold sensitivity and visual acuity without correction in 40 eyes (88.9%).

In the remaining 5 patients (5 eyes - 12.1%), no improvement



**Figure 2:** Dynamics of intraocular pressure after surgery.

in vision was observed due to the initial damage to the optic nerve, despite the success of the operation without the use of antihypertensive drugs.

## Conclusions

1. The proposed method for stabilizing the IOL-CTR-LC complex as a stage of anti-glaucoma surgery was effective and safe.
2. Further monitoring of patients is needed to evaluate effectiveness in the future.
3. In order to prevent the dislocation of the IOL-CTR-LC complex, this method can be recommended to patients with zonular weakness as a novel surgical development, preventing delayed complications from occurring.

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