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Implantable Collamer Lens (ICL) Surgery

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Disclosure for Dr. Georgios P. Roussopoulos

In compliance with COI policy, ESCRS requires the following disclosures to the session audience:

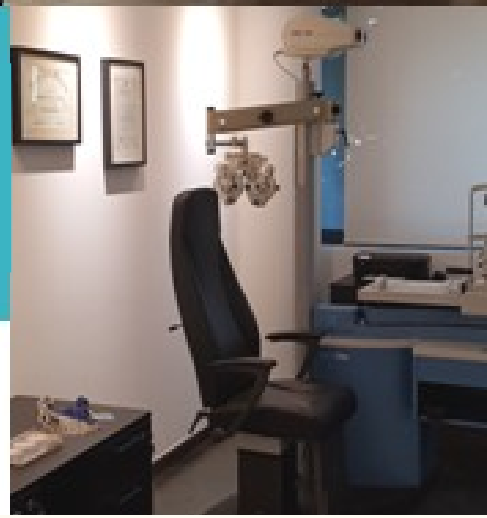
Shareholder	No relevant conflicts of interest to declare.
Grant / Research Support	**Théa**
Consultant	**Rafarm**
Employee	No relevant conflicts of interest to declare.
Paid Instructor	**Alcon, Bausch and Lomb**
Speaker Bureau	**Alcon, Bausch and Lomb**
Other	**Cooper, Erghani, Kite and Vianex**

Presentation includes discussion of the following off-label use of a drug or medical device:

None

EYE CLINIC
Dr Georgios Roussopoulos

HYPERVISION



Introduction: Why ICL?

- Rising global prevalence of myopia and astigmatism
- Increasing demand for refractive surgery
- ICL: A valuable alternative to corneal refractive procedures (LASIK/PRK)
- Suitable for patients with high ametropia or thin corneas

What is an Implantable Collamer Lens (ICL)?

- A phakic intraocular lens (pIOL) placed between the iris and crystalline lens
- Made from Collamer: a biocompatible, collagen-copolymer material
- Offers UV protection and excellent optical clarity
- Preserves natural accommodation

Types of ICLs

- EVO Visian ICL
- EVO+ Visian ICL (enhanced size range)
- Toric ICL (TICL) for astigmatism
- Central Port (KS-AquaPORT) design: eliminates pre-op iridotomy

Safety of EVO ICL

Eyes (n)	4196
Follow Up	Up to 5 years*
Weighted Average Safety Index	1.15
Visually Significant ASC	0.00% (n=0)
ECL	-2.6%
Pupillary Block	0.04% (n=1)**
Pigment Dispersion	0.00% (n=0)
Secondary Surgical Intervention	0.47% (n=14)***

Clinical Ophthalmology

Dovepress

REVIEW

The Implantable Collamer Lens with a central port: review of the literature

This article was published in the following Dove Press journal:
Clinical Ophthalmology

Mark Packer

Mark Packer MD Consulting, Inc., Boulder, CO, USA

Abstract: The purpose of this review is to summarize preclinical and clinical data from publications appearing in the peer reviewed scientific literature relevant to the safety and effectiveness of the EVO Implantable Collamer Lens (ICL) posterior chamber phakic refractive lens with a central port (V4c Visian ICL with KS Aquaport, STAAR Surgical, Inc.). A literature search was conducted using PubMed.gov to identify all articles relating to the EVO ICL. Articles were examined for their relevance, and the references cited in each article were also searched for additional relevant publications. On the basis of a total of 67 preclinical studies and clinical reports, including effectiveness data on 1,905 eyes with average weighted follow-up of 12.5 months and safety data on 4,196 eyes with weighted average follow up of 14.0 months, the EVO ICL is safe and effective for the correction of a broad range of refractive errors. High levels of postoperative uncorrected visual acuity, refractive predictability, and stability demonstrate the effectiveness of the EVO ICL. Safety data suggest reduced rates of anterior subcapsular cataract and pupillary block compared with earlier models. Improved safety and proven effectiveness make EVO an attractive option for surgeons and patients.

Keywords: myopia, astigmatism, hyperopia, phakic refractive lens

* weighted average 14 months
** due to retained viscoelastic (N=2517)
*** N = 2970

ASC: Anterior subcapsular cataract / ECL: Endothelial cell loss

1. Packer, M. The Implantable Collamer Lens with a central port: review of the literature. Clinical Ophthalmology 2018:12 2427–2438.

Indications & Patient Selection

- Moderate to high myopia (-3.0D to -20.0D)
- Hyperopia (+3.0D to +10.0D)
- Astigmatism (up to 6.0D with Toric ICL)
- Age: 21-45 years
- Anterior chamber depth ≥ 2.8 mm
- Stable refraction ≥ 1 year
- Good endothelial cell count

Contraindications

- Anterior chamber depth < 2.8 mm
- Endothelial cell density below safety limits
- History of glaucoma or uveitis
- Pregnancy/lactation
- Unstable refraction
- Unrealistic patient expectations

Preoperative Assessment

- Refraction (subjective & cycloplegic)
- Corneal topography & pachymetry
- Anterior chamber depth measurement
- White-to-white distance
- Endothelial cell count
- Dilated fundus exam

ICL Sizing & Power Calculation

- Accurate sizing crucial for optimal vault
- Based on WTW & ACD
- Software-assisted calculation

Diagnostic Imaging in ICL Assessment

- Modalities: Anterior segment OCT, specular microscopy, UBM
- Benefits: Accurate measurement of ICL vault and corneal health

Review

Diagnostic Techniques to Increase the Safety of Phakic Intraocular Lenses

Tadas Naujokaitis, Gerd U. Auffarth, Grzegorz Łabuz, Lucy Joanne Kessler and Ramin Khoramnia

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Abstract: Preoperative and postoperative diagnostics play an important role in ensuring the safety of patients with phakic intraocular lenses (pIOLs). The risk of endothelial cell loss can be addressed by regularly measuring the endothelial cell density using specular microscopy and considering the endothelial cell loss rate and the endothelial reserve in accordance with the patient's age when deciding whether to explant a pIOL. The anterior chamber morphometrics, including the anterior chamber depth and the distance between the pIOL and the endothelium, measured using Scheimpflug tomography and anterior segment optical coherence tomography (AS-OCT), can help to assess the risk of the endothelial cell loss. In patients undergoing posterior chamber pIOL implantation, accurate prediction of the vault and its postoperative measurements using AS-OCT or Scheimpflug tomography are important when assessing the risk of anterior subcapsular cataract and secondary glaucoma. Novel approaches based on ultrasound biomicroscopy and AS-OCT have been proposed to increase the vault prediction accuracy and to identify eyes in which prediction errors are more likely. Careful patient selection and regular postoperative follow-up visits can reduce the complication risk and enable early intervention if a complication occurs.

Keywords: anterior chamber depth; cataract; endothelial cell density; endothelial cell loss; iris-fixated pIOL; glaucoma; phakic intraocular lens; pIOL; posterior chamber; vault

REVIEW

Implantable Collamer Lens Procedure Planning: A Review of Global Approaches

Vance Thompson[1,2], Arthur B Cummings[3], Xiaoying Wang[4–6]

[1]Vance Thompson Vision, Sioux Falls, SD, USA; [2]Department of Ophthalmology, University of South Dakota Sanford School of Medicine, Vermillion, SD, USA; [3]Wellington Eye Clinic, Dublin, Ireland; [4]Eye Institute and Department of Ophthalmology, Eye & ENT Hospital, Fudan University, Shanghai, People's Republic of China; [5]NHC Key Laboratory of Myopia, Fudan University, Shanghai, People's Republic of China; [6]Shanghai Research Center of Ophthalmology and Optometry, Eye & ENT Hospital, Fudan University, Shanghai, People's Republic of China

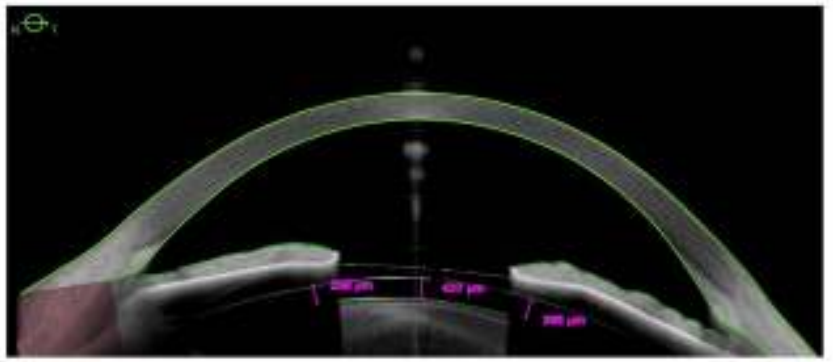

Figure 1 Anterior segment OCT image of postoperative vault with caliper values. Courtesy of Francisco Pastor-Pascual, Oftalmar Valencia.
Abbreviation: OCT, optical coherence tomography.

Anterior Segment OCT

- Visualizes ICL position, vault, and angle anatomy
- Helps prevent complications like pupillary block

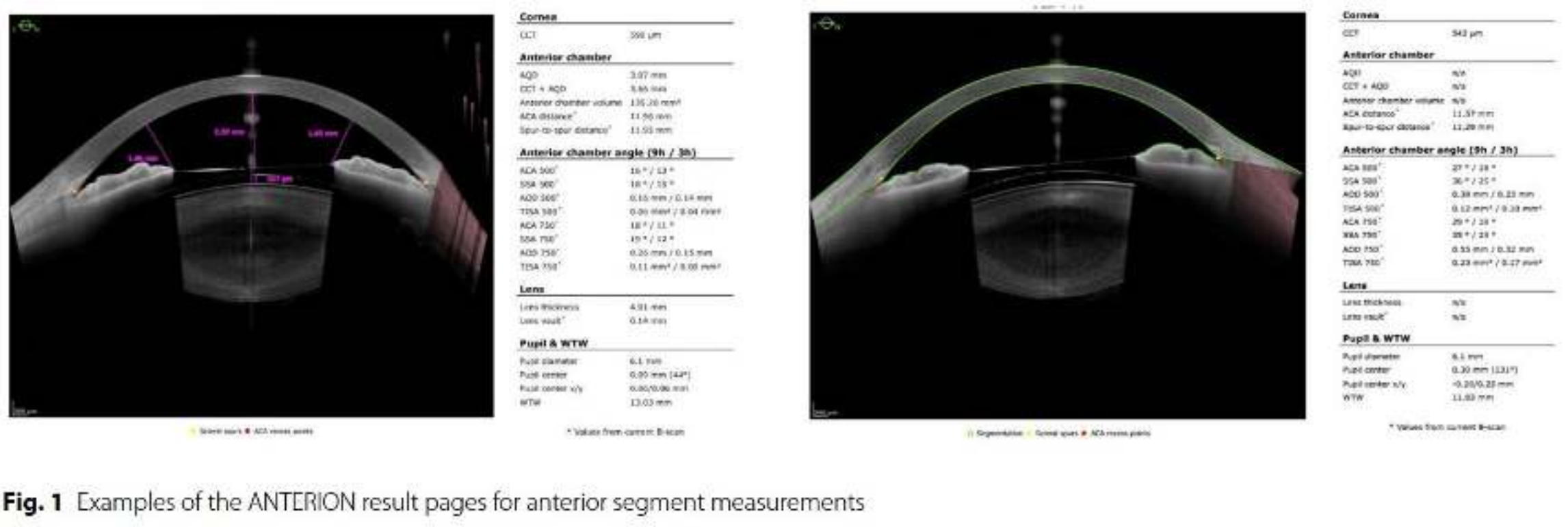

Fig. 1 Examples of the ANTERION result pages for anterior segment measurements

Specular Microscopy

- Monitors corneal endothelial cell density
- Regular examinations ensure long-term health

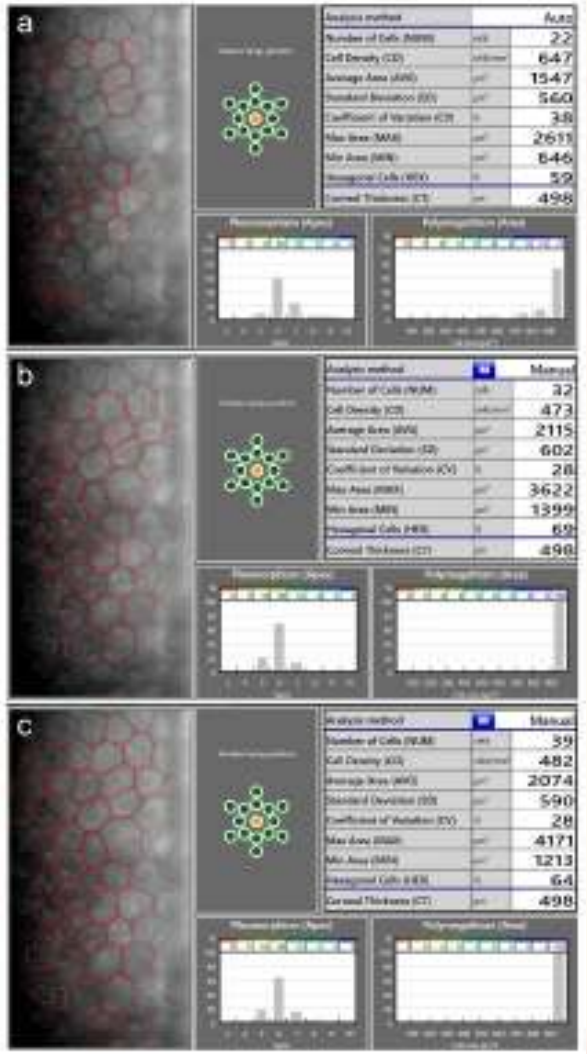

Figure 3. Endothelial cell density (ECD) measurement in a patient with a very low ECD. An automatic measurement (**a**) overestimated the ECD (674 cells/mm^2) as the algorithm did not recognize the cell boundaries correctly. Using the same image, manual measurements using the center method (**b**) and the corner method (**c**) resulted in lower ECD values (473 cells/mm^2 and 482 cells/mm^2, respectively).

1. Naujokaitis T, Auffarth GU, Łabuz G, Kessler LJ, Khoramnia R. Diagnostic Techniques to Increase the Safety of Phakic Intraocular Lenses. *Diagnostics (Basel)*. 2023;13(15):2503. doi:10.3390/diagnostics13152503

UBM

- Preoperative and postoperative analysis

Descriptive Analysis of Footplate Position After Myopic Implantable Collamer Lens Implantation Using a Very High-Frequency Ultrasound Robotic Scanner

Roger Zaldivar[1], Roberto Zaldivar[1], Pablo Adamek[1], Gabriel Quintero[1], Alejandro Cerviño[2]

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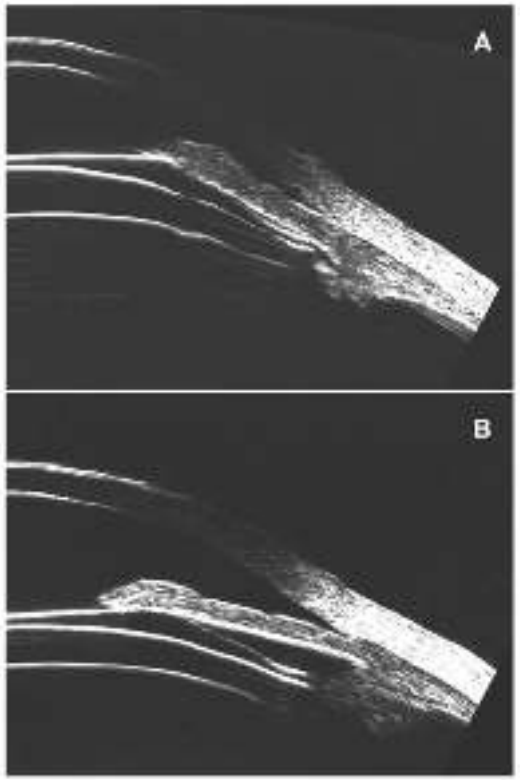

Results: In 81% of cases (42 eyes), the ICL rests on the ciliary body (CB) in both temporal and nasal sides, being slightly lower than 6% (3 eyes) those that rest on the sulcus in both sides, with significant correlations between ICL position and vault values ($p<0.05$). Cases in which the ICL position was CB-CB yielded central vault values across the whole range determined within the sample, but most of the eyes where the ICL rests on both the sulcus in one side and the CB in the other yield greater central vault values. Correlation was significant between ICL position and retroposition distance on the temporal side (Spearman's rho −0.487, $p<0.001$). A significant but weaker correlation was also found between ICL position and retroiridian space ($p<0.05$).

Importance of Post-Operative Monitoring

- Early detection is crucial
- Regular follow-up to check IOP, inflammation, and lens position

The Early Post-Operative Period (First 24 Hours)

- Key observations: IOP, inflammation, lens positioning
- Watch for IOP spikes and inflammation

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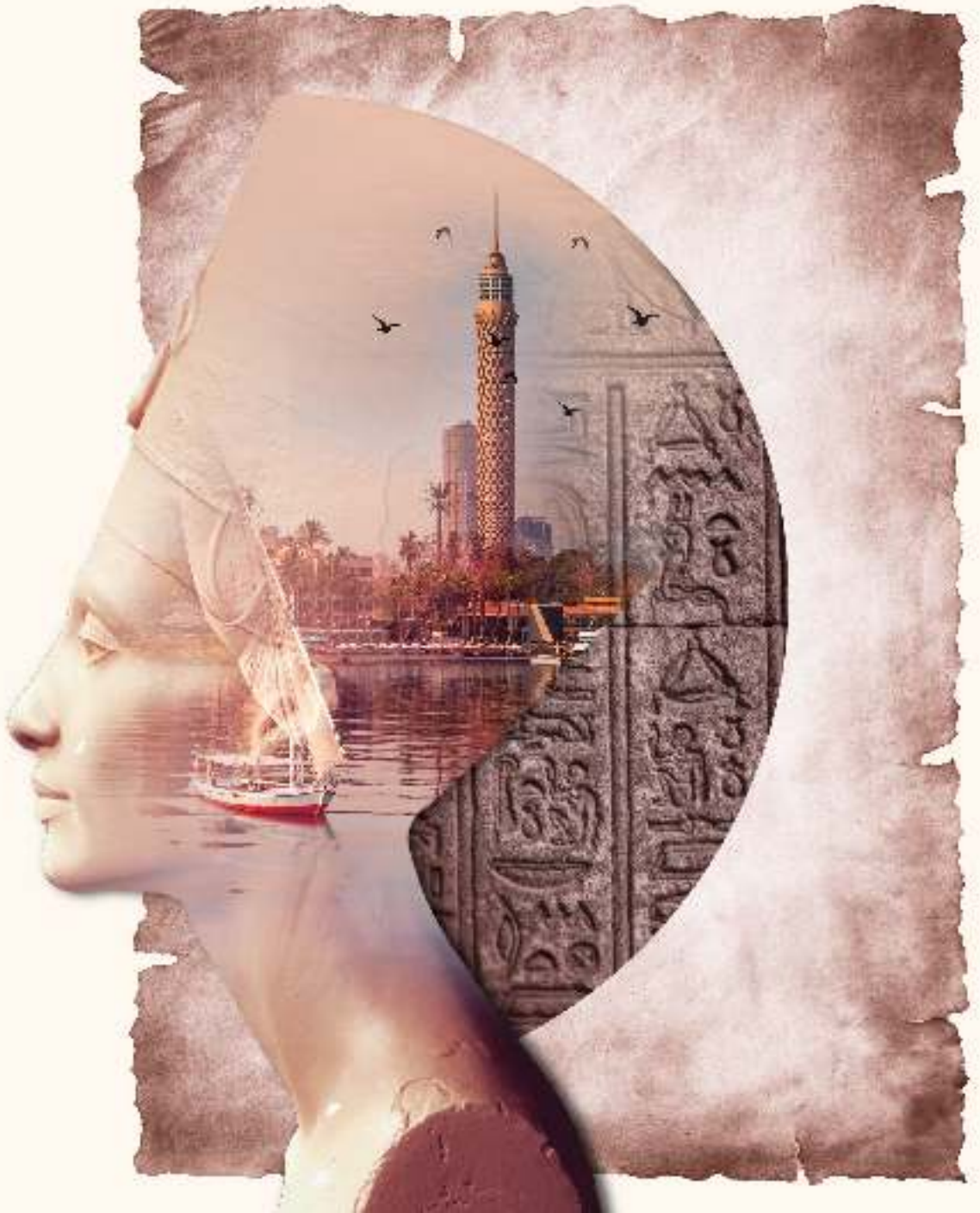
IOP Spikes



IOP Spikes – Definition & Incidence

- Definition: Significant rise in intraocular pressure post-op
- Causes: Retained viscoelastic, pupillary block, steroid response, excessive vault, TASS, UZS, Pigment dispersion syndrome, malignant glaucoma
- Relatively common if not managed properly

Causes and management strategies for elevated intraocular pressure after implantable collamer lens implantation

Di Gong[1†], Simin Deng[2†], Kuanrong Dang[1†], Zonghui Yan[1*] and Jiantao Wang[1*]

[1]Shenzhen Eye Hospital, Jinan University, Shenzhen Eye Institute, Shenzhen, Guangdong, China, [2]The 2nd Clinical Medical College (Shenzhen People's Hospital) of Jinan University, Shenzhen, China

Intraocular pressure during the early postoperative period after 100 consecutive implantations of posterior chamber phakic intraocular lenses with a central hole

Felix González-Lopez, MD, Rafael Bilbao-Calabuig, MD, Blas Mompean, MD, Victoria de Rojas, MD, PhD, Jorge Luezas, MD, Mohammad Reza Djodeyre, MD, PhD, Jaime Beltran, MD

PURPOSE: To study changes in intraocular pressure (IOP) during the early postoperative period in eyes having implantation of a posterior chamber phakic intraocular lens (pIOL) (Visian Implantable Collamer Lens V4c).

SETTING: Clínica Baviera, Instituto Oftalmológico Europeo, Madrid, Spain.

DESIGN: Case series.

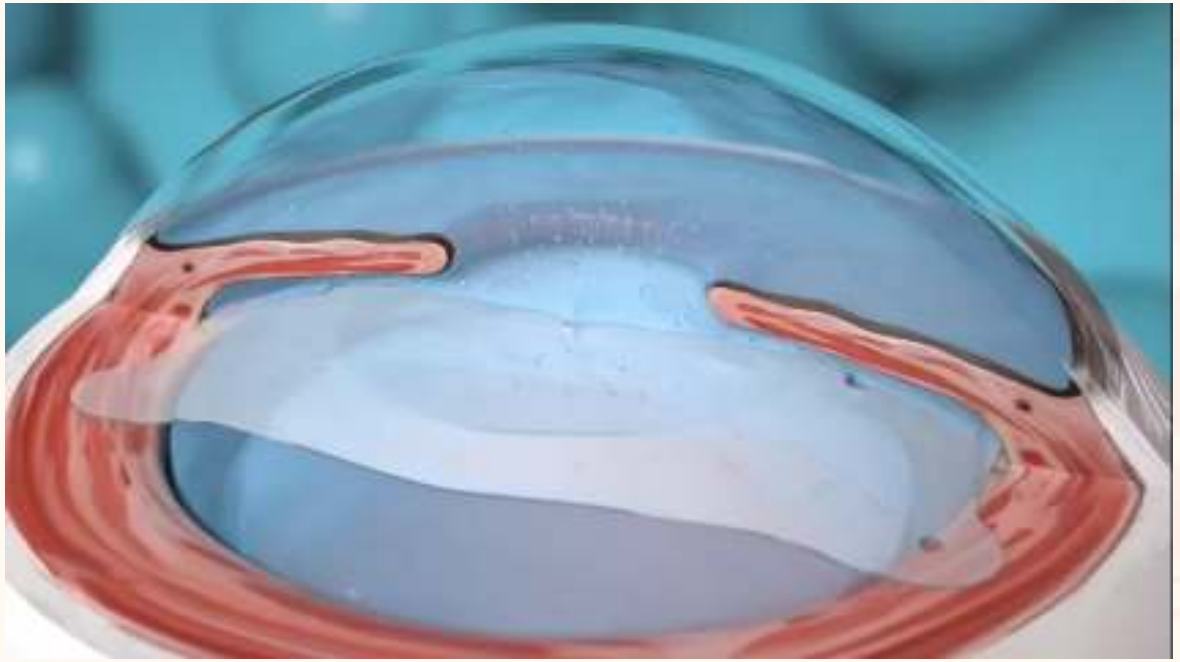
METHODS: This retrospective review included the first consecutive eyes having implantation of a spherical or toric myopic pIOL with a central hole at Clínica Baviera from December 2011 to June 2012 by the same experienced surgeon. The IOP was evaluated preoperatively and 1 day, 1 week, and 1 month postoperatively.

RESULTS: The study comprised 100 eyes. The mean IOP changed from 14.6 mm Hg ± 3.4 (SD) (range 8 to 26 mm Hg) preoperatively to 14.5 ± 4.6 mm Hg (range 6 to 30 mm Hg) 1 day postoperatively, 14.2 ± 4.2 mm Hg (range 6 to 29 mm Hg) at 1 week, and 12.3 ± 3.4 mm Hg (range 9 to 24 mm Hg) at 1 month. No statistically significant changes were detected over time postoperatively ($P > .2$). No perioperative complications associated with the implantation of the pIOL were recorded. No pIOLs were explanted, no toric pIOL rotation was detected, and no pupillary block or acute angle closure was observed.

CONCLUSION: The short-term clinical data for the new pIOL model with the central hole (KS-Aquaport) suggest that it is a safe and effective means for controlling postoperative IOP.

IOP Spike – Pathophysiology

- Mechanism: Residual OVD clogs the trabecular meshwork
- Effects: Corneal edema, eye pain, blurred vision



ETIOLOGIES OF ELEVATED IOP

Patient[1]

- Age [2]
- Myopia [2,3,7,8]
- History of ocular trauma
- Chronic iritis/Steroid response
- Gonioscopy
  - Narrow angles
  - Iris configuration
  - Pigment dispersion syndrome (young, myopic males) [2]

Surgeon

- Inadequate preoperative iridotomies [1,2,5,6]
- Careful and thorough removal of viscoelastic

ICL[4]

- Excessive vault (>1000 µm)
  - Angle crowding to angle closure
  - Iris chaffing and pigment dispersion

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2. Chun et al. iris and trabecular meshwork pigment changes after posterior chamber phakic IOL implantation. J Cataract Refract surg 2006; 32:1452-1458.
3. Xu L, Wang Y, Wang S, et al. High myopia and glaucoma susceptibility the Beijing Eye Study. Ophthalmology 2007;114:216–20.
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IOP Spike – Management Strategies

- Thorough removal of viscoelastic during surgery
- IOP-lowering medications
- Laser peripheral iridotomy (for older ICL models)
- Anterior chamber washout in severe cases

Thorough removal of viscoelastic during surgery
IOP-lowering medications
Laser peripheral iridotomy (for older ICL models)
Anterior chamber washout in severe cases

Causes	Clinical manifestation	Management strategies
Residual ophthalmic viscosurgical device	Intolerable ocular pain and corneal epithelial oedema in the first 24 h. Peak intraocular pressure (IOP) is usually 50 mmHg or higher, and residual viscoelastic in the anterior chamber can be observed by slit lamp.	1. Surgeons can choose the OVD application method based on their own experience. 2. If the IOP is only mildly elevated, short-term application of ocular hypotensive eyedrops may be considered. 3. If the IOP exceeds 50 mmHg and continues to rise, it is advisable to reinstate irrigation in the anterior chamber to thoroughly remove the remaining viscoelastic substance.
Steroid response	IOP elevation usually occurs 1 to 2 weeks after surgery.	1. The administration or replacement with a lower potency corticosteroid is recommended, accompanied by the topical application of glaucoma medications. 2. If the intraocular pressure continues to rise, further surgical treatment is needed. The most common surgery is trabeculectomy, but implantation of a drainage device (Ahmed valve) may also be considered.
Excessive ICL vault	Corneal touching, anterior chamber shallowing, iridocorneal contact, and ranging findings suggesting an vault<250 μm can be observed after surgery.	1. Precise measurement of various anterior segment parameters before surgery and reasonable selection of ICL model. 2. If conditions permit, OCT can be used during surgery. 3. Use slit lamp microscope and AS-OCT to observe the crystalline lens regularly after surgery. 4. Apply glaucoma medications to reduce IOP for a certain period of time. 5. If the patient has a low refractive error ICL, the vault can usually be lowered by moving the lens in the vertical axis. 6. In cases of pupillary block glaucoma, laser iridotomy or iridectomy may be necessary, and if needed, the ICL should be promptly removed.
Acute anterior segment syndrome (TASS) Uveitis-glaucoma-hyphema syndrome (UGH)	Acute manifestations within 12–48 h after surgery, with the main symptoms including elevated IOP, corneal oedema, and other anterior segment inflammatory reactions. Early postoperative symptoms such as glare, halos, and photophobia, signs such as increased intraocular pressure, pupil dilation, and anisocoria due to pupillary medication can be observed.	1. Excluding infectious endophthalmitis. 2. The main method is topical or systemic application of steroids. 3. The routine anterior chamber flushing should not be carried out, which may aggravate the damage of the anterior chamber. 1. Mannitol, topical use of drugs to reduce intraocular pressure. 2. Remove air or gas from the anterior chamber. 3. If necessary, iridectomy can be conducted to alleviate the closure of the anterior chamber angle.
Pigment dispersion syndrome (PDS)	Induced in the short-term postoperative period, may present with extensive pigmentation, ocular pain, eye redness, and blurred vision, with signs including iris transillumination defects, 360° peripheral iris transillumination defects, increased pigment deposition in the trabecular meshwork, and pigment deposition on the corneal endothelium (Krukenberg spindle).	1. Detailed slit lamp examination to monitor signs of pigment dispersion. 2. IOP lowering and anti-inflammatory therapy should be performed as soon as PDS and secondary IOP elevation are present. 3. Consider removal of the ICL if necessary to reduce friction between the lens and the iris. 4. Filtration surgery is safe and effective in the treatment of pigmentary glaucoma.
Malignant glaucoma	Elevated IOP, corneal edema, and anterior chamber shallowing occurred in the early postoperative period.	1. Exclude conditions such as pupil block, excessively high ICL vault, and suprachoroidal hemorrhage. 2. Pharmacological treatment is the first line of treatment for malignant glaucoma, including topical potent ciliary muscle paralysis, topical anti-inflammatory agents and aqueous humor inhibitors, as well as systemic hyperosmotic agents. 3. If conservative treatment is not effective, further surgical intervention is required, such as vitrectomy combined with iridotomy or iridectomy, with or without removal of the ICL.

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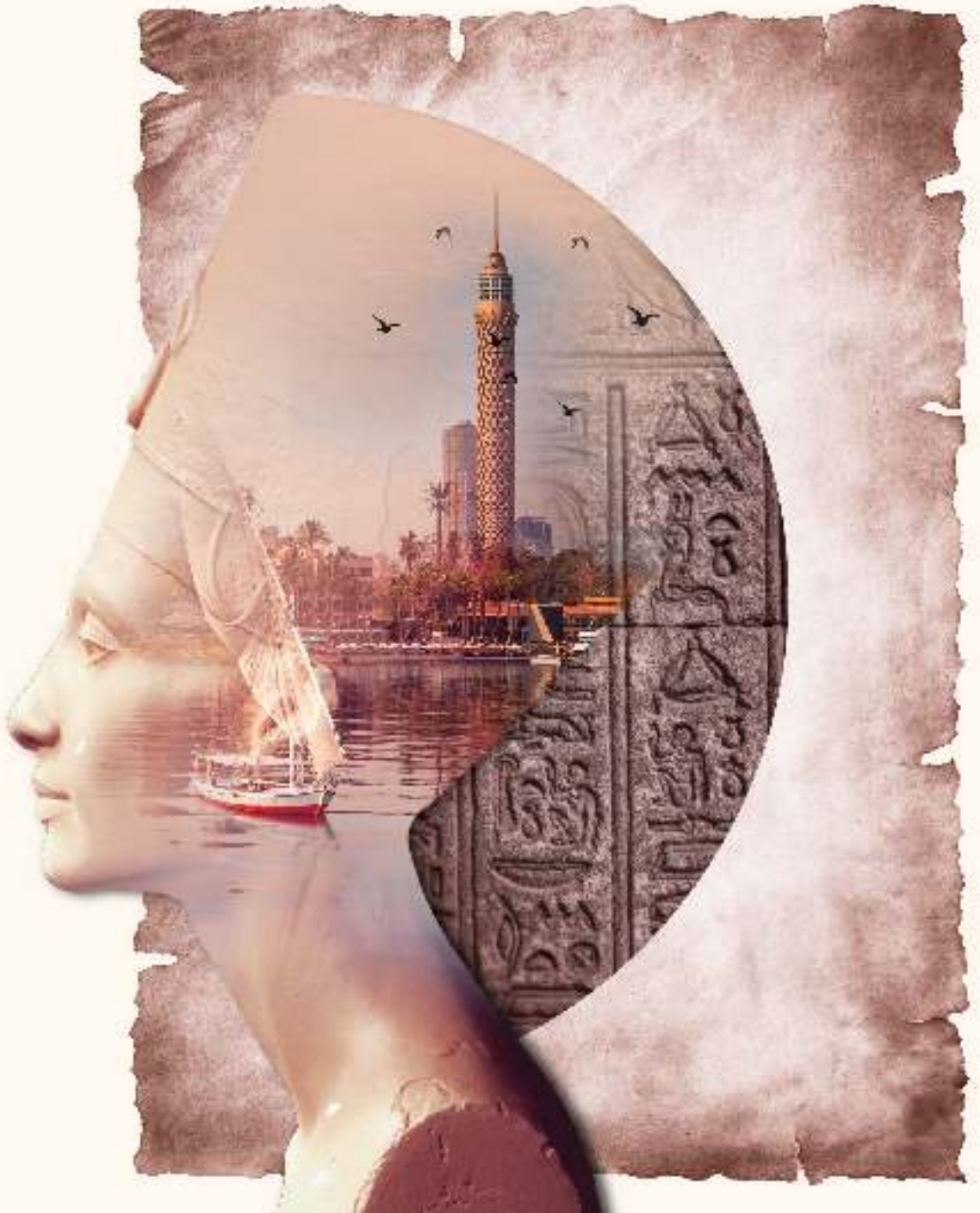
Inflammation



Inflammation – Etiology & Incidence

- Causes: Surgical trauma, residual contaminants
- Mild inflammation is common; severe TASS is rare

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Inflammation – Clinical Presentation & Grading

- Signs: Redness, pain, cells and flare in the anterior chamber
- Grading scales used to assess severity

Inflammation – Medical Management

- Treatment: Topical steroids and anti-inflammatory drops
- High-frequency dosing initially, then gradual taper

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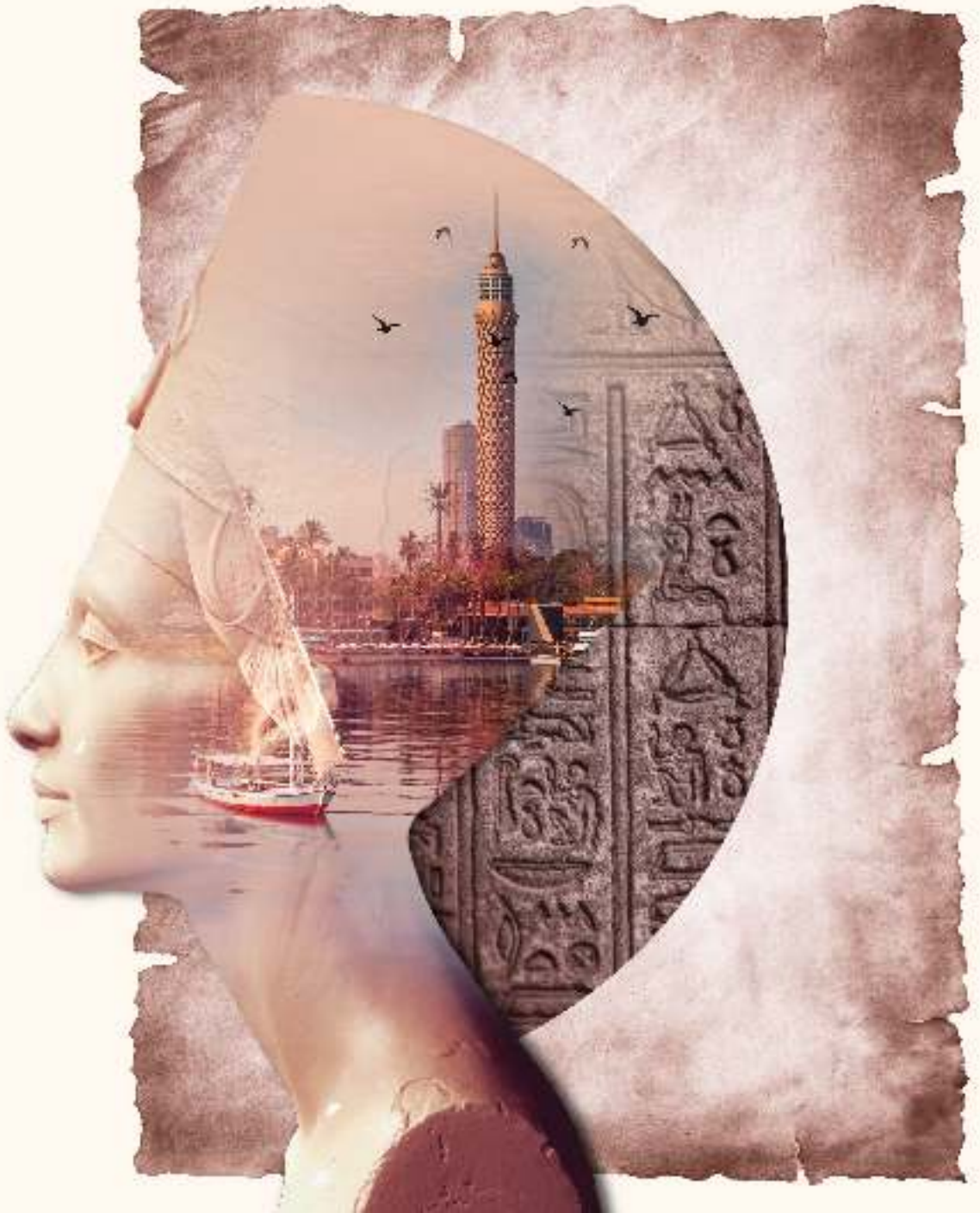
Endothelial Cell Loss



Endothelial Cell Loss – Mechanisms

- Risk: Surgical manipulation and potential contact with ICL
- Monitoring: Specular microscopy to track cell density

Endothelial cell loss post–implantable collamer lens V4c: meta-analysis

Filip Blazej Kisiel, MEng, Gerard Jonathan Gurumurthy, MBChB

Endothelial cell density (ECD) loss is a noted effect of implantable collamer lens (ICL) V4c surgery. Current literature provides a wide range of values for ECD loss postsurgery, which may not be helpful in advising patients and clinicians. A meta-analysis exploring ECD loss in ICL V4c for myopia correction was undertaken. 18 studies were included in this meta-analysis with 2 subgroup analyses to account for the variability in follow-up lengths. The average ECD loss 3 months, 12 months, and 21.25 (mean) months postsurgery were 1.32% ± 1.28% ($P < .001$, 95% CI, −75.158 to −1.19), 1.75% ± 2.17% ($P < .001$, 95% CI, −134.09 to 14.52), and 3.84% ± 1.78% ($P < .001$, 95% CI, −156.04 to −54.26), respectively. ECD loss is most pronounced 3 months postsurgery, suggesting that acute surgical trauma was the primary contributor rather than long-term lens implantation. Overall, ICL V4c is for myopia correction exhibits similar ECD loss as seen in other ICL models, thereby affirming its safety.

J Cataract Refract Surg 2024; 50:420–423 Copyright © 2024 Published by Wolters Kluwer on behalf of ASCRS and ESCRS

Endothelial Cell Density

Reference	N (eyes)	N (subjects)	Follow Up	Change in Endothelial Cell Density
Lisa [1] J Cataract Refract Surg 2015	**147**	**80**	**1 year**	**-1.7%**
Kamiya [2] Br J Ophthalmol 2017 Group 1: MRSE < -6 D (n = 57) Group 2: MRSE ≥ -6 D (n = 294)	**57** **294**	**57** **294**	**1 year**	**-0.1 ± 9.7%** **-0.1 ± 10.0%**
Fernandez-Vega-Cueto [3] Clinical Ophthalmology 2018	**184**	**92**	**3 years**	**-2.9%**
Shimizu [4] Medicine (Baltimore) 2016	**32**	**32**	**5 years**	**-0.5 ± 5.4%** "no significant change"(p = 0.73)
Alfonso [5] **J Refract Surg 2019**	**147**	**83**	**5 years**	**-0.43%** "non-significant loss" (p = 0.304)

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Endothelial Cell Loss – Impact on Corneal Health

- Reduced cell density may lead to corneal decompensation
- Long-term safety: Minimal ongoing loss if proper vault is maintained

Endothelial Cell Loss – Preventative Measures

- Accurate ICL sizing for proper vault
- Meticulous surgical technique
- Regular post-op monitoring

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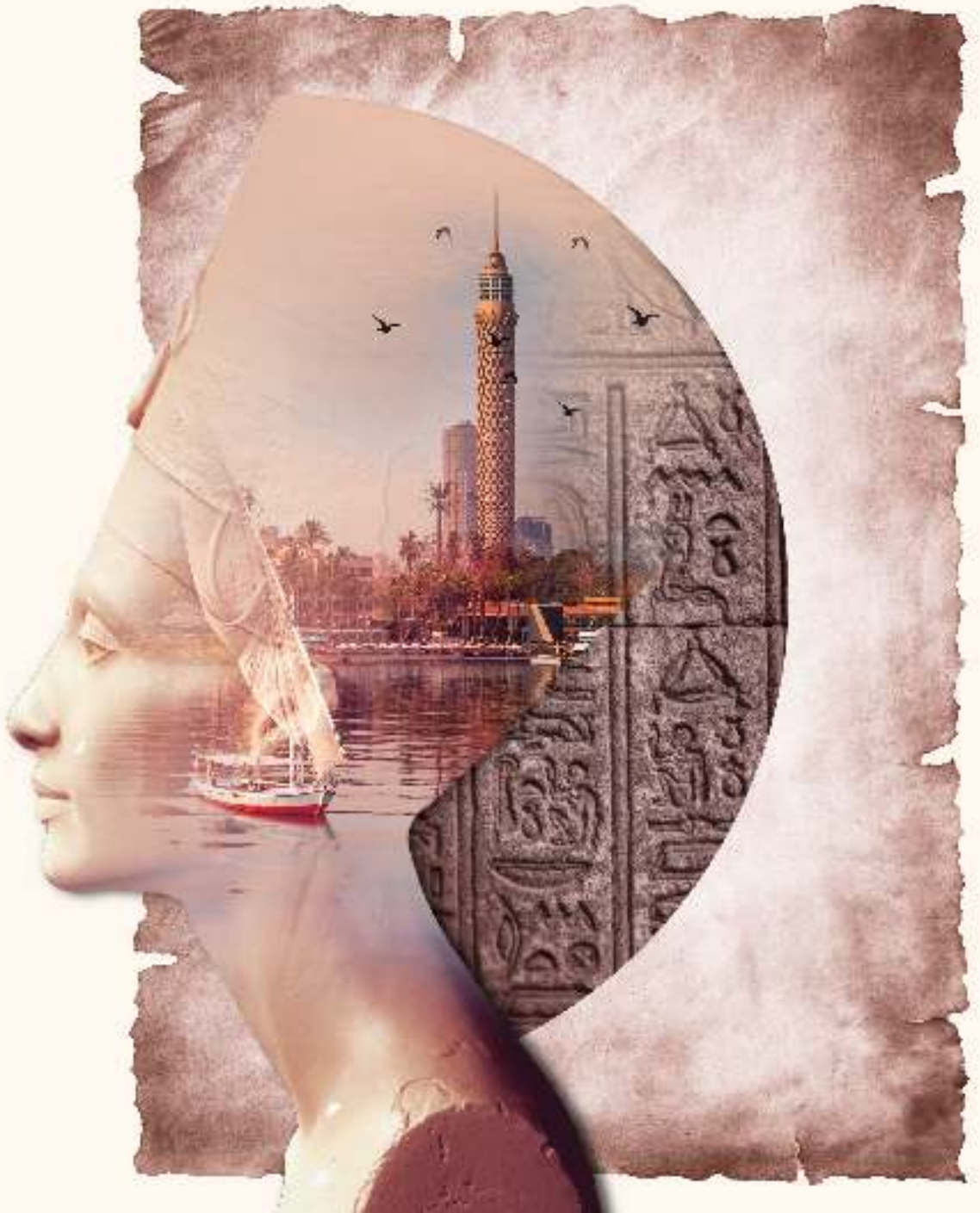
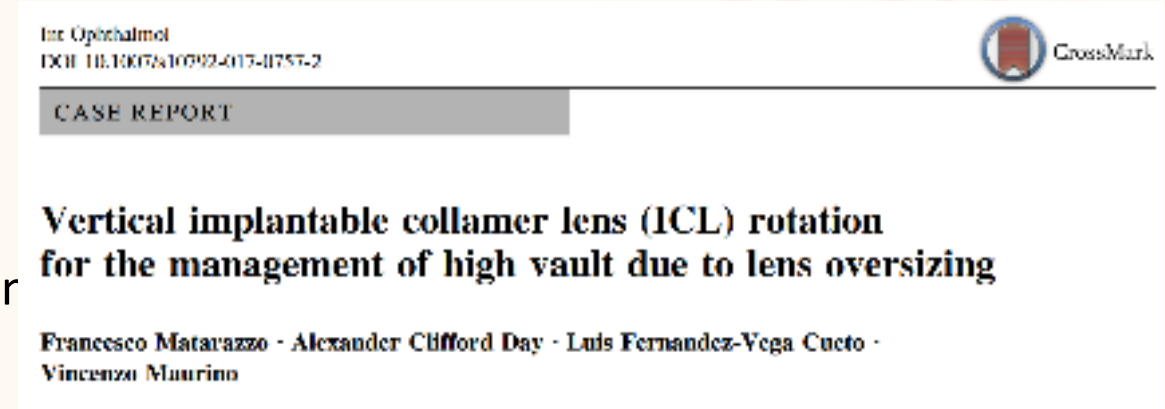
Lens Related Issues



Lens-Related Issues – Positioning & Rotation

- Risks: Incorrect vault (excessive or insufficient)
- Toric ICLs: Risk of rotation affecting astigmatic correction
- Management: Repositioning if significant rotation occurs


Int Ophthalmol
DOI 10.1007/s10792-017-0757-2

CASE REPORT

Vertical implantable collamer lens (ICL) rotation for the management of high vault due to lens oversizing

Francesco Matarazzo · Alexander Clifford Day · Luis Fernandez-Vega Cueto · Vincenzo Maurino


Nine Years' Follow-up of Bilateral Extremely Low Vaulting of Implantable Collamer Lens: Case Report

Nicole Mechleb, MD; Damien Gatinel, MD; Alain Saad, MD

Adequate vault ranges 90 to 1,000 microns [1,2]

Ideal vault range 250 – 750 microns [4]

Weak correlation between WTW and STS values [2,3]

1. Gonvers M, Bornet C, Othein-Girard P. Implantable Contact Lens for Moderate to High Myopia; relationship of vaulting to cataract formation. J Cataract Refract Surg 2003; 29:918-924
2. Dougherty PJ, Rivera RP, Schnieder D, Lane SS, Brown D, Vukich J. Improving accuracy of phakic intraocular lens sizing using high-frequency ultrasound biomicroscopy. J Cataract Refract Surg 2010; 37: 13-18.
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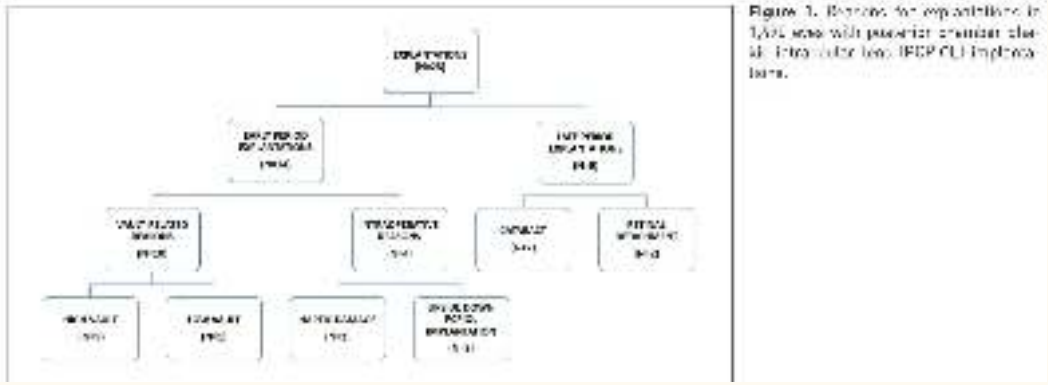
4. Alfonso JF, Fernandez-Vega, L, Lisa C, Fernandes P, Jorge J, Montes-Mico R. Central Vault after phakic intraocular lens implantation: Correlation with anterior chamber depth, white-to-white distance, spherical equivalent, and patient age. J Cataract Refract Surg 2012; 38:46-53

Lens-Related Issues – Positioning & Rotation


RESEARCH ARTICLE

Reasons for Explantations of Posterior Chamber Phakic Intraocular Lenses in 1,490 Eyes




Open ARTICLE

Factors leading to realignment or exchange after implantable collamer lens implantation in 10 258 eyes

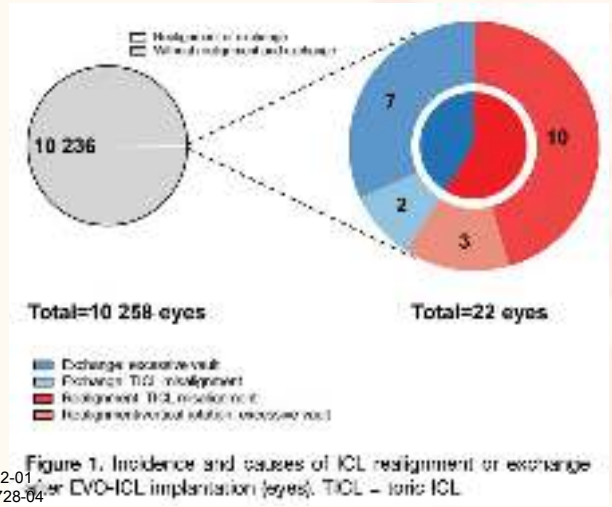


Figure 1. Incidence and causes of ICL realignment or exchange after EVO-ICL implantation (eyes). TICL = toric ICL

1. Alió JL, Toffaha BT, Peña-Garcia P, Sádaba LM, Barraquer RI. Phakic intraocular lens explantation: causes in 240 cases. *J Refract Surg*. 2015;31(1):30-35. doi:10.3928/1081597X-20141202-01
2. Galvis V, Tello A, Cuadros MO, Carreño NI, Berrospi RD, Niño CA. Causes of Explantation of Phakic Intraocular Lenses. *J Refract Surg*. 2015;31(8):566-567. doi:10.3928/1081597X-20150728-04
3. Zeng QY, Xie XL, Chen Q. Prevention and management of collagen copolymer phakic intraocular lens exchange: causes and surgical techniques. *J Cataract Refract Surg*. 2015;41(3):576-584. doi:10.1016/j.jcrs.2014.06.036
4. AlSabaani NA, Behrens A, Jastanieah S, Al Malki S, Al Jindan M, Al Motowa S. Causes of Phakic Implantable Collamer Lens Explantation/Exchange at King Khaled Eye Specialist Hospital. *Middle East Afr J Ophthalmol*. 2016;23(4):293-295. doi:10.4103/0974-9233.194076
5. Kaur M, Titiyal JS, Falera R, Sinha R, Sharma N. Indications for explant of implantable collamer lens. *Eye (Lond)*. 2018;32(4):838-840. doi:10.1038/eye.2017.307
6. Alhamzah A, Alharbi SS, Alfardan F, Aldebasi T, Almudhaiyan T. Indications for exchange or explantation of phakic implantable collamer lens with central port in patients with and without keratoconus. *Int J Ophthalmol*. 2021;14(11):1714-1720. doi:10.18240/ijo.2021.11.10
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8. Yildirim TM, Khoramnia R, Son HS, Mayer CS, Łabuz G, Munro DJ, Auffarth GU. Reasons for explantation of phakic intraocular lenses and associated perioperative complications: cross-sectional explant registry analysis. *BMC Ophthalmology*. 2021;21(1):80. doi:10.1186/s12886-021-01847-0
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10. Wei R, Li M, Aruma A, Knorz MC, Yang D, Yu Y, Wang X, Choi J, Yao P, Zhou X. Factors leading to re-alignment or exchange after ICL implantation in 10,258 eyes. *J Cataract Refract Surg*. Published online March 29, 2022. doi:10.1097/j.jcrs.0000000000000950
11. Coskunseven E, Kayhan B. Reasons for Explantations of Posterior Chamber Phakic Intraocular Lenses in 1,490 Eyes. *J Refract Surg*. 2024;40(11):e797-e803. doi:10.3928/1081597X-20240913-03

Refractive Enhancement – Introduction

- Secondary procedure to fine-tune residual refractive error
- Rationale: Achieve optimal visual acuity

Clinical Ophthalmology

Dovepress

ORIGINAL RESEARCH

Three-Year Outcomes of Implantable Collamer Lens Followed by Excimer Laser Enhancement ("Bioptics") in the Treatment of High Myopic Astigmatism

Samir Jabbour

Kraig S Bower

Patient Assessment for Refractive Enhancement

- Evaluation: Stable refraction, corneal thickness, patient symptoms
- Consider enhancement if residual error >0.75 D

Timing of Enhancement Procedures

- Wait at least 3 months post-ICL for stability
- Ensures full healing before enhancement

Techniques for Refractive Enhancement

- Options: Excimer laser (LASIK/PRK), ICL exchange, repositioning
- Laser is less invasive; exchange for larger errors

Laser-Assisted Enhancements – PRK & LASIK Considerations

- Advantages: Precise correction
- Consider corneal thickness and healing response

Lens Exchange vs. Refractive Enhancement

- Decision factors: Residual error, patient preference, corneal suitability
- Exchange is more invasive than a laser touch-up

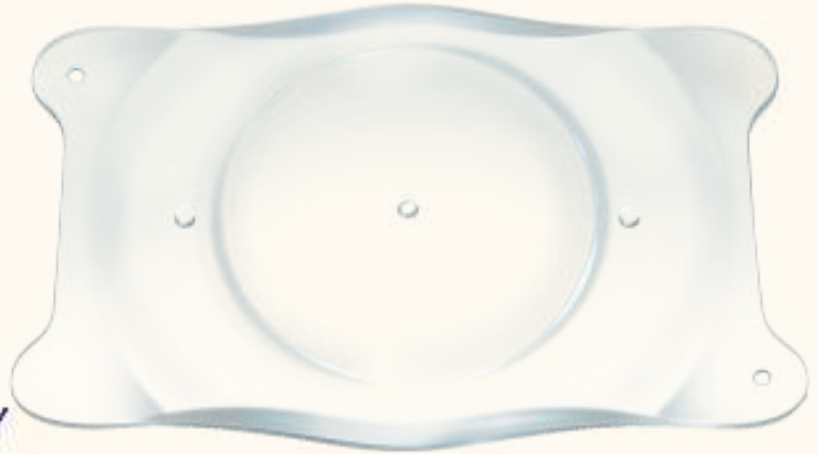
Visual Disturbances – Halos and Glare

- Causes: Lens design, post-op healing variations
- Mitigation: Proper lens placement and potential enhancements

Optical studies of the EVO ICL have demonstrated that the presence of the central port does not compromise the optical quality of the image as measured by MTF, wavefront aberrometry, or adaptive optics simulation.

One study has shown that reflected stray light from eccentric sources may result in positive dysphotopsia

1. Packer M. The Implantable Collamer Lens with a central port: review of the literature. *Clin Ophthalmol*. 2018;12:2427-2438. doi:10.2147/OPTH.S188785



Optical Effects

Authors	Finding
Shimizu et al	Provided data on **higher order aberrations** and **contrast sensitivity.** Found that the **central port had no significant impact**.
Kamiya et al	EVO implantation appears to be **essentially equivalent** in the **optical quality** variables to conventional ICL implantation. Suggesting that the **presence of the central artificial hole does not significantly affect the optical quality** and the intraocular scattering after surgery.
Huseynova et al	Reported **no significant differences** in **wavefront aberrations between EVO and conventional ICL** subjects.

Packer, M. The Implantable Collamer Lens with a central port: review of the literature. Clinical Ophthalmology 2018:12 2427–2438.

QUALITY OF VISION

- Prospective studies [1, 2] have been conducted comparing outcomes between subjects implanted with V4c (EVO) and V4b (ICL without central hole):
  - Higher Order Aberrations (HOAs)
  - Contrast Sensitivity (photopic, mesopic and mesopic with glare)
  - Subjective Symptoms (glare, halo)
- Quality of vision was equivalent between the V4c (EVO) and V4b (ICL without central hole) models

1. Shimizu K, Kamiya K, Igarashi A, Shiratani T. Intraindividual comparison of visual performance after posterior chamber phakic intraocular lens with and without a central hole implantation for moderate to high myopia. Am J Ophthalmol. 2012 Sep;154(3):486-494.
2. Kamiya K, Shimizu K, Saito A, Igarashi A, Kobashi H. Comparison of optical quality and intraocular scattering after posterior chamber phakic intraocular lens with and without a central hole (Hole ICL and Conventional ICL) implantation using the double-pass instrument. PLoS One. 2013 Jun 25;8(6):e66846.

Dysphotopsia – Overview & Patient Experience

- Definition: Unwanted visual phenomena (halos, glare)
- Often transient but can affect quality of vision

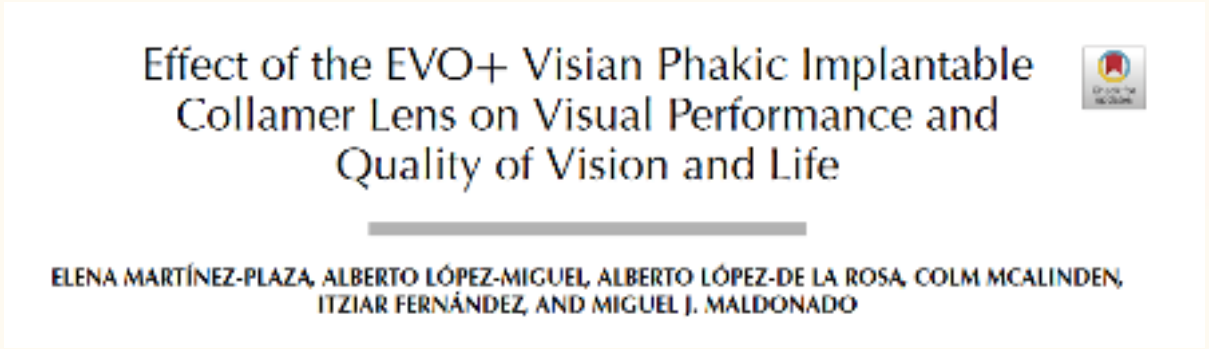
Ring-shaped dysphotopsia associated with posterior chamber phakic implantable collamer lenses with a central hole

Youngsub Eom,[1] Dae Wook Kim,[2] Dongok Ryu,[3,4,5] Jun-Heon Kim,[6] Seul Ki Yang,[3,4,5] Jong Suk Song,[1] Sug-Whan Kim[3,4,5] and Hyo Myung Kim[1]

[1]Department of Ophthalmology, Korea University College of Medicine, Seoul, South Korea
[2]College of Optical Sciences, University of Arizona, Tucson, Arizona, USA
[3]Space Optics Laboratory, Department of Astronomy, Yonsei University, Seoul, South Korea
[4]Center for Galaxy Evolution Research, Yonsei University, Seoul, South Korea
[5]Yonsei University Observatory, Yonsei University, Seoul, South Korea
[6]Joeunnuno Vision Clinic, Seoul, South Korea

Visual Disturbances – Optical Considerations

- ICLs typically provide high contrast sensitivity
- Modern designs minimize unwanted visual effects



Effect of the EVO+ Visian Phakic Implantable Collamer Lens on Visual Performance and Quality of Vision and Life

ELENA MARTÍNEZ-PLAZA, ALBERTO LÓPEZ-MIGUEL, ALBERTO LÓPEZ-DE LA ROSA, COLM MCALINDEN, ITZIAR FERNÁNDEZ, AND MIGUEL J. MALDONADO

• CONCLUSIONS: EVO+ implantation provides good mesopic visual performance, QoV, and QoL during up to 6 months follow-up. Some activities performed under mesopic conditions with glare sources may be affected during the first postoperative week. Ring-shaped dysphotopsia is negligibly bothersome 6 months after surgery.

Dysphotopsia – Overview & Patient Experience

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- Often transient but can affect quality of vision

Ring-shaped dysphotopsia associated with posterior chamber phakic implantable collamer lenses with a central hole

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[1]Department of Ophthalmology, Korea University College of Medicine, Seoul, South Korea
[2]College of Optical Sciences, University of Arizona, Tucson, Arizona, USA
[3]Space Optics Laboratory, Department of Astronomy, Yonsei University, Seoul, South Korea
[4]Center for Galaxy Evolution Research, Yonsei University, Seoul, South Korea
[5]Yonsei University Observatory, Yonsei University, Seoul, South Korea
[6]Joeunnuno Vision Clinic, Seoul, South Korea

Dysphotopsia – Management & Counseling

- Reassurance: Usually improves over time
- Options: Optical aids or enhancements for severe cases

Monitoring Protocols Post-ICL

- Recommended schedule: Day 1, Week 1, Month 1, then periodic reviews
- Monitor IOP, inflammation, lens position, endothelial count

Pharmacological Management Post-ICL

- Medications: IOP-lowering drops, topical steroids, NSAIDs
- Tailor therapy based on complications (e.g., steroid response)

Role of Steroids in Managing Inflammation

- High-frequency dosing initially, then gradual taper
- Monitor for steroid-induced IOP rise

Role of IOP-Lowering Agents

- Options: Beta-blockers, prostaglandin analogs, carbonic anhydrase inhibitors
- Rapid reduction of IOP during spikes

Surgical Interventions for Complications

- Indications: Uncontrolled IOP, significant lens malposition
- Options: Anterior chamber washout, ICL repositioning/exchange

Predictive Factors for Post-Op Complications

- Factors: Patient age, degree of myopia, anatomical measurements
- Pre-operative risk stratification minimizes complications

Risk Stratification & Patient Selection

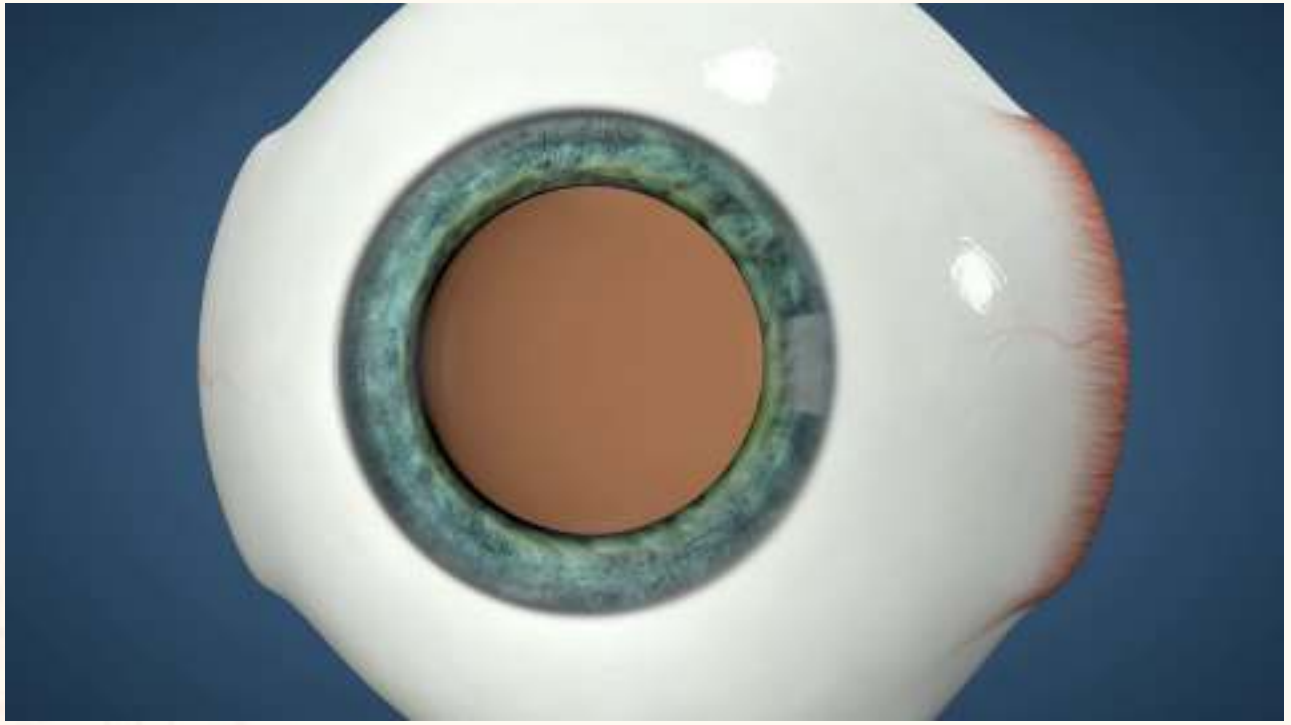
- Detailed screening: WTW, AC depth, endothelial count
- Better outcomes with proper patient selection

Preoperative Assessment and Optimization

- Comprehensive ocular exam and patient education
- Optimize outcomes and minimize risks

Enhancing Outcomes – Surgical Technique Refinements

- Innovations: Improved lens design (e.g., EVO ICL), minimal OVD techniques
- Lower complication rates and improved long-term outcomes



RESEARCH Open Access

Clinical observations of EVO-ICL implantation and changes in corneal astigmatism using a modified technique

Ying Wang, Ruibo Yang, Yue Huang, Chen Zhang, Hui Liu, Zhe Jia and Shaozhen Zhao*

One-year Observation of Safety of Implantable Collamer Lens V4c Implantation Without Using an Ophthalmic Viscosurgical Device

Zhuoyi Chen, Lingling Mu, Jing Zhao, Peijun Yao, Xiaoying Wang and Xingtao Zhou

Post-Operative Patient Education & Counseling

- Topics: Warning signs, medication adherence, follow-up schedule
- Early detection leads to better management

Follow-Up Regimens and Timing

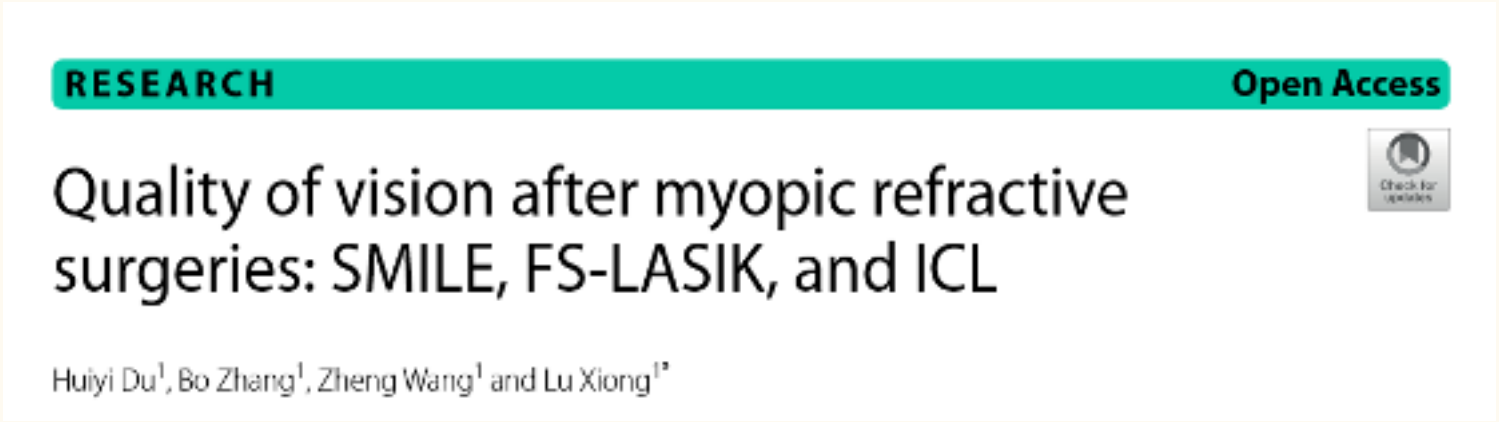
- Schedule: Day 1, Week 1, Month 1, then periodic reviews
- Focus: IOP, inflammation, lens position

Recent Advances in ICL Technology

- Innovations: Central port designs, toric models, improved materials
- Benefits: Reduced complications and enhanced visual quality

Comparative Studies – ICL vs. Other Refractive Surgeries

- ICL outcomes compared to LASIK/PRK in high myopes
- ICL offers excellent vision quality, especially for extreme prescriptions



RESEARCH Open Access

Quality of vision after myopic refractive surgeries: SMILE, FS-LASIK, and ICL

Huiyi Du[1], Bo Zhang[1], Zheng Wang[1] and Lu Xiong[1*]

Conclusions SMILE, FS-LASIK, and ICL had comparable visual outcomes. Overall, glare, fluctuation in vision, and halos were the most frequently experienced visual symptoms 3 months postoperatively. Patients with ICL implanted tended to report halos more frequently compared with SMILE and FS-LASIK. Mesopic pupil size, postoperative UDVA, and postoperative residual myopic sphere were predicted factors for reported visual symptoms.

A New Refractive Surgery Paradigm is Emerging

Matched population comparison of visual outcomes and patient satisfaction between 3 modalities for the correction of low to moderate myopic astigmatism[1]

- Patients having either **EVO Toric, FS-LASIK or ReLEx SMILE**
- 30 eyes of 30 patients in each group
- 21 to 40 years of age
- **MRSE −3.00 to −8.00 D**
- Astigmatism ≥ −0.75 D.
- 1 year follow up

1. Ganesh S, Brar S, Pawar A. Matched population comparison of visual outcomes and patient satisfaction between 3 modalities for the correction of low to moderate myopic astigmatism. Clin Ophthalmol. 2017;11:1253-63.

A New Refractive Surgery Paradigm is Emerging

Matched population comparison of visual outcomes and patient satisfaction between 3 modalities for the correction of low to moderate myopic astigmatism[1]

"All 3 groups were comparable for UDVA, DCVA, SE and Cyl correction"

EVO Toric ICL demonstrated:

- Highest efficacy index (post-op UCVA/pre-op CDVA: 1.12)
- Highest safety index (post-op CDVA/pre-op CDVA: 1.24)
- No significant change in endothelial cell density

1. Ganesh S, Brar S, Pawar A. Matched population comparison of visual outcomes and patient satisfaction between 3 modalities for the correction of low to moderate myopic astigmatism. Clin Ophthalmol. 2017;11:1253-63.

A New Refractive Surgery Paradigm is Emerging

Matched population comparison of visual outcomes and patient satisfaction between 3 modalities for the correction of low to moderate myopic astigmatism[1]

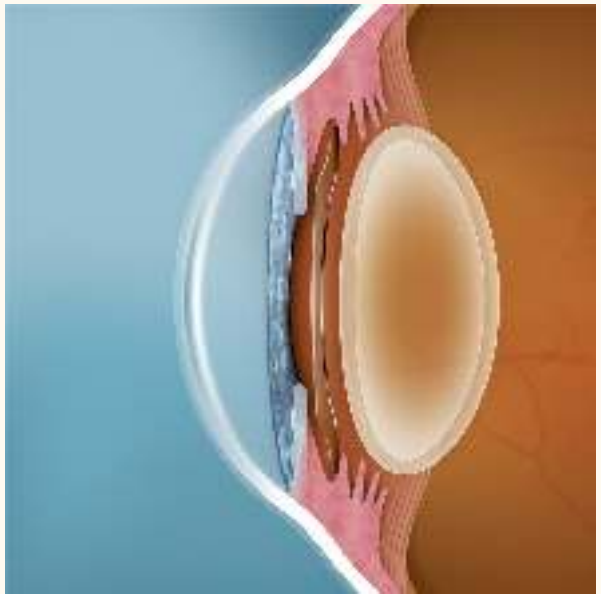
EVO Toric ICL demonstrated:

- "Postoperative dry eye was least with T-ICL" (EVO Toric)
- Improvement in contrast sensitivity
  - "Significantly Better ($p<0.05$)" when compared to ReLEx SMILE and FS-LASIK"
- "Significant improvement" (reduction) in higher order aberrations"
  - HOAs increased with ReLEx SMILE (marginal, not significant ($p=0.68$) and FS-LASIK (significant ($p=0.038$))
- "Patients reported excellent satisfaction with their quality of vision"

1. Ganesh S, Brar S, Pawar A. Matched population comparison of visual outcomes and patient satisfaction between 3 modalities for the correction of low to moderate myopic astigmatism. Clin Ophthalmol. 2017;11:1253-63.

Summary of Key Points

- ICLs provide outstanding refractive correction for high myopes
- Short-term complications are manageable with early detection
- Refractive enhancements (bioptics) fine-tune outcomes
- Emphasis on pre-operative planning, precise technique, and follow-up



Final Recommendations for Surgeons

- Pre-operative diligence, accurate ICL sizing, vigilant monitoring
- Inform patients about possible enhancements if needed

Do You Have Any Questions ?

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