



SPECIALTY LENSES FOR VISION REHABILITATION



A primer on fitting patients with irregular corneas using rigid gas permeable and scleral lenses.

BY JESSICA O. YU, OD, FAAO, FSLs

Fitting irregular corneas can be one of the most rewarding, albeit at times challenging, clinical experiences. Each case often has a unique presentation, and thus, it's important to consider each patient's ocular history, specific needs, and lifestyle goals before choosing from the spectrum of tools

in our armamentarium. Management options typically include photorefractive or phototherapeutic keratectomy, lamellar keratoplasty, penetrating keratoplasty, keratoprosthesis, and rigid lenses.

When fit properly and comfortably, rigid gas permeable (RGP) and scleral lenses can offer a less invasive and

cost-effective way to improve visual acuity, which can help to delay or avoid surgical intervention and associated risks, while still improving quality of life.¹

EFFECT OF CORNEAL SCARRING ON VISION

A normal cornea has a prolate shape, meaning it is steepest in the center and flattening progressively towards the periphery. Whether the cornea is altered by trauma, surgery, or infectious disease that causes scarring or opacities, the resultant irregular astigmatism ultimately affects the clarity and quality of the patient's vision. The disorganization of the new collagen fibers post-trauma or post-infection scatter light as a nontransparent scar is formed, which frequently decreases BCVA as a result of the increased light scatter and corneal surface irregularities secondary to the scarring.¹

Subjective complaints from patients with corneal scarring can include reduced visual acuity, ghosting, glare sensitivity, and diplopia or doubling of images.² Some patients may also experience reduced contrast sensitivity, with increased difficulty in mesopic conditions.³

Because these cases tend to be unilateral in nature, anisometropia and even aniseikonia often occur as a result relative to the fellow eye.⁴ This vision impairment can have dramatic effects on lifestyle, including the patient's ability to work and drive, and can cause binocular visual discomfort.

CHALLENGES IN CORRECTING IRREGULAR ASTIGMATISM

Patients with scarred corneas tend to have high amounts of irregular astigmatism that cannot be adequately corrected with spectacle lenses or soft contact lenses due to the scatter of light rays and minimal improvement in BCVA. The location and density of the corneal scar directly affects how successful the individual modes of correction are (Figure 1). Patients with post-infectious scars or irregularities involving the pupillary axis, however superficial, may only experience minimal benefit from vision rehabilitation. The opacity creates excessive glare and scatter, and despite objective improvement in BCVA, a lack of visual clarity often persists subjectively for the patient. In contrast, scars located *outside* of the pupillary axis, even if denser or deeper than a scar *involving* the pupillary axis,

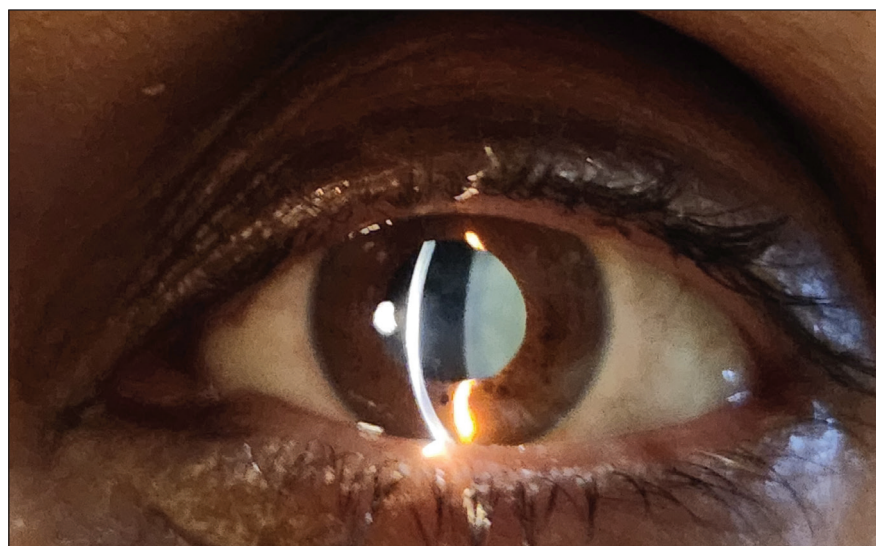


Figure 1. The central scarring shown here is secondary to a corneal ulcer. Although the scarring is not very dense, because it is more central to the pupillary axis, the patient's BCVA was 20/30.

tend to be more amenable to vision rehabilitation.

Another notable variable is corneal higher-order aberrations (HOAs) that can be present or result in post-infectious or post-traumatic cases of scarring. Research has demonstrated that whether HOAs stem from the anterior or posterior corneal surface, they can directly degrade visual acuity in these diseased corneas.^{5,6}

THE ROLE OF RGP LENSES

RGP lenses can offer a good solution for patients by providing

a smooth refractive surface and negating their irregular astigmatism with the help of the tear lens formed between the lens and the anterior corneal surface.^{1-5,7} The underlying irregular corneal surface is masked, with the RGP providing a new, smooth refractive surface.¹⁻⁴ Thus, RGP lenses can mask significant amounts of irregular astigmatism and help negate HOAs stemming from the anterior corneal surface.⁵

Choosing the Right Design

Different RGP lens designs are available. Choosing which one will be most beneficial for your patient depends on the type of scar they have and/or the postoperative corneal topography data. In scarred corneas from either traumatic penetrating corneal injuries or post-infection, the differences in corneal elevation among and between the central, midperipheral, and peripheral cornea can be dramatic and variable.

Although *spherical designs* can work, they often fail due to poor centration and fit. *Aspheric design* lenses can provide better centration on some irregular corneas, as they can enhance tear fluid exchange

AT A GLANCE

- ▶ RGP and scleral lenses can offer a less invasive and cost-effective way to improve visual acuity.
- ▶ Patients with scarred corneas tend to have high amounts of irregular astigmatism that cannot be adequately corrected with spectacle lenses or soft contact lenses due to the scatter of light rays and minimal improvement in BCVA.
- ▶ Regardless of the type of specialty lens chosen to manage an irregular cornea, patient education and communication cannot be ignored.

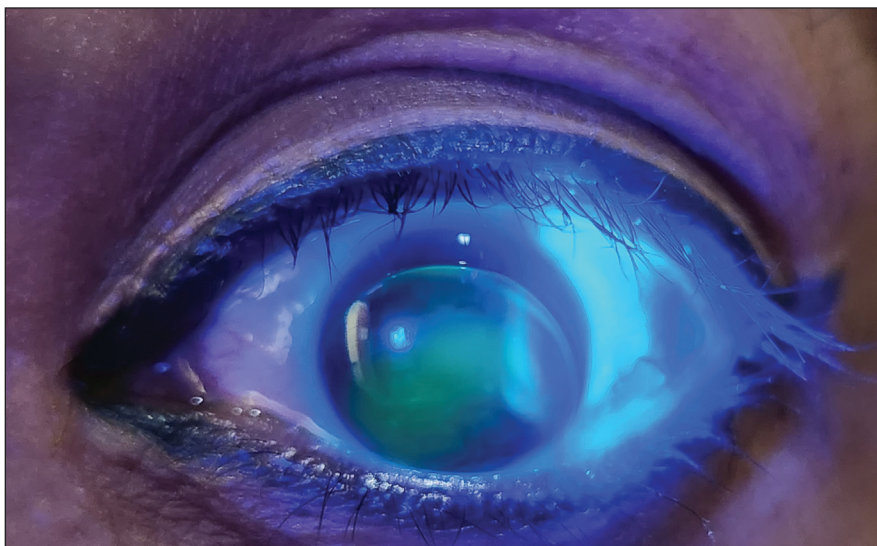


Figure 2. This fluorescein pattern shows a lens that is fit with too much apical clearance and not enough edge lift. Because of the more oblate cornea, this patient may benefit from a reverse geometry design.

and corneal wettability by following the corneal shape more closely, and decreasing discomfort by minimizing lid-lens interaction.¹ Sometimes, in cases with extreme elevation differences, a *back-surface toric* or *bitoric design* is necessary to avoid excessive edge lift or lens instability (Figure 2).⁷ This can help to alleviate potential fluctuations in vision and discomfort during daily wear.

In presentations where the central cornea has become less prolate and more oblate secondary to scarring or post-surgical intervention, larger diameter *reverse-geometry* RGPs are another good option.

SCLERAL LENSES FOR EXTREME CORNEAL SCARRING

In cases where extreme corneal scarring requires surgical intervention prior to being fit for specialty lenses, it is important to maintain a healthy lens-to-cornea relationship postoperatively. Post-penetrating keratoplasty corneas require extreme care to minimize corneal bearing with RGPs and to avoid further corneal compromise.⁸ In cases where RGP lenses are not well tolerated, piggybacking with a soft contact lens can offer better comfort (Figure 3). If enhanced stability or

comfort is required, scleral lenses can also be a valuable and sometimes first-line approach.

The Scleral Advantage

Scleral lenses have undergone a surge in popularity in recent years, with notable improvements in technology and availability of designs. The larger diameters of scleral lenses, typically ranging from 14.5 mm to 24 mm in size, vault the cornea and limbus to be completely supported by the sclera.⁹ As such, a fluid reservoir

is maintained between the lens and the anterior cornea, which continuously hydrates the ocular surface and allows a more comfortable wearing experience.⁹ By vaulting over the cornea, and hence any epithelial irregularities, the ocular surface is protected, while eliminating foreign body sensations secondary to lid interaction during blinks. With a more stable and centered fit, scleral lenses can oftentimes yield more superior and consistent BCVA throughout the day.¹⁰⁻¹² Scleral lenses can also be a more comfortable choice of lens for the pediatric population.

CHOOSING THE RIGHT MATERIAL AND FIT

Many higher-Dk materials are available for both RGP and scleral lenses, which offer increased oxygen transmissibility to an already compromised cornea. It is essential that RGP lenses are fit to be centered and aligned well to ensure good tear exchange, minimizing the risk of corneal staining, microbial keratitis, and corneal neovascularization.^{1,4} Striving for the best possible alignment of weight-bearing areas of the lens is crucial to guarantee corneal integrity and to enable a comfortable wearing experience for the patient.⁸

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IN CASES WHERE EXTREME CORNEAL SCARRING REQUIRES SURGICAL INTERVENTION PRIOR TO BEING FIT FOR SPECIALTY LENSES, IT IS IMPORTANT TO MAINTAIN A HEALTHY LENS-TO-CORNEA RELATIONSHIP POSTOPERATIVELY.

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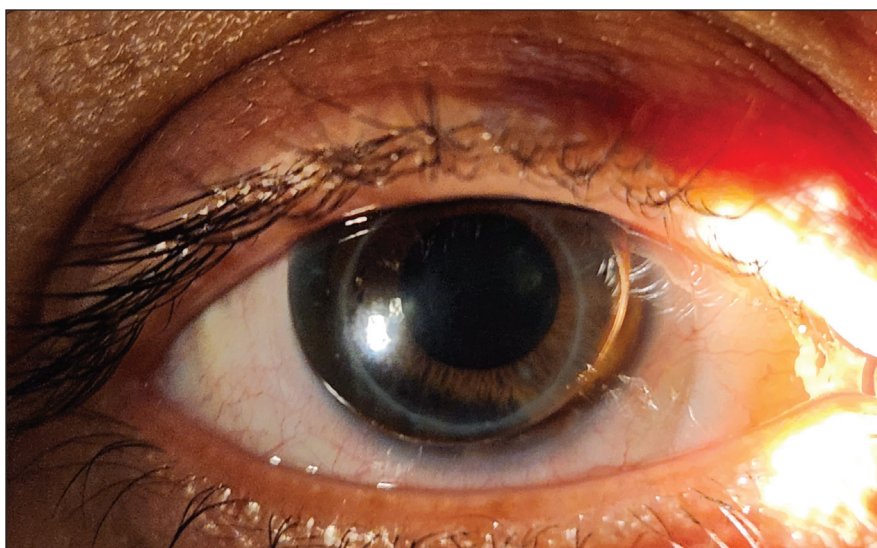


Figure 3. This patient's cornea required an RGP lens post-penetrating keratoplasty for best-corrected vision, and a piggyback soft contact lens to achieve optimal comfort.

Similarly with scleral lenses, adequate corneal clearance centrally and over the midperipheral and limbal areas is critical to maintaining corneal integrity. Creating the best fit ensures good comfort and ocular health, reducing unnecessary issues, such as edema, limbal injection, midday fogging, or discomfort with lens removal. Various parameters beyond sagittal depth can be manipulated to refine the fit and provide consistently sharp vision throughout the day. Front surface toricity can be added to correct any residual astigmatism. Customized wavefront-guided front surfaces can also reduce certain HOAs and enhance BCVA. Additionally, landing zone design options include spherical, toric, quadrant, or meridian-specific, or can be completely customized based on ocular impression or scleral profilometry. Alignment in this region of the lens can affect centration and tissue compression, and create seal-off or suctional issues.⁶

PATIENT EDUCATION AND COMMUNICATION

Regardless of the type of specialty lens chosen to manage an irregular cornea, patient education and

communication cannot be ignored. Although specialized RGP lenses can offer significant vision improvement for scarred corneas, these cases often occur monocularly. If the fellow eye has good visual acuity, patients can find it hard to stay motivated. Dropout rates have been noted to be as high as 36.8%, and thus, patient education is crucial.¹² It is important to set realistic expectations of both anticipated levels of corrected vision and practical wearing time and use of the lens.

Even with longtime previous soft contact lens wearers, there is still re-adaptation that has to occur with RGP or scleral lenses. Not only are patients learning a new style of lens use, but they may also be apprehensive about putting something into their eyes again. Perceptions of altered corneal sensitivity can vary from case to case. Acknowledging and normalizing the challenge can be comforting to the patient as they journey on the path toward accepting that their eye has forever changed. In pediatric cases, parents can play an integral role with the child using the RGP or scleral lens appropriately. Anxiety and fear may be noted, but parents have to be

educated on the necessity of contact lens correction versus spectacle wear, the importance of full binocular correction, and any potential risks of amblyopia.^{4,8,12}

WHEN THE SITUATION CALLS FOR REHABILITATION WITH RIGID LENSES

Therapeutic use of RGP and scleral lenses are effective means of visual rehabilitation, especially when compared with spectacle or soft contact lens correction. It can be a particularly useful short-term solution before planned surgery or when surgical correction is undesirable or contraindicated. Cases exhibiting extreme and irregular astigmatism resulting from corneal disease and scarring can be successfully managed, whereby significant visual function is regained in the affected eye, and patients are able to resume their habitual lifestyle. ■

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