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Original Article

The Clinical and Refractive Outcomes of Internal Fixation Method in Intraocular Lens Dislocation

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Abstract

Objectives: To reveal the clinical and refractive results of internal fixation surgery in patients who underwent intraocular lens (IOL) fixation.

Methods: This retrospective study included 40 eyes of 40 patients (FM/M:20/20) who have been operated for dislocated IOL in Balıkesir University, Faculty of Medicine. The demographic and clinical data were obtained from the files. The demographic data (age, sex, comorbidities, systemic treatment), the cause of IOL dislocation, primary surgery-dislocation duration, best-corrected visual acuity (BCVA) (decimals), objective refraction, spherical equivalent (SE), intraocular pressure (IOP), the status of centration, endothelial cell density (ECD), and complications were recorded. Pre-operative parameters compared with the final visit parameters as post-operative results.

Results: The cause of dislocation was spontaneous in 80% of the patients, and trauma in 20%. The mean duration between cataract surgery and IOL dislocation was 33.2±39.6 months. The mean follow-up time was 19.8±8.3 months. The BCVA was improved from 0.12±0.21 to 0.73±0.33 (p=0.001), and IOP was changed from 17.6±3.2 to 17.9±2.9 mmHg (p=0.672) after surgery. The SE was decreased from 5.52±2.95 to −0.73±1.32 D (p=0.023), and the total astigmatism was decreased from 2.74±2.63 to 1.38±0.75 D (p=0.014) after surgery. ECD was increased from 1740.6±219.8 cell/mm^2 to 1724.5±243.0 cell/mm^2 (p=0.219). In the final visit, IOL was found centralized in 90% of patients through both miotic and mydriatic pupils. The post-operative complications were intravitreal hemorrhage in 2.5%, corneal edema in 7.5%, and ocular hypertension in 2.5%.

Conclusion: Internal IOL fixation is a safe and reliable method in patients with dislocated IOLs, and it can be applied by fixating the dislocated IOL regardless of the haptic type. Post-operative results are acceptable.

Keywords: Cataract surgery complications, dislocated intraocular lens, internal fixation, intraocular lens reposition

Introduction

The implantation of an intraocular lens (IOL) is the routine step of cataract surgery. Even the implantation of IOL was completed at the time of the surgery, it may dislocate during the follow-up period due to various causes, such as pseudoexfoliation, eye rubbing, trauma, the history of vitreoretinal surgery, and zonular deficiency (1). The prevalence of IOL dislocation increases with age, and ophthalmologists will encounter it more frequently with the increasing number of cataract surgeries.

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The subluxation and dislocation of IOL is a significant complication and its management could be challenging. In the dislocated IOLs, the IOL can be refixed in the ciliary sulcus if adequate capsular support exists. If there is not enough capsular support, IOL is extracted, and the eye can be rehabilitated either with retropupillary iris fixation of IOL or scleral-fixated IOL at the time of surgery or later (2-4). The conventional methods have the risk of globe collapse, the decentration or tilt of the IOL, and suture-related complications (5,6). According to the novel techniques, the dislocated IOL itself can be refixed to the sclera with the internal fixation method (1). Both the lower rate of complications and the cost-effective results of internal fixation, can be preferred in most of the dislocated IOL cases.

In this study, we evaluated the clinical and refractive results of the internal fixation technique which requires minimal intraocular manipulation, and no need for sophisticated surgical instruments to stabilize the IOL.

Methods

The study was followed the tenets of the Declaration of Helsinki, and it was approved by the local ethical committee. Informed consent was obtained from all participants. 64 patients who have IOL dislocation and managed through internal fixation technique in Balıkesir University, Faculty of Medicine between May 2019 and May 2022 were evaluated. All patients underwent intraocular surgery with repositioning using a scleral fixation technique due to the subluxated IOL. Patients with inadequate medical records, pediatric age group (under 18 years old), accompanying ocular trauma, such as retinal detachment, corneal perforation, and scleral perforation, in traumatic decentered IOLs were excluded. After exclusion, 40 eyes of 40 patients were scanned retrospectively.

The demographic data (age, sex, comorbidities, systemic treatment), the cause of IOL dislocation, primary surgery-dislocation duration, pre- and post-operative best-corrected visual acuity (BCVA) (decimals), objective refraction, spherical equivalent (SE), intraocular pressure (IOP) through Goldmann applanation tonometer, the status of centration, endothelial cell density (ECD) through specular microscope (Nidek CEM-530, Japan), pre- and post-operative complications were recorded from the files of patients. The pre-operative measurements were recorded from the immediate pre-operative period, and the post-operative measurements were taken from the final visit.

Surgical Procedure

All included patients underwent internal IOL fixation surgery under regional anesthesia (subtenon anesthesia: lidocaine 2% and bupivacaine 0.5%, 2.5–3 mL; retrobulbar anesthesia: lidocaine 2% and bupivacaine 0.5%, 3–4 mL). The conjunctival peritomy from two diagonally opposite sides was performed, and the points that were 2 mm far from the limbus were marked with a sterile marker pen. The two opposite-side corneal ports were placed on the same location of the peritomy area. The intracameral triamcinolone acetonide (Kenacort-A®; Bristol-Myers Squibb) 2 mg/0.05 mL was injected into the anterior chamber through the paracentesis using a 27-gauge cannula to visualize the vitreous in the anterior chamber. The anterior vitrectomy was performed if needed. The IOL was freed by trimming the adherent vitreous around the IOL.

The loop of 10.0 polypropylene sutures (20 cm length, FSSI, Germany) was released by cutting at the one edge of the junction of the loop and needle. After that, the sutures with straight needles were passed through the marked point by passing from the back of the haptic and externalized from the opposite side port with the guidance of a 26 G injector, the same suture was passed from the same side port by passing from the anterior haptic of IOL, and externalized from the initial scleral point with the guidance of 26 G injector. The same application was performed for the other haptic, and the IOL was centralized by balanced pulling the sutures from the sclera. The polypropylene sutures were tied with multiple throws, and the knots were buried by turning into the sclera to prevent exposure (Fig. 1). The conjunctiva was closed with 8.0 vicryl sutures. Patients were followed up for a minimum of 6 months.

Statistical Analysis

Statistical analysis was performed using Statistical Packages for the Social Sciences 23.0 software. The frequency analysis was held for sex and cause of dislocation. The mean of the age, BCVA, IOP, SE, and total astigmatism were calculated and were shown with ± standard deviation. The paired t-test was used to compare pre- and post-operative BCVA, IOP, SE, total astigmatism, and ECD. $P<0.05$ was considered significant.

Results

The study included 40 eyes of 40 patients (20 female, 20 male). The mean age of the patients was 73.0±7.6 years. The cause of dislocation was spontaneous in 80% of the patients, and trauma in 20% of the patients. All of the cases had a subluxated IOL: 34 were a monoblock subluxated IOL, and 6 were a 3-piece IOL. The mean duration between cataract surgery and IOL dislocation was 33.2±39.6 months. The mean follow-up time was 19.8±8.3 months. The intracameral triamcinolone acetonide was performed to visualize the vitreous in the anterior chamber in all cases, and the anterior vitrectomy was applied if needed. The BCVA was improved from 0.12±0.21 to 0.73±0.33 ($p=0.001$), and IOP was changed from 17.6±3.2 to 17.9±2.9 mmHg ($p=0.672$) after surgery. The SE was decreased from 5.52±2.95 to

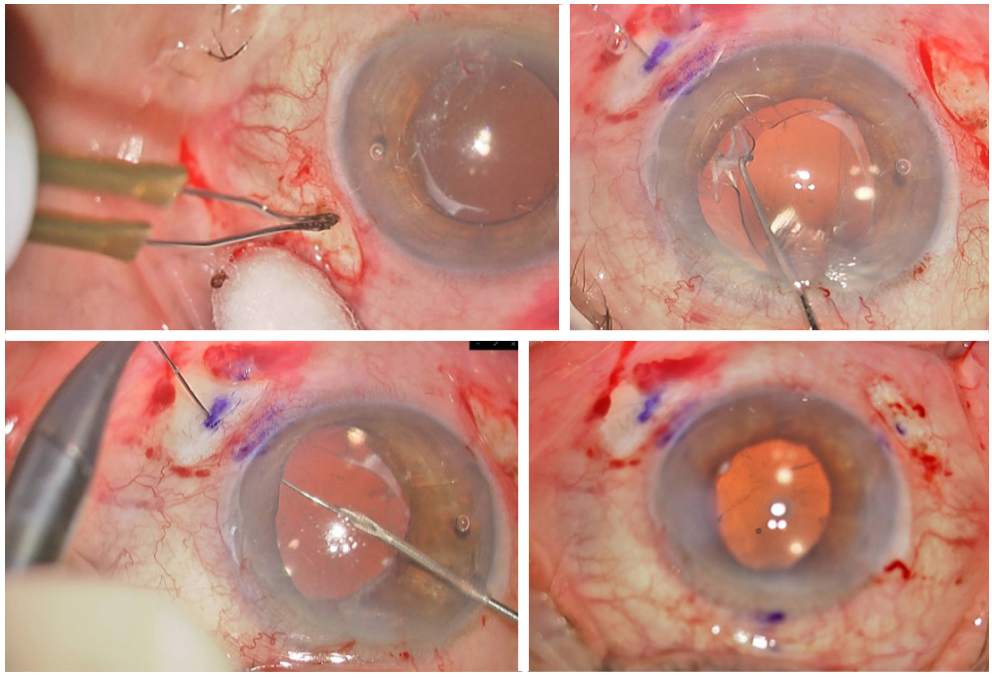

Figure 1. The surgical procedure of internal fixation technique. Upper left: The preparation of scleral entries by conjunctival cutting and cautering episcleral vessels. Upper right: The fixation of the dislocated intraocular lens with a Sinsky hook. Bottom left: The suturation of the dislocated haptic with the guidance of the injector. Bottom right: The final status of the dislocated intraocular lens.

−0.73±1.32 D (p=0.023), and the total astigmatism was decreased from 2.74±2.63 to 1.38±0.75 D (p=0.014) after surgery. ECD was increased from 1740.6±219.8 cell/mm^2 to 1724.5±243.0 cell/mm^2 (p=0.219).

In the final visit, IOL was found centralized in 90% of patients through both miotic and mydriatic pupils. The post-operative complication was detected as intravitreal hemorrhage in 2.5%, corneal edema in 7.5%, and ocular hypertension in 2.5%. During the follow-up period, one of the patients underwent keratoplasty for permanent corneal edema, and one of the patients underwent pars plana vitrectomy for persistent intravitreal hemorrhage at the 1st-month visit, one patient underwent dislocated IOL extraction and sutured scleral IOL fixation at 3rd-month.

Discussion

The dislocation of IOL is one of the most challenging complications of cataract surgery in the post-operative period. Various factors may cause IOL dislocation, such as pseudoexfoliation, trauma, and zonular deficiency. In literature, several methods have been described to provide IOL fixation (7-10). For example, the "laso technique" that was described by Lawrence and Hubbard is performed by anchoring the IOL haptic to the scleral sulcus by means of 9–0 polypropylene sutures (7). The haptics of IOL can be tied with cow-hitch sutures (8), or they can be externalized through the clear corneal incision (9) and can be sutured to the sclera or fixed by flanging the haptics (4). This study represents reliable and applicable surgical results for dislocated IOLs. The post-operative position of IOL is centered in most of the cases with low complication results. With conventional methods, the dislocated IOL is explanted through a reopened incision with/without vitreoretinal interventions, but the rate of the complications is quite frequent, such as high IOP, post-operative astigmatism, and corneal trauma (11). In addition to possible risks, a new IOL should be used for aphakia correction. As mentioned in this paper, the dislocated IOL itself may be fixed sclerally. The several approaches for internal fixation of IOL were described in the absence of capsular support. Kumar et al. (12) described a balanced two-string technique which is performed by entering from a pars plana incision and fixating the IOL, but they performed this technique only in the rigid IOLs with dialing holes. Kumar et al. performed combined vitrectomy and refixation of the IOL through vitrectomy ports in posterior dislocated IOLs while Ibrahim et al. (13) also described this surgical method for foldable IOLs. The authors declared that the pars plana approach is a safe and effective technique of IOL fixation with less post-operative astigmatism due to avoiding cornea-scleral incision. In this study, all eyes had improvement in the BCVA in the post-operative period. In addition to several internal fixation techniques, the novel techniques in aphakic or dislocated IOL patients such as sutureless flanged haptic fixation have been popular, because this method is fast and reliable, but it

can be performed only in three-piece polymethyl methacrylate (PMMA) haptics IOLs. Furthermore, once the haptics are fixated, lens adjustment may be challenging.

The internal fixation has another advantage related to scleral sites due to the both scleral entry and exit can be adjusted because the direction of scleral movement is always from the outside to the inside through a guide-injector. Another advantage of internal fixation is no need for lens replacement. Both the possible calculation mistakes in IOL formulas in dislocated IOL patients and not available in stock immediately at the time of surgery are disadvantages of IOL exchange methods. In this method, any kind of IOL (monoblock or 3-piece IOLs) can be fixed to the physiological position behind the iris, away from the trabecular elements and corneal endothelium. Furthermore, the IOP was controlled in both pre- and post-operative periods and showed no change after surgery due to closed-eye surgery, and minimal manipulations. A significant astigmatic change was not expected, because a large corneal incision was not performed.

The suture breakage complication was not encountered in this study. In studies with long-term follow-up, the rate of suture breakage is higher. The mean follow-up duration was 19.8 months in this study. The rate of suture breakage can be detected if a longer follow-up is held. Not to encounter suture breakage, some authors recommend the use of a more durable suture material, such as polytetrafluroethylen (Gore-Tex) or a thicker (9–0 instead of 10–0) polypropylene suture material (14,15).

This technique requires two side-port incisions, so if the lens is centralized, additional astigmatism has not been induced. As a result, the mean of total astigmatism was significantly decreased post-operatively ($p=0.014$).

Besides the advantages, the internal fixation methods require attentive surgical skills. The proper and certain opposite scleral sites should be maintained to require centration, and if the loop is too tight, it may lead to cheese wiring, or if it is too lax, the lens would sag. And also, the IOL should be supported with a guide injector to prevent IOL drop. At the beginning of the surgery, the IOL should be freed by trimming the adherent vitreous. The excessive vitrectomy may cause hypotony, and disrupt the form of the globe.

In our longest follow-up, the rate of sight-threatening complications was acceptable. The IOL decentration was only detected in one patient (2.5%). The rate of IOL dislocation after internal fixation in the published literature varied between 0.21 and 0.90 mm (13). This technique does not require the removal of IOL or lens rotation and needs only one or two sclerotomy sites. This decreases the risk for sclerotomy-related complications such as choroidal or retinal detachment, and ciliary body injury.

The loss of ECD loss is expected after Scleral fixation of IOL (SFIOL), which ranges from 5% to 20% (16,17). There are rare studies that reported stable ECD using either intrascleral pocket or flap techniques (18). Jo et al.(19) proposed that ECD loss in SFIOL surgery was related to IOL removal or phacoemulsification rather than the surgery itself, with ECD loss of 1.5% in patients with refixating the existing IOL or fixating a new IOL in the aphakic eye, compared with a loss of 14.3% ($p<0.01$) in patients who required a simultaneous IOL explant. If we compare these studies with our results, internal fixation methods seem to be more reliable on ECD. Only two patients have corneal decompansation during follow-ups, but the pre-operative ECD was already under 1000 cell/mm^2, and only one patient required keratoplasty.

In the present study, the criteria for centration were subjective. The evaluation of decentration was made through biomicroscopic examination. This was one of the limitations of our study. The objective evaluation can be performed through anterior segment optical coherence tomography (OCT). Unfortunately, we could not reach data about IOL centration through OCT due to the retrospective design of the study.

Conclusion

The IOL fixation with the internal approach offers several advantages. First, the corneal incisions are smaller than the incisions that require the IOL extraction, so the post-operative corneal astigmatism is acceptable. Related to the small corneal incision, the control of IOP is excellent. The IOL centration is good, and reliable with a low rate of complications. Furthermore, this technique can be used for all kinds of IOLs, such as one-piece monoblock IOLs, IOLs with PMMA haptics, one-piece PMMA lenses, and the IOLs without dialing holes.

Disclosures

Ethics Committee Approval: The study was followed the tenets of the Declaration of Helsinki, and it was approved by the Balıkesir University ethical committee. Informed consent was obtained from all participants.

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