

# EYES ON THE SKY

Surgeons debate how to get a 78-year-old patient back in the cockpit.

**BY KARL G. STONECIPHER, MD; PALOMA ARIAS-GOMEZ DE LIANO, MD; H. BURKHARD DICK, MD, PHD, FEBOS-CR;**

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## CASE PRESENTATION

A 78-year-old man presents for a refractive surgery evaluation. The patient's history is significant for Russian-style four-incision radial keratotomy (RK) with two astigmatic keratotomy incisions in 1992, bilateral automated lamellar keratoplasty (ALK) in 1995, and a PRK enhancement in each eye in 1998. Five years ago, he underwent uneventful bilateral cataract surgery with a monofocal 8.00 D AcrySof IQ lens (model SN60WF, Alcon). The posterior capsule in each eye is intact.

When evaluated at 3 PM, the patient's manifest refraction is  $-3.75 +5.50 \times 160^\circ = 20/20$  OD and  $-4.75 +2.25 \times 027^\circ = 20/20$  OS. When

evaluated at 7:30 AM, his manifest refraction is  $-3.25 +6.25 \times 163^\circ = 20/20$  OD and  $-3.50 +2.50 \times 031^\circ = 20/20$  OS (Figures 1 and 2).

A slit-lamp examination finds four RK incisions, two astigmatic keratotomy incisions, and an ALK flap in each eye. The optical zone of each RK treatment is 3.0 mm. The findings are otherwise unremarkable.

The patient is a pilot and would like to resume flying. How would you proceed?

—Case prepared by Karl G. Stonecipher, MD

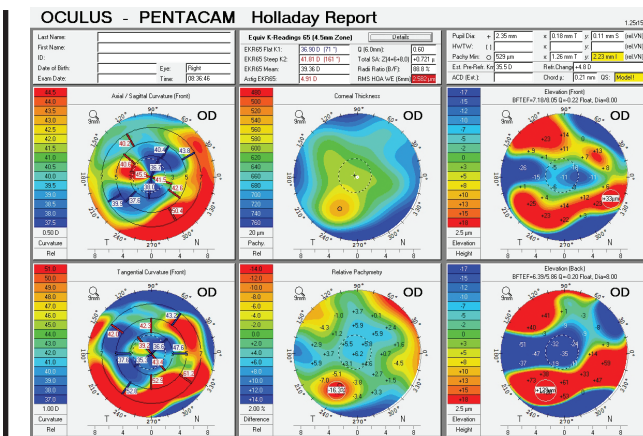


Figure 1. Preoperative Holladay report on the Pentacam (Oculus Optikgeräte).

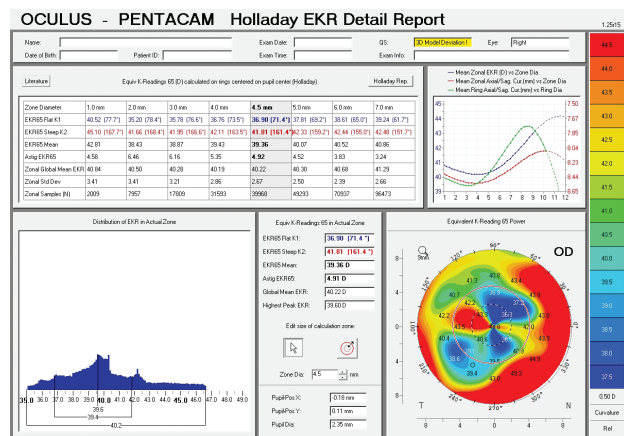


Figure 2. Preoperative Holladay equivalent keratometry readings detail report.



**PALOMA ARIAS-GOMEZ DE LIANO, MD;  
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Additional examinations are required, including a detailed evaluation for dry eye disease (DED), endothelial cell count, and aberrometry. Given the patient's age and history of multiple ocular surgeries, our approach would be as conservative as

possible to minimize additional surgical manipulation. Aggressive procedures would be avoided, and solutions that ensure safety and preserve the eye's functional integrity would be prioritized.

In patients who have a history of RK, refractive fluctuations suggest corneal hydration and biomechanical changes. Our primary goal would therefore be to achieve corneal and thus refractive stability.

A scleral contact lens could improve the patient's refraction and reduce corneal instability. By creating a hydrated space between itself and the cornea,

the lens could greatly improve his DED symptoms, enhance his ocular comfort, and improve his vision.

CXL would be another option. Although not commonly performed in post-RK cases, the procedure could help stabilize corneal biomechanics.

If the patient is dissatisfied with noninvasive solutions, a small-aperture add-on mask (XtraFocus, Morcher) could be implanted in the ciliary sulcus.<sup>1</sup> This strategy would render primary IOL explantation and further modifications of the cornea unnecessary. The small-aperture technology, moreover, would benefit the

patient by blocking peripheral aberrations. Given his age, pseudophakia, myopia, and probable decreased sensitivity to crepuscular contrast, the patient's ability to adapt to low-light conditions would be carefully assessed before surgery.

Owing to the complexity of the case, an aviation medical examiner would be consulted to ensure that any intervention meets certification standards. Postoperative stability would be confirmed before the patient resumes flight duties.



**LUKE REBENITSCH, MD**

This case highlights the challenge of hitting a refractive target in patients who underwent early refractive procedures such as RK and ALK or PRK using a small optical zone. Thankfully—and somewhat surprisingly—the patient's corrected distance visual acuity is 20/20 OU, albeit with an expected diurnal fluctuation in manifest refraction. If he desires a third-class medical certificate for aviation, his visual acuity in each eye must be 20/40 or better at both distance and near—preferably without spectacle correction.

Given the type and extent of the patient's previous refractive surgery, hitting the refractive target he desires with laser vision correction would be difficult, and he would continue to experience diurnal fluctuations even if the refractive target is achieved. In situations like this, I often recommend the implantation of a Light Adjustable Lens (LAL; RxSight). The US FDA approved the LAL for the treatment of up to 2.00 D of cylinder, but the lens may be used off-label to correct up to 3.00 D. The point is moot, however, because a far greater amount of cylinder is present in the patient's right eye.

The patient would be counseled on his options as well as their risks and benefits. The astigmatism in his right eye would be debulked with a wavefront-optimized

LASIK procedure. If he is satisfied with the result after 3 to 6 months, he could wear glasses when flying. If he is dissatisfied with the surgical outcome, both IOLs would be exchanged for an LAL, which would likely provide him with 20/40 or better uncorrected distance and near visual acuity in each eye despite diurnal fluctuation.



**PRIYANKA SOOD, MD**

I admire the patient's desire to maintain his independence and appreciate his need for excellent quality of vision to fly a plane.

After multiple corneal incisional procedures, high irregular astigmatism is to be expected. The patient's corneal curvature fluctuates throughout the day but to a lesser extent than I would have anticipated based on his surgical history. That his UCVA is 20/20 OU is amazing.

The patient would be fitted with a scleral contact lens. This would be the least invasive management strategy, and it might offer him the best possible quality of vision. It would also eliminate fluctuations in vision, and future changes in the shape of his corneas would not affect his refractive error. Many elderly individuals feel concerned about their ability to insert and remove scleral lenses, but if this patient has the manual dexterity to fly a plane, he likely can handle scleral contact lenses. This would therefore be my preferred strategy.

I would hesitate to recommend PRK because his corneas are unstable, progression to frank ectasia is possible, and the patient is at increased risk of postoperative haze formation.

If he desires greater spectacle independence, a Toric ICL (STAAR Surgical) would be an option, but cost might be a factor. I am not convinced that an IOL exchange would be in his best interest, because the risks associated with the procedure would

be high and diurnal fluctuation in his refraction would persist postoperatively.



**FARRELL C. "TOBY" TYSON, MD, FACS**

Extensive corneal surgery has led to refractive instability and inaccurate targeting. My first impulse is to avoid additional corneal treatment.

The right eye has a large amount of cylinder and a spherical equivalent that varies from -1.00 to -0.13 D. Because the axial length is likely great, a custom-ordered plano LAL would be implanted in the sulcus. The implant could be removed if it proves ineffective. At this power, moreover, most of the treatment could address the cylinder. The left eye has a lower and more stable magnitude of astigmatism, but the spherical equivalent varies from -3.63 to -2.25 D. A customized -3.50 D LAL would be placed in the sulcus. My expectation is that, after refractive stability is confirmed in both eyes, the intraday variability would decrease and a result near plano would be achieved in both eyes.

As much of the astigmatism as possible would be debulked during the first light adjustment of the LAL. The patient's residual ametropia and intraday fluctuations would then be evaluated. Further refractive shifts experienced by the patient as he ages would typically be hyperopic. The LAL would therefore be fine-tuned until the intraday refractive variation ranges from -0.25 to -1.00 D.



**WHAT I DID: KARL G. STONECIPHER, MD**

After considering all his options, the patient elected to undergo aggressive DED treatment followed by

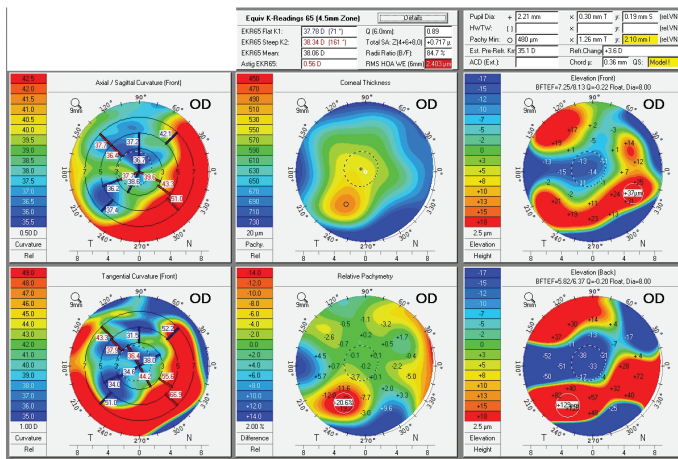


Figure 3. Postoperative Holladay report on the Pentacam

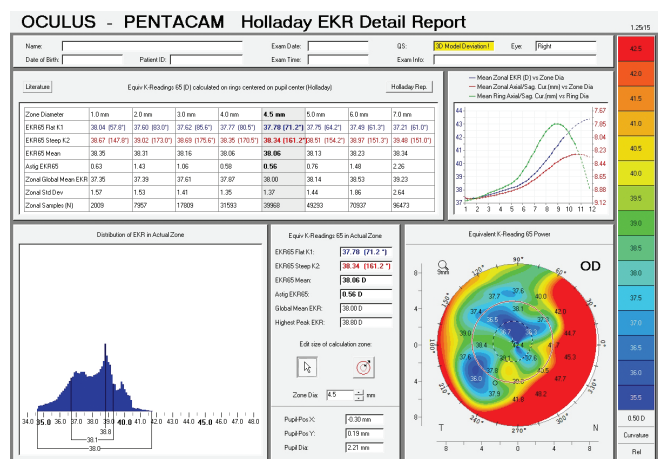


Figure 4. Postoperative Holladay EKR detail report.

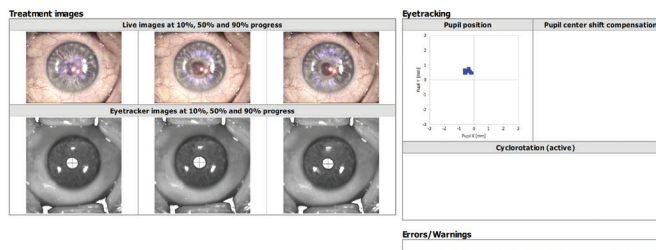


Figure 5. Treatment pattern and fixation.

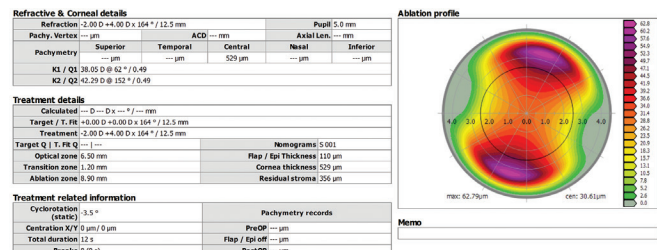


Figure 6. Treatment programmed into the WaveLight EX500 laser (Alcon).

wavefront-optimized LASIK. A contact lens trial was not entirely successful. Several morning and evening refractions were performed, and the patient was asked to determine the best one. A pair of glasses was then made for him to wear.

The patient's primary aim was to reduce his anisometropia and dependence on glasses. The nomogram-adjusted treatment of -2.00 +4.00 x 164° was performed on the right eye. Three months after surgery, his UCVA was 20/20-2 OD, and his BCVA was 20/20+1 OD with a manifest refraction of +0.50 +0.50 x 144°. The patient is considering undergoing treatment of the left eye. He is happy wearing glasses to fly and enjoys spectacle independence for most of his day.

To my mind, the teaching point of this case lies in the preoperative evaluation. In challenging situations like this one, ocular surface disease must be treated aggressively. The next step is to determine—with either a contact lens trial or a glasses prescription—the patient's happiest refraction during the day and adjust for it.

The patient and I discussed the option of CXL before refractive surgery, but he rejected the intervention (Figures 3–6). ■

1. Trindade C. Development of a pinhole implant. *XtraFocus. Cataract & Refractive Surgery Today Global Europe Edition*. February 2016. Accessed January 8, 2024. <https://crstodayeurope.com/articles/2016-feb/development-of-a-pinhole-implant-xtrafocus>

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