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Case Report and Review of the Literature

Femtosecond Laser Assisted Cataract Surgery in a Patient with Anterior Chamber Phakic IOL *in situ*

Hassan Hashemi, Rama Pourmatin and Soheila Asgari*

Noor Ophthalmology Research Center, Noor Eye Hospital, Tehran, Iran

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ABSTRACT

Introduction: Conventional phacoemulsification and intraocular lens (IOL) implantation for patients who already have a phakic IOL (PIOL) *in situ* can present challenges in IOL power calculation and the surgical procedure. Here we report a case of phacoemulsification with IOL implantation without removing the anterior toric PIOL.

Patient and Clinical Findings: This 45-year-old male was referred to our clinic with mature cataract in the right eye, and a history of multiple corneal surgical procedures including radial keratotomy, LASIK, corneal cross-linking, and Artiflex toric PIOL implantation. Uncorrected (UDVA) and corrected (CDVA) distance visual acuity were 20/2000.

Diagnosis, Intervention, and Outcomes: Since CDVA was 20/25 after toric PIOL implantation and prior to the development of cataract, and the cornea was compromised, the toric PIOL was not removed. Using femtosecond laser assisted cataract surgery (FLACS) through the toric PIOL, capsulotomy and lens fragmentation were completed without modifying the device setting, and an IOL was inserted in the bag. At one year after surgery, right eye UDVA, CDVA, and refraction were 20/32, 20/25, and +1.25/-1.00*120°.

Conclusion: In this case, FLACS was a successful technique for preserving the toric PIOL, and results were stable during the one year of postoperative follow up.

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Introduction

Phakic intraocular lens (PIOL) implantation is a treatment option for the correction of myopia and myopic astigmatism [1]. One of the reported complications of this procedure is cataract formation, which may require surgery [2]. Routine phacoemulsification cataract surgery can be challenging in these patients, particularly in capsulotomy and nuclear fragmentation stages as well as intraocular lens (IOL) calculation [3]. In addition, there is risk of certain postoperative complications, including endothelial corneal decompensation and refractive surprise [4]. As such, femtosecond laser-assisted cataract surgery (FLACS) can be a suitable alternative, especially if the patient has a history of ocular surface manipulation such as corneal refractive surgery [5].

Here we describe using FLACS and IOL implantation in the capsular bag for treating a case of cataract with an anterior toric PIOL *in situ* and a history of post refractive surgery corneal ectasia that was treated with

corneal cross-linking (CXL) followed by PIOL implantation to correct the refractive error.

Case Report

The case was a 45-year-old male who was referred to our center with a diagnosis of mature cataract after he presented complaining of reduced vision. The patient's medical records indicated multiple corneal procedures starting with bilateral radial keratotomy (RK) in 1998 and laser-assisted *in situ* keratomileusis (LASIK) in 1999.

In 2008, the patient had presented complaining of progressive blurred vision in both eyes. His cycloplegic refraction was recorded as -4.75/-2.50*115° and -5.25/-0.50*180° in the right and left eyes, respectively. Uncorrected and corrected distance visual acuity (UDVA and CDVA) were respectively counting fingers and 20/25 in both eyes. Orbscan II (Bausch & Lomb, Rochester, NY, USA) topographic images confirmed bilateral post refractive surgery ectasia, and the patient underwent

*Correspondence to: Soheila Asgari, PhD, Noor Ophthalmology Research Center, Noor Eye Hospital, No. 96 Esfandiar Blvd., Vali'asr Avenue, PO BOX: 3475-19395, Tehran, Iran; Tel: +982188651515; Fax: +982188651514; E-mail: soheilaasgari@gmail.com

epithelium-off CXL using the standard 30-minute protocol. On the 1-year follow-up exam after CXL, cycloplegic refraction was $-4.50/-3.00 \times 110^\circ$ and $-5.5/-1.00 \times 170^\circ$ in the right and left eyes, respectively, UDVA was 20/400 in both eyes, CDVA was 20/50 and 20/63 in the right and left eyes, respectively, and no topographic evidence of ectatic progression was indicated.

Later in 2009, the patient was considered for bilateral PIOL implantation due to spectacle and contact lens intolerance. After measuring endothelial cell density using a specular microscope (Konan Medical, Inc., Hyogo, Japan), an Artiflex PIOL (Ophtec BV, Groningen, Netherlands) was enclavated onto the iris of the left eye. For the right eye, a Toric Artiflex PIOL was implanted six months later. In 2010, the UDVA, CDVA, and cycloplegic refraction were respectively 20/30, 20/25 and $-1.00/-0.75 \times 145^\circ$ in the right eye and 20/25, 20/20, and $0.00/-0.75 \times 95^\circ$ in the left eye. The Records of follow-up examinations indicated reduced CDVA (20/30) in right eye due to mild posterior subcapsular cataract in 2012, which further decreased to 20/40 by 2017.

Upon referral to our clinic in July 2020, the patient had a complete ophthalmic examination which indicated mature cataract and further CDVA decline to 20/2000 in the right eye. The standard procedure in such cases is PIOL explantation prior to phacoemulsification and IOL implantation in the posterior chamber. However, given the fact that good astigmatism correction was achieved with the toric PIOL (CDVA of 20/25) before the development of cataract, and since the cornea had already undergone multiple surgical procedures, he was scheduled for FLACS and IOL implantation to keep the PIOL *in situ*.

Surgical Technique

IOL power was calculated as +15.5D using the ASCRS IOL Calculator for Eyes with Prior Myopic LASIK/PRK [6]. With the toric PIOL in place, FLACS was performed using the Femto LDV Z8 platform (Ziemer Ophthalmic Systems AG, Switzerland) using the same settings used for eyes without a PIOL. Laser parameters were a diameter of 5.2 mm and a laser power of 105.0% for capsulorhexis, followed by a diameter of 6.0 mm, power of 110.0% and a 4-segment cut for lens fragmentation. The laser was also used for creating a 2.6 mm wide corneal incision at 215° position and 0.2 mm distance to limbus with 30° entrance angle and -35° bend angle. After undocking the laser system from the eye, the anterior chamber was formed using an ophthalmic viscosurgical device (Pe-Ha-Visco, 2.0%, Albomed, Germany). Segments were then extracted through the corneal incision at 40.0% power and a suction depth of 350 mmHg. Finally, a Tecnis ZCB00 IOL (Johnson & Johnson surgical vision Inc., CA, USA) was inserted in the bag uneventfully.

At one month after FLACS, right eye UDVA was 20/32, and CDVA was 20/25 with $+1.00/-1.00 \times 120^\circ$ correction. UDVA, CDVA, and manifest refraction were respectively 20/40, 20/30, and $+1.5/-1.25 \times 120^\circ$ on the 6-month follow-up visit, and 20/32, 20/25, and $+1.25/-1.00 \times 120^\circ$ at one year after FLACS.

Discussion

For cataract surgery in patients with PIOL, the accepted procedure involves the removal of the PIOL, followed by conventional

phacoemulsification cataract surgery and IOL implantation, because performing some of the steps of conventional phacoemulsification (e.g., capsulotomy and nuclear fragmentation) through a PIOL can be quite a challenge [3]. It has been suggested that capsulotomy and nuclear fragmentation in the presence of anterior and posterior chamber PIOLs can be safely done with femtosecond laser [3]. It induces lower corneal endothelial cells loss and postoperative refractive surprise compared to conventional phacoemulsification cataract surgery [7].

For this case, we decided to perform FLACS and preserve the anterior PIOL for multiple reasons. Firstly, the toric PIOL provided good astigmatism correction and the CDVA was improved to 20/25 prior to cataract formation. PIOL explantation would have required a relatively large incision and suturing, which could induce astigmatism. In addition, the patient had already received multiple surgical procedures on this eye and minimizing manipulation could help avoid corneal decompensation.

It has been reported that incomplete nuclear fragmentation can be more common when performing FLACS in the presence of anterior or posterior chamber PIOLs [8, 9]. Incomplete nuclear fragmentation has been attributed to bubble accumulation beneath the PIOL which can also be responsible for incomplete capsulotomy [9]. Other reported challenges are related to the docking procedure. None of these challenges or complications were experienced in our case and performing FLACS through the anterior PIOL was completed successfully.

What Was Known

- i. Cataract formation after phakic intraocular lens (PIOL) implantation complicates IOL calculation and conventional phacoemulsification cataract surgery.
- ii. Femtosecond laser can be used to perform capsulotomy and nuclear fragmentation safely in the presence of anterior and posterior chamber PIOLs.

What This Paper Adds

- i. Femto laser-assisted cataract surgery (FLACS) is especially useful in challenging cases when capsulorhexis and nuclear fragmentation are difficult.
- ii. Since the PIOL is not explanted, there is no need for a large incision or suturing in prior to femtosecond ablation and phacoemulsification.

Conflicts of Interest

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