Refractive Lens Exchange after Implanted Collamer Lens: A Case Report

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ABSTRACT

Introduction: Myopia stands as a prevalent ametropic condition. Posing ongoing challenges for ophthalmologists. Surgery to correct refractive errors is a primary intervention for severe myopia, encompassing procedures like the removal of the crystalline lens coupled with the placement of an intraocular lens (IOL), and the insertion of phakic IOL. The Implantable Collamer Lens (ICL) is commonly utilized in the posterior chamber but carries potential risks including the disruption of the eye’s normal function, potentially leading to conditions like cataracts and glaucoma.

Methods and Purpose: This case report explains a single case patient with ICL that includes previous clinical condition, current condition, steps of surgical procedure, and follow-up after procedure.

Case Illustration: We present the case of a 66-year-old male patient who came to the hospital for refractive surgery due to a cataract with a history of implantable collamer lens (ICL) for high myopia. Cataract surgery was performed after an explanation of the ICL followed by an implanted capsular tension ring (CTR) and IOL.

Discussion: Several cases of patients using ICL will have complications such as glaucoma and cataracts. Determining ICL design will influence the progression of these complications. An explanation procedure by tuck and pull method is needed for age-related cataract patients.

Conclusion: ICL is a safe procedure for high myopia patients. Explanation of ICL can be performed by several medical conditions.

Keywords: Cataract, Implanted Collamer Lens, Posterior Chamber Phakic Intraocular Lens, Refractive Lens Exchange.

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1. INTRODUCTION

Refractive surgery aims to reduce dependence on using contact lenses or glasses in daily activities. There are various types of refractive surgery to achieve optimal vision, namely based on the anatomical position of the cornea, sclera, and intraocular. Refractive surgery for cornea such as Femtosecond Lenticule Extraction (FLEX), ReLEx/Small Incision Lenticule Extraction (SMILE). Intraocular procedure includes a phakic intraocular lens (PIOL) at the anterior or posterior chamber, cataract surgery, and Refractive Lens Exchange (RLE) that consists of monofocal, toric, or multifocal lens implantation. Phakic Intraocular Lenses (PIOL) have been known since the 1950s in Europe as a treatment for patients with refractive errors including myopia. Posterior Chamber PIOL (PCPIOL) was made of flexible collamer material which is implanted through a small corneal incision. The Visian Implantable Collamer Lens (ICL, STAAR, Surgical Co, Monrovia, CA) since 2005 is the only one approved by the FDA for implantable lenses in the posterior chamber. It is demonstrated by the effectiveness, safety, and reversibility of refractive surgery procedures. The risk of vision loss due to color contrast sensitivity is almost nonexistent with ICL compared with laser therapy in high myopia [1]. Meanwhile, the incidence of ICL explantation is less than 4% due to inappropriate size and poor anterior chamber curvature [2]. Patients with ICL implantation still have a risk for cataracts due to crystalline lens opacities that require a lens extraction followed by implanted IOL in the posterior chamber.
2. Method and Purpose of the Study

Data in this case report was taken through anamnesis and medical records regarding preoperative status, intraoperative technique, and clinical follow-up. The preoperative examination included visual acuity, non-contact tonometry, keratometry, biometry, and specular microscopy. Slit lamp microscopy and dilated fundoscopy were also performed. This case report will explain the stages and outcomes of replacing implanted lenses with IOL for cataract patients.

3. Case Illustration

A 66-year-old male patient came with complaints of blurriness in both eyes for approximately 15 years and his vision decreased slowly. Previously he had used glasses since childhood due to high myopia and astigmatism without knowing the lens size. The patient underwent ICL surgery in Mexico for both eyes about twenty years ago and after the surgical procedure, he usually used medication for lowering intraocular pressure (dorzolamide and timolol) which has been used for twenty years. His vision was clear after the implantation collamer lens, but five years after surgery, his vision became blurry and need glasses to look closely. Lately, he felt his vision still blurry with glasses and uncomfortable. The patient decided to seek treatment at Bali Mandara Eye Hospital.

Evaluation of visual acuity from Snellen chart as right eye (RE) 6/21 and left eye (LE) 6/15. Intraocular pressure: RE 12.8 mmHg, LE 17.7 mmHg. Slit lamp examination found the ICL in posterior chamber RE and LE with opacities of both crystalline lenses as illustrated in Fig. 1. Specular biomicroscope examination found cell density (CD) RE 1806, LE 2500, central corneal thickness (CCT) RE 580, LE 478. IOL Master examination found axial length (AL) RE 28.84 mm, LE 29.69 mm, anterior chamber depth (ACD) RE 3.78 mm, LE 3.24 mm as shown in Fig. 2.

We performed the first surgery on the right eye by giving mydriatic eye drops when the patient was prepared in the operating room. The first step is a corneal incision less than 3 mm as a main port for ICL explanation, the next step is an injection of viscoelastic to the anterior chamber, and then a small incision of the cornea as a side port. The viscoelastic injection was given to the anterior and posterior chambers to make ICL haptic rise. Hooked it to the blunt tip then ICL removed by the main port using forceps as illustrated in Fig. 3.

He underwent refractive lens exchange followed by phacoemulsification. A capsular tension ring (CTR) was implanted before IOL. We implanted multifocal IOL +4.50 D for the right eye and +3.00 D for the left eye. After the surgery, the visual acuity of the patient is getting better. Clinical follow-up after surgery of visual acuity RE 6/12, IOP (intraocular pressure) 12.8 mmHg, anterior segment RE within normal limits. Visual acuity LE 6/7.5, IOP 16 mmHg, LE anterior segment examination using slit lamp showed Descemet folds and edema of the cornea as shown in Fig. 4. The patient was treated with ciprofloxacin and prednisolone eye drops six times daily, and sodium chloride eye drops two times daily.

4. Discussion

Myopia ranks as a highly prevalent ametropic condition, posing significant challenges to ophthalmologists. A study from China in 2015 reported that myopia affected 22.9% of adults and between 70%–80% of adolescents. More recent research indicates that myopia impacts up to 90% of adolescents and young adults globally. Surgical correction particularly refractive surgery is a prevalent approach for managing severe myopia. This includes procedures such as the removal of the crystalline lens followed by the implantation of an intraocular lens (IOL), and the insertion of a phakic IOL. Based on the IOL’s position in the eye, the implantation can be categorized into either anterior or posterior chamber procedures. The implantable collamer lens, a type of posterior chamber IOL, is the most commonly utilized for this purpose and stands as the sole approved IOL for correcting substantial myopia in the phakic posterior chamber [3]. This scenario outlines the situation of a patient who received bilateral ICL implantation and subsequently experienced elevated intraocular pressure (IOP) in both eyes along with an immature senile cataract. In a prior investigation conducted by Sanders and Vuckich concerning the occurrence of lens opacities and clinically significant cataracts associated with ICL models, they observed a higher prevalence of lens opacities and cataract incidence in patients with the V3 model compared to those with the V4 model. This disparity was attributed to a larger percentage of eyes exhibiting inadequate vaulting in the V3 group [4]. In another study by Kamiya et al., the incidence of cataracts was 13.88%, which has been significantly linked to the use of V3 model ICL [3].
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Fig. 3. ICL Explantation Technique: (a) Viscoelastic to the anterior chamber, (b) moving ICL haptic to the anterior chamber using Shinskey, (c) viscoelastic injection to the posterior chamber and removed by forceps.

Fig. 4. Follow-up after surgery. Right eye: (a) Presence of IOL, an anterior segment within normal limit, (b) There is one corneal suture at 9 o’clock, left eye: (c) Descemet folds of corneal, (d) Central corneal edema.

stable IOP indicates that the central hole in ICL V4c could help maintain the IOP without peripheral iridotomy, which further certified the safety of ICL V4c implantation [6].

Implantable collamer lens (ICL) is a method of implanting a lens in the posterior chamber which is placed in the space between the iris and the natural crystalline lens. Globally more than two million ICLs have been implanted and their use has been clinically tested for more than twenty years. The ICL EVO design with a central hole around 0.36 mm in the optical part of the lens made this design provides aqueous humor circulation which reduces the risk of glaucoma due to pupillary block. The difference between the ICL and RLE procedure is the absence of natural lens excision. In several study reviews with 1,906 eyes followed up for 12.5 months for effectiveness and 4,196 eyes followed up for 14 months for safeness, ICL EVO showed effective and safe for refractive problems treatment. There is no risk of flattening the cornea when using ICL and prevents spherical aberration that causes difficulty in driving at night [7].

Refractive Lens Exchange (RLE) is a procedure to remove a crystalline lens followed by implantation intraocular lens (IOL) with the main aim of correcting refractive errors such as myopia, hyperopia, and astigmatism. Patients with presbyopia necessarily to have preoperative discussions about implanted multifocal lenses that reduce the risk of needing glasses after a surgical procedure [1]. The patient in this case has been educated about using multifocal lenses to minimize the risk of using glasses to look closely.

Complications from ICL placement can occur intraoperatively and post-operatively. According study by Hao Zhang et al., intraoperative complications can occur in the form of astigmatism, acute posterior vitreous detachment, iris and ciliary cyst, and endophthalmitis. Post-operative complications such as night vision syndrome, ICL shift, reduced corneal endothelial cells, high intraocular pressure, cataracts, and macular edema [8]. Incidence replacement of ICL due to complications was very low between 1%–3%. 2 This case showed post-operative complications about high IOP tolerated well by the patient without complaint about a persistent headache or any sign of angle closure glaucoma. However, the patient still needs routine intraocular lowering agent eyedrop for IOP control. In a retrospective study conducted by Rehakova et al., subjective refraction, IOL, and endothelial cell density (ECD) were observed in 63 eyes of patients who had ICL implants for 2 years. The results showed some improvement in subjective refraction, an ECD decrease of about 13%, 5% over 2 years, and an
IOP range before and after a follow-up of approximately 15 mmHg. This study found post-operative complications were increased IOP, IOL decentration with subcapsular opacity, and pigment dispersion without an increase in IOP [9]. A systematic review of Kamiya et al. about eight-year outcomes of implantation of posterior chamber phakic intraocular lenses with a central port for moderate to high ametropia, cataract complications were lower in ICL holes compared to non-hole ICL. While various factors including patient age, preoperative refractive error, type of ICL, surgeon expertise, examiner proficiency, and duration of follow-up may influence surgical outcomes, the incidence of cataract development has notably reduced with advancements in technology, potentially attributable to enhancements in the circulation of aqueous humor to the anterior surface of the crystalline lens [5].

The tuck-and-pull technique with full mydriasis pre- or intraoperatively was used for IOL explantation from the posterior chamber. It needs one side port for IOL explantation, but if this procedure is followed by cataract surgery, two side ports are needed. The Purpose of injecting a viscoelastic substance into the posterior chamber behind the PCPIOL is to create space between the PCPIOL and the crystalline lens, thereby safeguarding the lens during subsequent procedures. Additionally, viscoelastic is also injected into the anterior chamber to protect the corneal endothelium. A primary corneal incision measuring 2.8 mm is deemed adequate for PCPIOL removal. Additional viscoelastic is injected underneath the PCPIOL to lift its haptic. The critical steps involve tucking and pulling the PCPIOL haptic through the main incision. This is achieved by hooking and tucking the haptic using a chopper with an elongated, blunted tip, then pulling it through the main incision and holding it out. The haptic held through the main incision by the copper is grasped by a suture forceps in one hand and then successively extracted by two suture forceps in both hands, employing a hand-to-hand maneuver while maintaining parallel alignment with the incision plane [10]. All the steps of explantation PCPIOL procedures were carried out according to the theory in this case. We continued the next procedures with phacoemulsification and IOL implantation for both eyes.

The combination of multifocal and monofocal IOL was implanted for this case with several considerations based on previous studies. The drawbacks associated with the use of bilateral multifocal lenses when implanted include a decrease in contrast sensitivity, as well as experiencing halos and glare. However, a study conducted by Vitus et al. revealed that individuals who underwent unilateral implantation of multifocal lenses did not encounter issues with neuroadaptation. Moreover, they demonstrated a significantly higher level of independence from glasses, excellent reading ability, no adverse effects on distance vision, and were not affected by optical side effects like halos and glare [11]. Cionni et al. discovered that implanting multifocal IOLs unilaterally resulted in patients achieving a notable degree of freedom from spectacles, along with maintaining good visual acuity without any detrimental effects on contrast sensitivity. They suggested that multifocal IOL implantation could serve as a favorable alternative for numerous patients dealing with monocular cataracts [12]. Kim et al. and Iida et al. observed that patients who had previously received a monofocal IOL implant in one eye and later underwent implantation of a diffractive multifocal IOL in the other eye showed promising outcomes in addressing the loss of accommodation post-cataract surgery. Less than 10% of patients reported discomfort with halo or glare during postoperative period. The use of multifocal IOLs could thus serve as a viable strategy for enhancing both distance and near vision in individuals who have previously undergone cataract surgery with monofocal IOL [13], [14].

5. Conclusion

ICL is a safe procedure for high myopia patients. Explantation of ICL can be performed by several medical conditions such as cataracts or progressively decrease of visual acuity. Giving information to the patient before ICL implantation about ICL will be removed one day and replaced with a new lens is important. Implantation IOL using a combination of monofocal and multifocal provides good visual acuity.

6. Patient Consent

Consent to publish the case report was obtained. This report does not contain any personal information that could lead to the identification of the patient.

Conflict of Interest

Author declares that they do not have any conflict of interest.

References


