

Aphakia After Repair of Ruptured Globe

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CASE PRESENTATION

A 19-year-old man suffered a traumatic rupture of the left globe. He underwent a repair of the full-thickness corneal laceration and removal of the crystalline lens 1 year before presentation. He is contact lens intolerant and would like to consider his surgical options. The patient's BSCVA is 20/60 with a manifest refraction of +12.75 -2.00 X 108, but his BCVA with a rigid gas permeable lens is 20/25. His examination is remarkable for aphakia and a 3.5-mm irregular corneal scar inferotemporal to the optical center of his cornea (Figure 1). The remainder of his examination is unremarkable (Figures 2-6).

What are the surgical options for his cornea and aphakia?



Figure 1. Corneal scar in the patient's left eye.

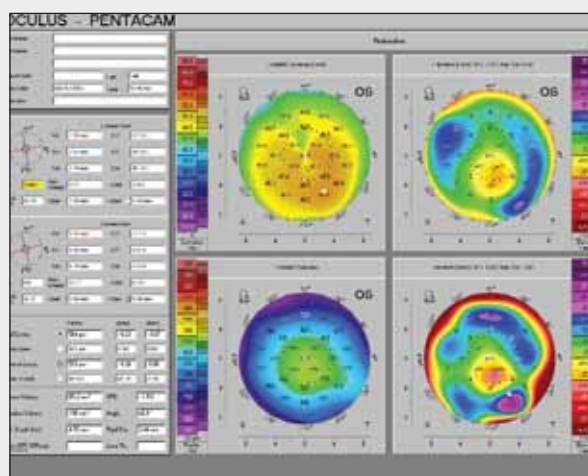


Figure 2. Pentacam refractive four maps for the patient's left eye.

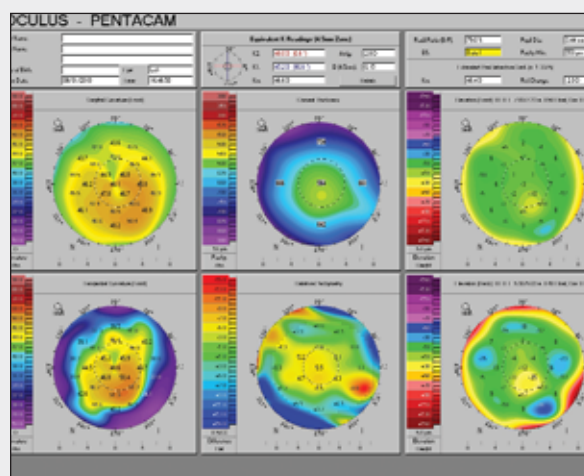


Figure 3. Pentacam Holladay report for the patient's left eye.

(Figures 1-6 courtesy of Bonnie A. Henderson, MD.)

CASE PRESENTATION (CONTINUED)

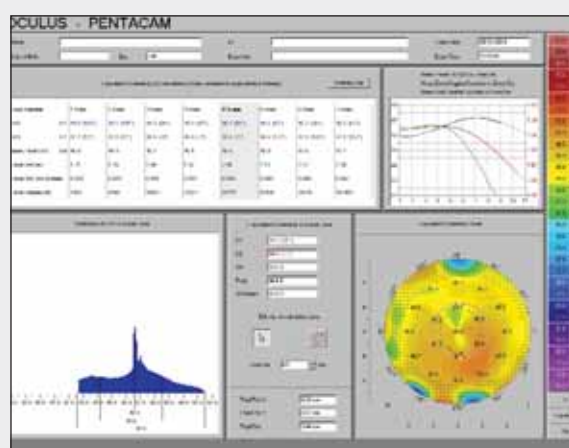


Figure 4. Pentacam Holladay detail for the patient's left eye.

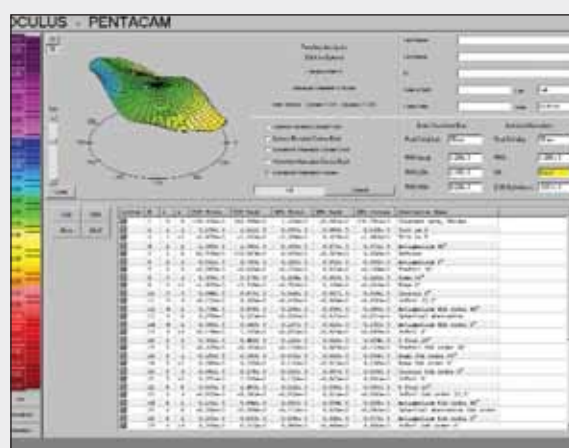


Figure 5. Pentacam Zernike analysis for the patient's left eye.

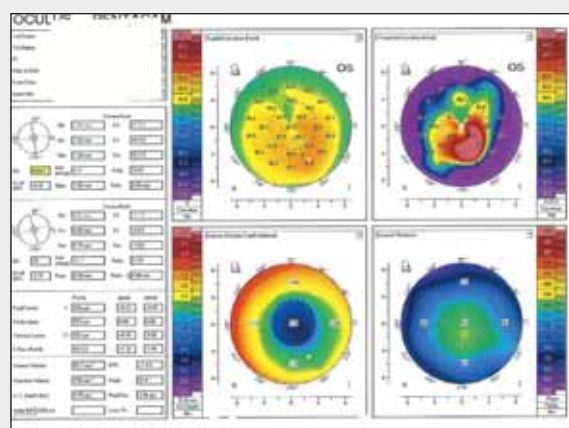


Figure 6. Pentacam four maps for the patient's left eye.

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On first examination, an evaluation with the Pentacam Comprehensive Eye Scanner (Oculus, Inc., Lynnwood, WA) showed significant positive islands on both the anterior and posterior surfaces, abnormal pachymetric progression, and a progression index greater than 2.0. These are all typical findings in eyes with ectatic disease (Figure 7).

Because recommendations for treatment would likely differ for a young man with a progressive disease (keratoconus), it is essential to rule out preexisting keratoconus (ie, patients with keratoconus can undergo trauma). An examination of this patient's other (right) eye reveals no evidence of any ectatic degeneration, strongly suggesting that the changes in his left eye are traumatic in origin (Figure 8).

A review of the Scheimpflug image of the patient's left eye reveals the full-thickness corneal scar corresponding to

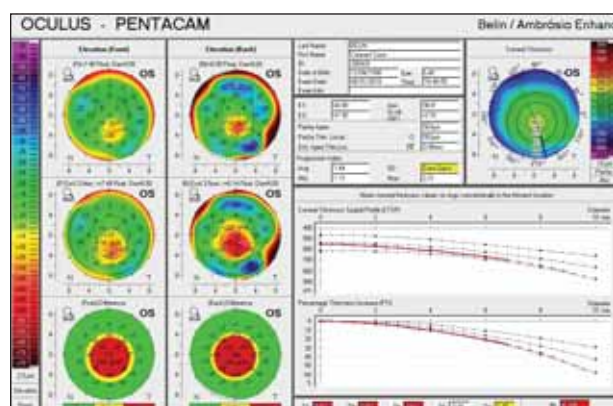


Figure 7. The Pentacam's Belin/Ambrosio Enhance Ectasia Display for the left eye shows positive islands of elevation on the anterior and posterior corneal surfaces, abnormal pachymetric progression graphs, and a progression index (maximum) of 2.21. These findings are more than five standard deviations from the norm.

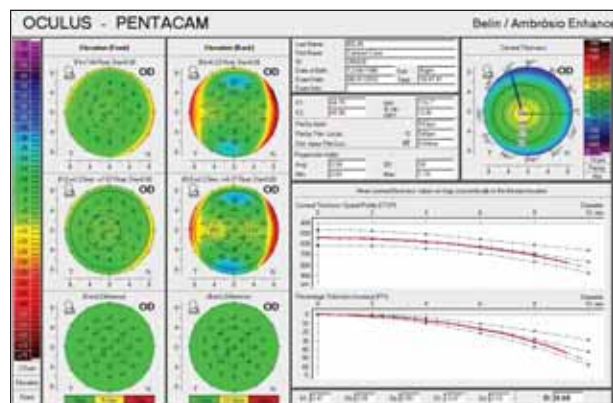


Figure 8. The same display as in Figure 7 of the patient's uninvolved right eye shows all normal parameters (elevation and pachymetric).

(Figures 7-11 courtesy of Michael W. Belin, MD)

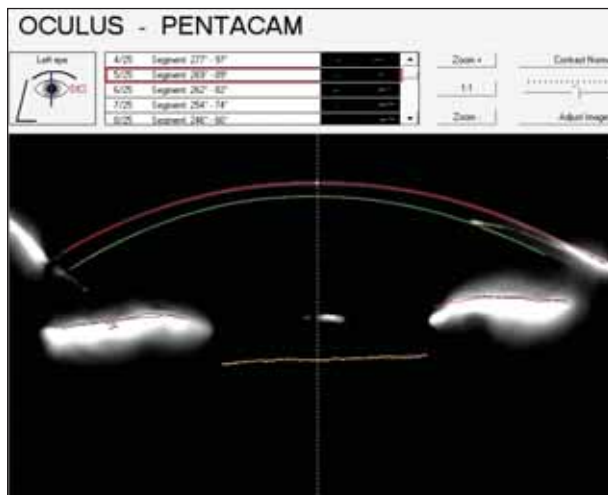


Figure 9. Scheimpflug cross-sectional image (vertical) shows what appears to be a relatively normal anterior segment with a normal iris and no obvious angle recession. The corneal injury can clearly be seen as a full-thickness laceration.

the islands of positive elevation as well as what appears to be a normal iris and angle (no recession) (Figure 9). What we have, then, is a young man with unilateral aphakia, corneal scarring, decreased BSCVA, and contact lens intolerance. The etiology of his reduced spectacle vision is his irregular astigmatism, as seen in Figure 10, which shows the total corneal refractive power by ray tracing. The map demonstrates the nonorthogonal hemi-meridians.

Contact lens intolerance is like Penicillin allergies: patients frequently report them, but few actually have these problems. This patient's simulated contact lens fluo-

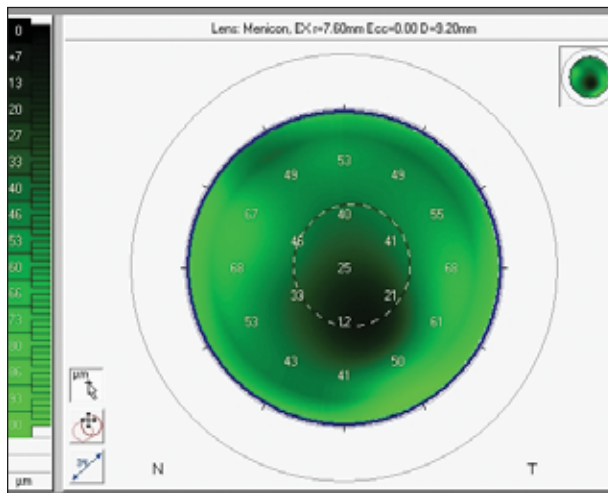


Figure 11. The simulated rigid contact lens fluorescein pattern reveals an inferior area of touch corresponding to the area of positive elevation. Overall, the pattern is acceptable, however, and suggests that refitting should be attempted.

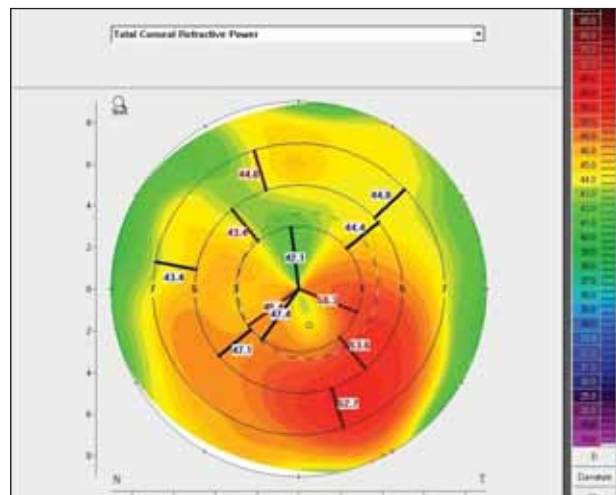


Figure 10. The total corneal refractive power map analyzes both anterior and posterior corneal surfaces and thickness with ray tracing. The display shows irregular astigmatism with significant distortion of the principal meridians.

rescein pattern shows the expected area of touch over the elevated scar but an otherwise acceptable fit (Figure 11). There is a high probability that his contact lens intolerance related more to his aphakic status than his corneal irregularity. Aphakic rigid lenses are thick and heavy and often do not center well due to their weight.

I would implant a secondary IOL (most likely, an ACIOL, assuming normal angles and IOP) and subsequently attempt to have him refit with a rigid contact lens. Many "contact lens intolerant" patients can be successfully refit, and there is a strong likelihood of success in this case.^{1,2} If this patient subsequently turns out to be contact lens intolerant, one could consider phototherapeutic keratectomy based on the anterior elevation map or a topography-guided ablation in hopes of improving his BSCVA or increasing his contact lens tolerance.

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This patient's contact lens intolerance should be investigated and, if appropriate, corrected with a new lens or perhaps a less invasive procedure that will allow him to recommence wearing aphakic contact lenses.³ Phototherapeutic keratectomy would probably not be helpful in this regard.

Rotational autokeratoplasty moves the area of scarring farther from the pupil while preserving the endothelium.⁴ A contact lens is often needed, however, to manage post-operative astigmatism in these patients.

Deep anterior lamellar keratoplasty or crescent-shaped lamellar keratoplasty are options that also spare the endo-

thelium. Although the “big bubble” technique is reported to achieve a better visual outcome than manual stromal dissection, the former can be compromised by preexisting breaks in Descemet’s membrane from hydrops or, of concern in this case, previous trauma.⁵

Partial-thickness procedures are becoming more popular than penetrating keratoplasty (PKP), but the latter remains an option for patients with a full-thickness injury accompanied by scarring and a high degree of irregular astigmatism.⁶⁻⁸ A large or eccentric graft would be required to incorporate peripheral scarring, a requirement that increases the risk of rejection and, in some cases, glaucoma.

Managing this patient’s aphakia would ideally take advantage of residual capsular support with a sulcus-supported monofocal IOL, a better option than an angle-supported ACIOL due to his age. Suture fixation to the iris or a transscleral approach is an off-label option if capsular support is insufficient, but the suture may require repair or replacement in the future as it hydrolyzes and breaks.⁹

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The patient should be informed of the likely outcome of any surgery. After a combination of implant surgery and corneal refractive procedures, his visual acuity is not likely to be 20/20. A rigid gas permeable contact lens, hybrid lens, or scleral lens will probably improve his visual acuity postoperatively and could be tried prior to surgery. Using one of these lenses would buy time for the patient, as there will almost certainly be better surgical options in the future. In the United States, in particular, our options are limited. US surgeons do not have toric IOLs for aphakic patients, and topography-guided excimer laser treatments are not approved by the FDA.

Optimal surgical management will probably require a combination of lenticular and corneal surgery. Initially, I would opt for a PCIOL. In a patient this age, I prefer to sew a lens with eyelets on the haptics to the sclera using 9-0 Prolene (Ethicon, Inc., Somerville, NJ). I do not place the knots under a flap, which might increase the chance of the suture’s “cheese wiring” through the thinner sclera under the flap. I prefer a girth hitch attachment of the suture to the eyelet rather than a single loop that might erode more easily with years of movement by the implant. I would select the IOL’s power based on the estimated corneal power of approximately 46.50 D. Aiming for some myopia will facilitate subsequent corneal refractive surgery. Sewing the IOL to the iris or placing an ACIOL are also acceptable options.

Topography-guided PRK could reduce the asymmetric steepening. I would perform PRK (based on wavefront

measurements, if possible), followed by an application of mitomycin C, to treat the patient’s residual refractive error.

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The decrease in the patient’s BCVA is due to irregular astigmatism rather than actual scarring of his central cornea, given the improvement in his visual acuity with a hard contact lens refraction. A rigid gas permeable contact lens would be the ideal solution for him. The patient must be advised and motivated to use the lens, and he should work with a contact lens fitter who has experience with these types of cases. Surgery to correct the irregular astigmatism should only be considered if the patient becomes significantly intolerant of contact lenses and after every attempt has been made to refit him.

Correction of the irregular astigmatism using the excimer laser is a possibility. Wavefront-guided PRK will not be successful in this case, because aberrometers will certainly fail to capture reliable data through the distorted cornea. On the other hand, topography-guided PRK could help to smooth the irregular corneal surface and rehabilitate the patient’s BCVA. Results cannot be guaranteed, because corneal scars ablate at different rates than adjacent normal corneal tissue, which can lead to unexpected results. One must bear in mind, however, that the worst-case scenario after a topography-guided PRK would be a need for PKP, which is the patient’s other alternative given his decision to seek surgery. The insertion of an intrastromal ring could be another technique to regularize the cornea. Adding mass to the superonasal cornea could neutralize the steepness caused by the patient’s inferotemporal corneal scar.

If the aforementioned approaches failed to correct the patient’s BCVA, then PKP would be the last resort. His full-thickness scar and history of trauma and aphakia take away the advantages and practicality of performing a lamellar keratoplasty and make a full-thickness transplant a more logical option.

To correct the patient’s aphakia, an IOL could be sutured to the sclera at the time of the PKP, owing to the absence of capsular support. On the other hand, if the more conservative measures discussed were successful and the patient did not require a PKP, then an iris-fixed IOL or a three-piece IOL sutured to the iris would be better options, because they require a smaller incision for implantation. The surgeon should perform an anterior vitrectomy along with the secondary IOL’s insertion and remove any vitreous bands in the anterior chamber, which will otherwise increase the patient’s risk of developing cystoid macular edema and retinal detachment. ■

(Continued on page 35)

(Continued from page 32)

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