



Phaco with ICL in situ in a case of high hyperopia

Sri Ganesh, Supriya Samak Sriganesh, Sushmitha Samak Sriganesh^{*}, Skanda Samak Sriganesh

Nethradhama Superspecialty Eye Hospital Kanakapura Main Road, 7th Block Jayanagar, Bangalore, India

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ABSTRACT

Purpose: To describe a unique method of biometric calculation and surgical technique of phacoemulsification and posterior chamber intraocular lens (PCIOL) implantation with an implantable collamer lens (ICL) in situ; for a high hyperope with post – ICL cataract.

Observations: A patient with high hyperopia who underwent bilateral ICL implantation later developed cataract in both eyes. He underwent phacoaspiration of the cataract with ICL in situ and a standard power PCIOL implantation in the left eye. A unique method of PCIOL power calculation was later devised for the right eye by accounting for the residual refractive error of the eye and implanted by a similar surgical technique.

Conclusion and importance: Following cataract surgery with the ICL in situ, the patient had a residual refractive error of +3.00D in the left eye however had a minimal residual refractive error in the right eye. A new surgical method of PCIOL implantation after cataract extraction with an ICL in situ as well as the biometric calculation for a PICOL to be implanted with an ICL in situ was devised.

1. Introduction

Phakic IOLs are popular for correction of high refractive error in myopia and hyperopia where corneal ablative procedures are unsuitable.¹

A known complication following hyperopic ICL implantation is development of anterior subcapsular cataract as there is no center flow hole.²⁻⁴ High refractive error, intraoperative trauma, inadequate vault and advancing age contribute to this.³ In these cases, cataract extraction with of the ICL and implantation of a PCIOL is usually performed.^{5,6} Among third and fourth generation formulae used for IOL power calculation post ICL, the Haigis and Barrett Universal II formulae showed better post-operative refractive results.⁷

We present a case of a high hyperopic patient who underwent ICL implantation and later developed cataract. Since the IOL power required was very high, it was decided to perform cataract surgery with ICL in situ maintaining it as a piggyback IOL without explantation.

We herein discuss the surgical procedure as well as the methodology of biometric calculation which was different for both the eyes.

Literature review revealed that this is the first report of its kind i.e., phacoemulsification with PCIOL implantation with ICL in situ.

2. Case report

A 29-year-old male with UDVA of counting fingers 2 m, CDVA of 20/40 with a spherical correction of +13.00D in both eyes and underwent uneventful bilateral ICL implantation of +21.00D [Table 1]. 2 weeks post-operatively, the patient had UDVA of 20/120 and CDVA of 20/40 (p) in both eyes with a correction of +4.00D OD and +4.50D OS.

1-year post operatively, the left eye had developed a visually significant anterior subcapsular cataract. Biometry using the IOLMaster 500 (Zeiss Meditec, Jena, Germany) showed net IOL power of +47.00D using Haigis regular formula. Since there was no described method for calculating IOL power to be implanted while maintaining the ICL in situ, a standard IOL of +22.00D was implanted and ICL maintained in its place without explantation. Under topical anaesthesia, temporal clear corneal incision of 2.8mm and side port of 1mm were created and preservative free xylocaine 1% was injected intracamerally [Video 1]. Following injection of OVD (HPMC 2%) (Aurolab, Madurai, India), the proximal haptics of the ICL were elevated from the sulcus and placed over the iris. OVD was injected between the ICL and anterior capsule and a capsulorrhexis of 5.5mm was performed. Hydrodissection and phacoaspiration with cortical aspiration was performed. A single piece hydrophobic PCIOL of +22.00D was implanted in the bag. The proximal haptics of the ICL were tucked under the iris into the ciliary sulcus using a Vukich ICL manipulator and OVD evacuated.

^{*} Corresponding author. Nethradhama Superspecialty Eye Hospital, 256/14, Kanakapura Main road, 7th block Jayanagar, Bangalore, Karnataka, 560070, India.
E-mail address: sush.samak@gmail.com (S.S. Sriganesh).

Table 1

Table containing vision and refraction pre and post ICL surgery, ICL details, vision and refraction pre and post cataract surgery, PCIOL details and biometry parameters.

	LEFT EYE	RIGHT EYE
Pre-icl:		
UDVA	CF 2 m	CF 2 m
CDVA	20/40 (Amblyopic)	20/40 (Amblyopic)
CNVA	N10	N10
Refraction	+13.00DS	+13.00DS
ECD (cells/ mm ³)	2800	2850
ACD (mm)	3.03	3.02
ICL details:		
Type	ICL Visian; STAAR Surgical Co., Switzerland	ICL Visian; STAAR Surgical Co., Switzerland
Optic diameter (mm)	5.5	5.5
Overall diameter (mm)	11.5	11.5
Power	+21.00D	+21.00D
Post ICL (2 weeks):		
UDVA	20/120	20/120
CDVA	20/40(p)	20/40(p)
CNVA	N8	N8
Refraction	+4.00D	+4.50D
ECD (cells/ mm ³)	2720	2740
Pre cataract surgery:		
UDVA	20/120	20/120
CDVA	20/60	20/60(p)
K1	47.94@165	48.18@ 3
K2	48.84@ 75	49.87@ 93
Axial length (mm)	17.48	17.33
ACD (mm)	3.17	3.49
Net IOL power	+47.00D	+47.00 D
Type of IOL	Sensar One, Advanced Medical Optics, California	Sensar One, Advanced Medical Optics, California
IOL power used	+22.00D	+30.00D
ECD (cells/ mm ³)	2720	2730
Post cataract surgery:		
UDVA	20/80(p)	20/60
CDVA	20/40	20/40(p)
Refraction	+3.00DS	-0.75 DC@10°
ECD (cells/ mm ³)	2630	2650

D = Diopters, DS = Diopter Sphere, DC = Diopter cylinder, ACD = Anterior Chamber Depth, m = meter.

Supplementary video related to this article can be found at <https://doi.org/10.1016/j.ajoc.2022.101360>

One year after the left eye cataract surgery, the patient had UDVA of 20/120, CDVA of 20/40 and subjective refraction of +3.00 DS in the left eye.

8 years following the primary ICL surgery, he presented with anterior subcapsular cataract in his right eye. Biometry using IOLMaster 700 (Zeiss Meditec, Jena, Germany) showed a net IOL power of +45.00 D with Barrett Universal II formula. The method of IOL power calculation was devised as follows - the patient initially presented with refractive error of +13.00D in both eyes and had a residual refractive error of +4.00D in the right eye and +4.50D in the left eye post ICL implantation. This meant that the ICL had corrected +9.00 D of refractive error and the target refraction for biometry would be +9.00D, maintaining the ICL in situ. However, the patient had a cylinder of +1.69@93° so in order to aim for a myopic astigmatism, the target refraction was entered as +9.50D and IOL power required was +30.00D. For the right eye, a

surgical method similar to the left eye was adopted and a single piece hydrophobic PCIOL of +30.00D was implanted in the bag maintaining ICL in situ.

1-year post right eye cataract surgery, the patient had CDVA of 20/40(p) OD and 20/40 OS. Subjective refraction was -0.75 DC@10° in the right eye and remained +3.00DS in the left eye.

3. Discussion

When a high hyperope undergoes pIOL implantation and develops anterior subcapsular cataract, the surgical options for cataract removal are - 1. Explantation of ICL with cataract extraction followed by implantation of a high-powered custom made IOL⁷; 2. Explantation of ICL with cataract extraction followed by implantation of two IOLs (Primary Piggyback). The first option is more expensive, involves time consuming manufacture of a custom made IOL and requires a special injector and larger incision for the thicker lens. The second option i.e., primary piggyback IOL has complications including interlenticular opacification, posterior capsular opacification and glaucoma.⁸ With these considerations, an innovative surgical approach was adopted where phacoaspiration was done with the ICL in situ and PCIOL was implanted in the capsular bag. This may be more challenging for the surgeon as the steps have to be performed with ICL in place which may interfere with visibility. The potential complications include damage to the ICL and zonular damage especially in denser cataracts where higher phaco energy is used with more complex surgical maneuvers. If performed safely, while reducing surgical cost, this method also reduces damage to the endothelium as the ICL shields the endothelium above.⁶ The accurate method of calculation for an IOL to be implanted by this method was unclear for left eye cataract surgery and a standard power of +22.00 D was used, resulting in a residual refractive error of +3.00D.

For the right eye cataract surgery, a unique biometric method [Ganesh Formula] was devised for a PCIOL to be implanted while maintaining the ICL in situ as a piggyback lens, as follows: Target refraction (Power corrected by the ICL) = [The total pre - ICL subjective refraction] - [post ICL residual refraction]. Target refraction is then entered in the biometric formula to get the final IOL power. This results in full correction of the refractive error with a negligible residual refraction.

4. Conclusion

In this report, we describe two innovative approaches for a high hyperope with post - ICL cataract: Phacoemulsification with ICL in situ as a piggyback lens and the method of biometric calculation. To the best of our knowledge, this surgical technique and biometric approach is the first of its kind.

Patient Consent

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

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Intellectual property

We confirm that we have given due consideration to the protection of

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Research ethics

We further confirm that any aspect of the work covered in this manuscript that has involved human patients has been conducted with the ethical approval of all relevant bodies and that such approvals are acknowledged within the manuscript.

Declaration of competing interest

No conflict of interest exists.

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