

Management of Refractive Surprise with Add-On IOL Implantation Following Cataract Surgery

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Abstract

Background: To describe a case of significant refractive surprise following cataract surgery, complicated by significant postoperative anisometropia, successfully managed with a sulcus-fixated add-on intraocular lens (IOL). A 70-year-old male presented with significant postoperative myopia following cataract surgery due to an incorrect intraocular lens (IOL) power implantation. In the right eye, uncorrected visual acuity (UCVA) was 20/200, with a myopic refractive surprise of approximately -2.375 D spherical equivalent. Following implantation of a sulcus-fixated add-on IOL, uncorrected visual acuity (UCVA) improved to 20/20 with a residual spherical equivalent of approximately -0.375 D. Postoperatively, the patient achieved spectacle independence for distance vision without any significant visual symptoms and used reading glasses only for near vision. **Conclusion:** In this patient, a sulcus-fixated add-on IOL provided effective and reversible correction of a significant postoperative refractive surprise.

Keywords

Add-On IOL, Piggyback IOL, Cataract Surgery, Phacoemulsification, Refractive Surprise, Secondary IOL

1. Introduction

Cataract surgery replaces the cataractous lens with an artificial intraocular lens and usually reduces a patient's dependence on distance glasses. Some patients still end up with a refractive surprise and need glasses or further treatment to correct it. Implanting a second lens to fix this has been shown to significantly improve distance vision [1] [2].

Residual refractive error after cataract surgery can be managed conservatively, with spectacles or contact lenses, or surgically, with LASIK, PRK, IOL exchange, or supplementary IOL implantation. Which one makes sense depends on the type and size of the refractive error, whether the cornea is suitable, the condition of the primary IOL and capsular bag, and what the patient actually expects from their vision. LASIK and PRK tend to give more predictable results for small spherical errors and astigmatism, while a sulcus-fixated supplementary IOL is often the better choice for larger spherical errors. One small prospective comparative series in the review found that 92% of eyes treated with a piggyback IOL landed within ± 0.50 D of emmetropia, versus 82% for IOL exchange, though statistical significance was not reported [3].

IOL exchange doesn't always go smoothly, though. Removing an IOL from the capsular bag gets harder the longer it's been in place, since the haptics become firmly adherent to the bag over time. Sulcus-based add-on IOL implantation sidesteps that problem: it's straightforward to remove if necessary, regardless of how much time has passed [3] [4].

Achieving the intended refractive outcome is a principal goal of cataract surgery. A discrepancy between the predicted and achieved postoperative refraction, commonly termed a "refractive surprise", may cause dissatisfaction for both the patient and the surgeon and may necessitate additional treatment when the error is clinically significant [3]. Because the final refractive outcome can be influenced by multiple preoperative, intraoperative, and postoperative factors, accurate ocular measurements and appropriate application of biometric data are essential for minimizing prediction.

Accurate biometry is what gets patients the correct IOL power, but refractive surprises still happen from inaccurate measurement of axial length or corneal curvature, an incorrect lens-calculation formula, improper lens insertion, or mistakes in the lens constants used. IOL decentration or displacement can also play a role, and in rare cases, so can surgery on the wrong patient or the wrong eye [5] [6].

One case report described a patient who developed a refractive surprise after an otherwise uneventful phacoemulsification, caused by a mislabeled IOL; IOL exchange surgery brought the patient back to 20/20 best-corrected visual acuity (BCVA) [7].

Add-on IOL implantation is considered safe when a primary IOL is already in the capsular bag and the anterior chamber depth is at least 3 mm. In one study, every add-on implantation went uneventfully, with none of the expected intraoperative or postoperative complications like no capsular tears, hyphema, iris chafing, inflammation, or elevated intraocular pressure, and no long-term problems, such as interlenticular opacification, pupillary optic capture, pigment dispersion syndrome, or secondary pigmentary glaucoma turned up on follow-up [8].

None of this guarantees a perfect result; the refractive surprises can still occur, whether due to measurement error or because the lens settles in an unexpected

position within the eye (effective lens position). Sulcus-fixated add-on IOLs offer a reversible way to correct them [2] [9].

2. Case Presentation

A 70-year-old male presented with bilateral nuclear cataracts and underwent uneventful phacoemulsification in both eyes. His ocular history was negative for previous corneal refractive surgery, glaucoma, or uveitis, and preoperative endothelial assessment of the right eye showed no clinically significant abnormality. Preoperative biometry (Topcon Aladdin; **Figure 1**) was performed using the Barrett Universal II formula, with emmetropia targeted in both eyes, with an Alcon Clareon AF CNA0T0 IOL (A-constant 119.330) selected at a planned power of +19.0 D per eye. The left eye was operated on first, with implantation of a +19.0 D Clareon AF IOL, and the patient achieved an uncorrected visual acuity (UCVA) of 20/20 one day postoperatively.

Two weeks later, the right eye was operated, but an IOL of +22.5 D was implanted instead of the intended +19.0 D. On the first postoperative day, the patient reported dissatisfaction with their vision: UCVA was 20/200 in the right eye and 20/20 in the left, while best spectacle-corrected visual acuity was 20/20 in both eyes.

The anterior and posterior segments were unremarkable, with good IOL position in the capsular bag. We discussed conservative options with the patient, including monovision or a contact lens, but he preferred surgical correction.

Postoperative refraction, obtained six weeks after right-eye cataract surgery once refractive stability had been confirmed, was: right eye (RE) -2.25 D sph/ -0.25 D cyl $\times 49^\circ$; left eye (LE) $+0.25$ D sph/ -0.25 D cyl $\times 0^\circ$. The refractive surprise in the right eye was significant enough to cause real dissatisfaction. The patient wanted spectacle independence, so secondary IOL implantation was planned. It was later confirmed that the surprise came from selecting the wrong IOL power at the time of implantation, not from a preoperative biometric error.

A detailed slit-lamp examination ruled out capsular distension syndrome and a tilted or subluxated IOL.

Once the residual myopic error was confirmed, a dilated fundus exam excluded posterior segment pathology and anterior chamber depth (ACD) was measured at ≥ 3.0 mm. Three months after the primary right-eye surgery, we performed secondary piggyback IOL implantation: a -3.5 D Sulcoflex Aspheric supplementary IOL (Rayner Sulcoflex), calculated from the stabilized postoperative residual refraction using the manufacturer's recommended method, was implanted in the ciliary sulcus to correct the residual myopia. Both haptics were confirmed correctly positioned within the ciliary sulcus, with the optic centered behind the pupil and no evidence of optic capture. Viscoelastic was thoroughly removed from the anterior chamber at the end of the procedure, and intraocular pressure was monitored postoperatively with no elevation observed.

The postoperative course was uneventful. UCVA was 20/20 in both eyes.

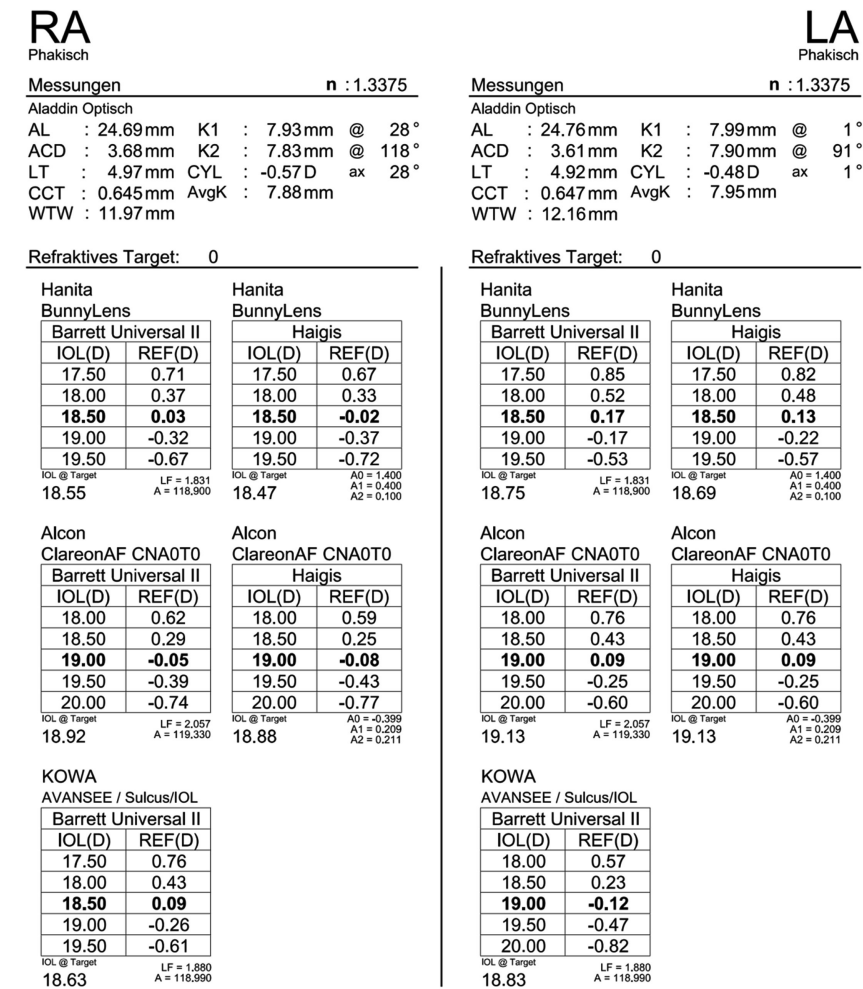
Post-secondary-surgery refraction came out to: right eye -0.25 DS/ -0.25 DC $\times 50^\circ$; left eye $+0.25$ DS/ -0.75 DC $\times 15^\circ$. Final UCVA was 20/20 in both eyes.

Outcome and Follow-Up: At the one-year follow-up after supplementary IOL implantation, the clinical examination remained unremarkable. The sulcus-fixed supplementary IOL was well positioned without interference with iris movement. No pigment dispersion was observed; the anterior chamber remained deep, and gonioscopy findings were normal (Figure 2).

Intraocular pressure in the right eye was 16 mmHg. Central corneal thickness in the right eye was 630 μm , compared with 645 μm preoperatively, with no post-operative increase from baseline (Figure 3). Endothelial cell density was 2073 cells/ mm^2 , with cell size and morphology remaining within normal limits (Figure 3).

The patient remained spectacle-independent for distance vision and reported no significant visual symptoms, including glare or halos. Reading glasses were used for near vision.

Given the stable clinical course, continued annual follow-up was advised.



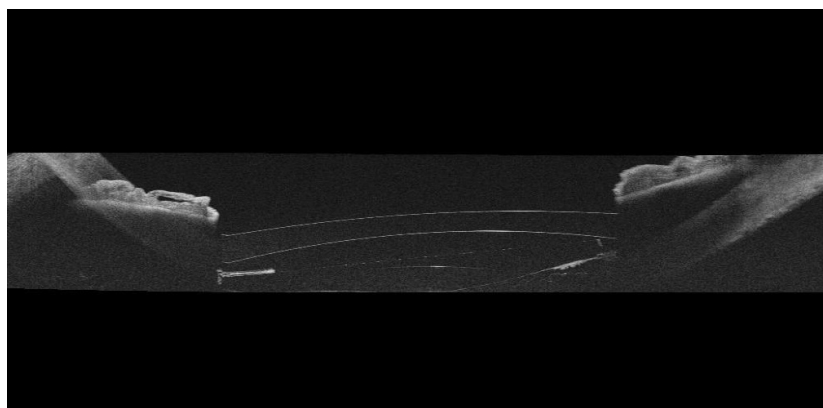


Figure 2. Anterior-segment OCT at the one-year follow-up demonstrating stable positioning of the supplementary sulcus-fixated IOL anterior to the primary posterior-chamber IOL, with adequate interlenticular separation and no apparent iris contact.

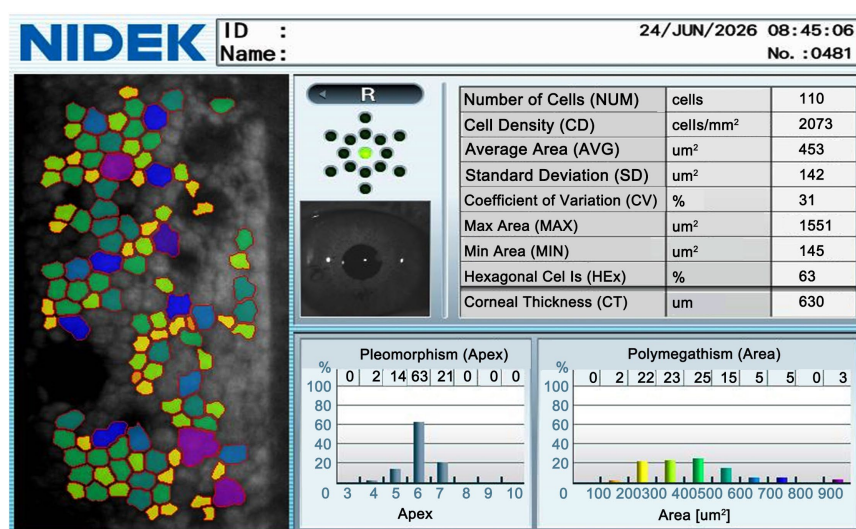


Figure 3. Specular microscopy of the right eye at the one-year follow-up showing an endothelial cell density of 2073 cells/mm² and a central corneal thickness of 630 μm.

3. Discussion

Refractive surprise after cataract surgery is something most surgeons run into at some point, and it can be disappointing for both the patient and the surgeon. Fixing it often means going back in to exchange the IOL, but that second procedure carries its own risks such as corneal edema, posterior capsule rupture, vitreous loss, and unsatisfactory vision. Beyond the clinical stress, it can even lead to legal exposure for the surgeon [6] [10].

Accurate postoperative refractive assessment is therefore essential when evaluating a refractive surprise. Handheld autorefractometers have been investigated for measuring refraction following cataract surgery [11].

In the present case, the residual refractive error was assessed after refractive stability had been achieved six weeks postoperatively, and this measurement was used to calculate the power of the supplementary IOL.

In appropriately selected eyes, implantation of a supplementary sulcus-fixated IOL offers a less invasive and potentially reversible alternative to exchanging a well-positioned primary IOL [2] [9].

This approach was selected in the present case to correct the residual myopic error while avoiding removal of the primary in-the-bag IOL.

Multifocal IOLs disappoint a fair number of patients, usually because of residual vision problems such as astigmatism, especially, but also subtle optical aberrations like coma or spherical aberration, naturally large pupils, or a lens that isn't quite centered or level. Posterior capsule opacification, dry eye, and simply struggling to adapt to the new way of seeing can add to it. The net effect is reduced contrast sensitivity and visual side effects like glare, halos, or starbursts at night, and it only gets more complicated if that patient later needs an additional IOL for some other reason [12] [13].

If the IOL shifts forward, you get a myopic change; shift back, and it's hypermetropic. Tilt or decentration brings astigmatism and spherical aberration into play [5]. And every so often, rarely, the wrong lens is packaged or labeled and ends up in the eye [6] [7].

Add-on IOL implantation isn't right for every eye. It's a poor fit for eyes with a history of complicated cataract surgery, particularly aphakic cases or ones where the primary IOL already sits in the sulcus; Furthermore, it's contraindicated with significant zonular instability (advanced pseudoexfoliation syndrome, zonular dialysis, pseudophacodonesis), dense secondary cataract, chronic uveitis, active rubeosis iridis, or central corneal opacities [4].

Patient selection matters just as much. Someone who's likely to struggle with the optical quirks of an add-on lens, such as a shorter reading distance, more image magnification, needs a cautious conversation up front, since what they expect and what the implant actually delivers can be two different things [4].

In those cases, sulcus implantation of a conventional three-piece IOL, or a purpose-designed supplementary lens like the Rayner Sulcoflex, are reasonable alternatives; both have shown favorable results and are worth considering when appropriate [2] [9].

4. Conclusion

The sulcus-implanted secondary IOL used here looks like a viable way to correct residual refractive error after primary IOL implantation. In this patient, the refractive surprise came down to selecting the wrong IOL power at the time of implantation, not a manufacturer labeling error, as wrong-lens selection is a recognized, if uncommon, cause of postoperative refractive surprise [6]. The case makes the point that intraoperative IOL-power verification matters and that sulcus-fixated add-on IOL correction is a solid fallback when that verification fails.

5. Limitations

This report is based on a single patient, so it can't establish comparative effective-

ness or general safety. Follow-up ran to one year after the supplementary IOL implantation. We didn't perform wavefront aberrometry, corneal topography, or contrast-sensitivity testing, so subtle optical effects beyond visual acuity, refraction, corneal thickness, and endothelial assessment couldn't be evaluated.

Consent for Publication

Written informed consent was obtained from the patient for publication of this case report and any accompanying clinical images.

Author Contributions

Abdelhamid Ghunaim: conception of the case report, clinical management, data collection, literature review, and drafting of the manuscript.

Mohammed Allawi: literature review, interpretation of clinical findings, and critical revision of the manuscript.

Ali Zimmermann: surgical care of the patient, clinical review, and critical revision of the manuscript.

All authors read and approved the final manuscript.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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