

GP Fitting in Keratoconus Status-Post Penetrating Keratoplasty and Glaucoma Implant Device

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Background:

Keratoconus is a disease of progressive corneal thinning, which can lead to irregular astigmatism, double vision, corneal scarring, and in severe cases, the need for a corneal transplant¹. Until more recently, the gold standard for corneal transplants was a penetrating keratoplasty (PKP)². Gas permeable (GP) lenses are indicated for providing better visual outcomes for corneal ectasia and irregular astigmatism after corneal surgery, such as PKP, while limiting the risk of corneal hypoxia or graft rejection.

Case Description

74-year-old white male presented for his annual exam on May 24, 2023. He complained of blurry vision OD and difficulty with insertion of current scleral lens. Ocular history included primary open angle glaucoma status-post (s/p) implant and scleral graft OD; keratoconus s/p penetrating keratoplasty (PKP) OD; and complex cataract extraction with anterior chamber intraocular lens (ACIOL) (*Figure 1*).

Previous lens was an impression-based scleral lens with a notch at 11:00 o'clock to avoid compression at glaucoma device implant (GDI). The patient reported difficulty with insertion due to the importance of keeping the notch in the correct location. Best-corrected visual acuity through refraction was 20/40 OD, 20/20 OS.

Tomography revealed an irregular cornea OD secondary to KCN s/p PKP, with flat central elevation, but steep inferior mid-peripheral elevation at the graft-host junction (*Figure 2*).

Gas Permeable Contact Lens Ordered:

An intralimbal GP lens was ordered with reverse geometry in order to provide a better fit over the irregular cornea. The intralimbal design allowed the lens vault over the graft-host junction of the PKP without being large enough to have the potential to compress the GDI at the sclera.

Base Curve	Secondary Curve	Intermediate Curve	Peripheral Curve	Diameter
7.42	6.82	7.82	10.82	10.8
Dk: 100		Power: Plano		

Table 1: Contact lens parameters ordered. Note steeper secondary curve (4D) to incorporate reverse geometry over elevated graft.

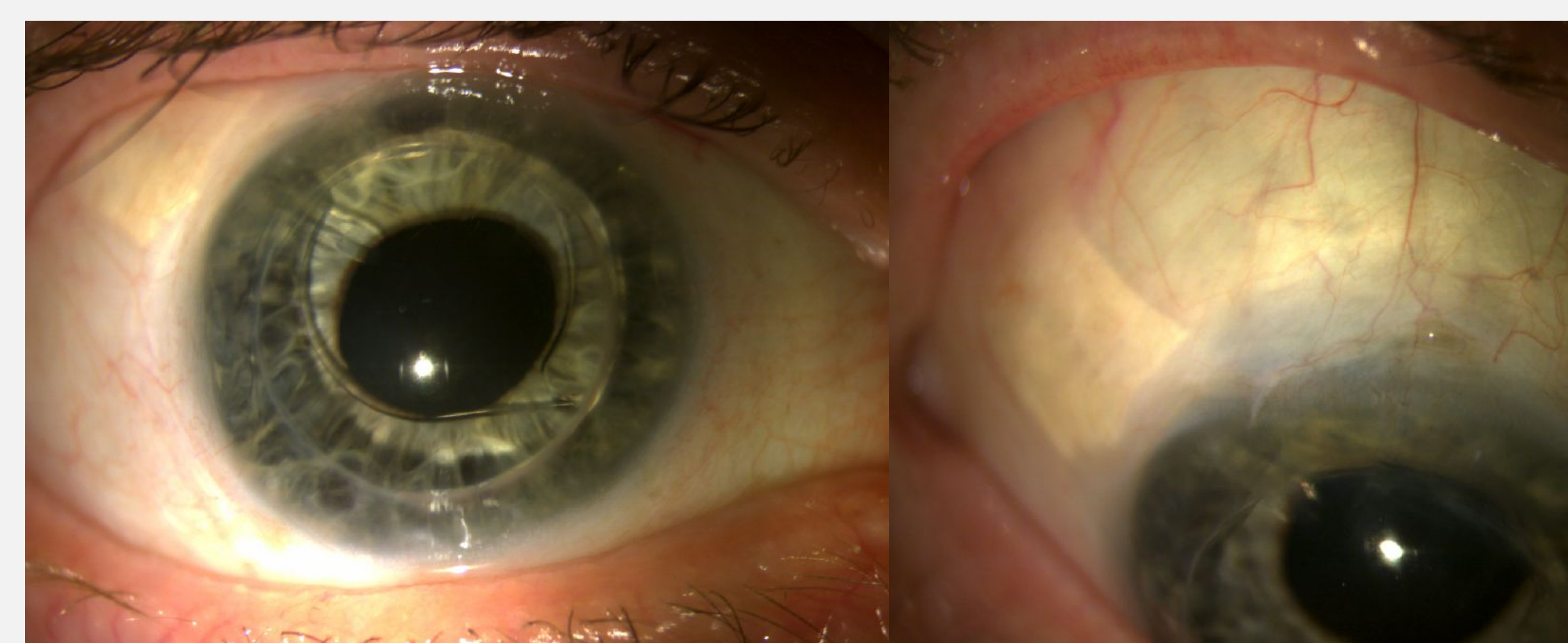


Figure 1: OD s/p PKP, GDI with scleral graft, and ACIOL. Previous scleral had a notch at 11 o'clock to avoid the scleral graft.

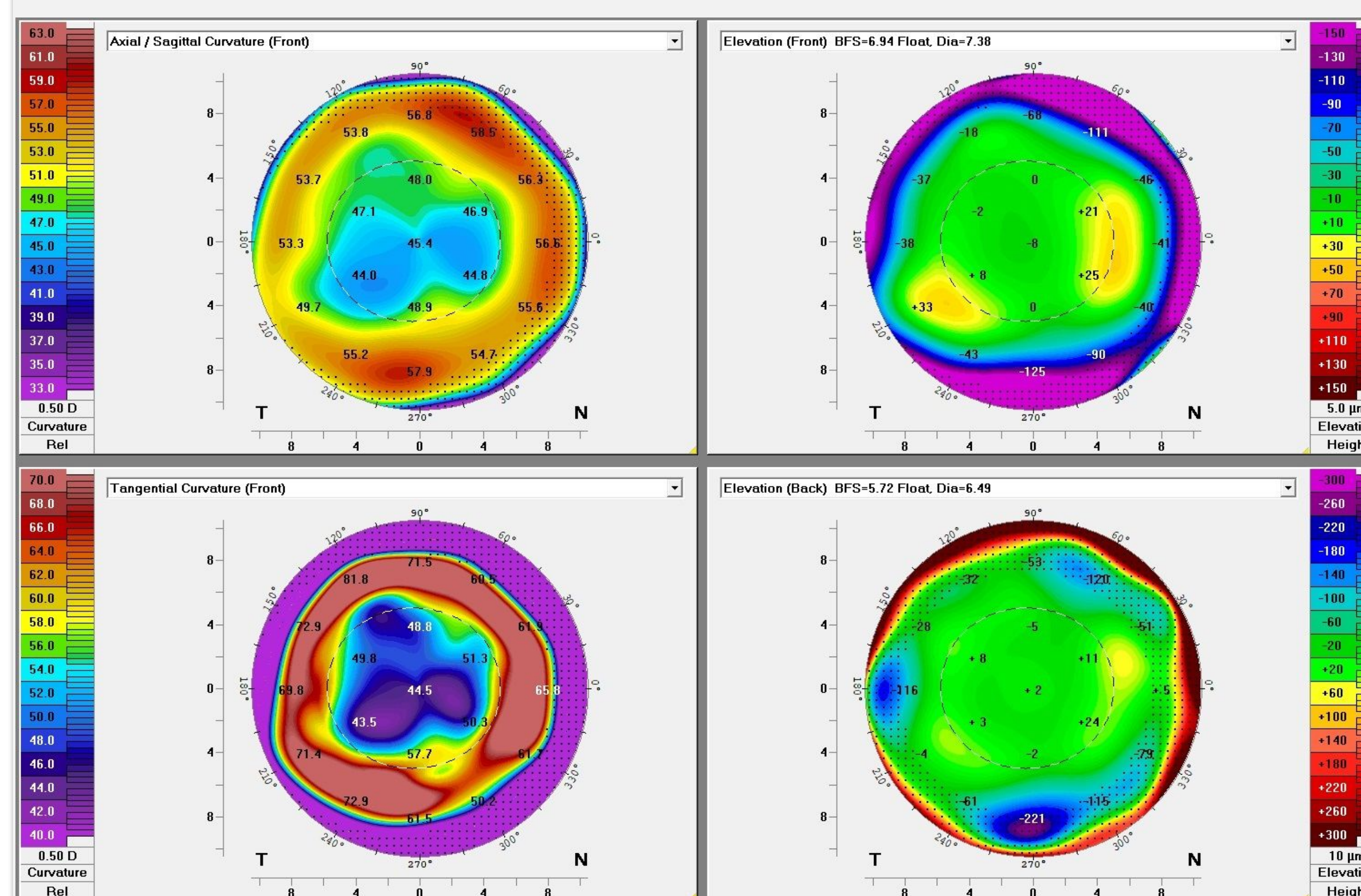


Figure 2: Tomography scans OD showing inferior elevation at graft-host junction

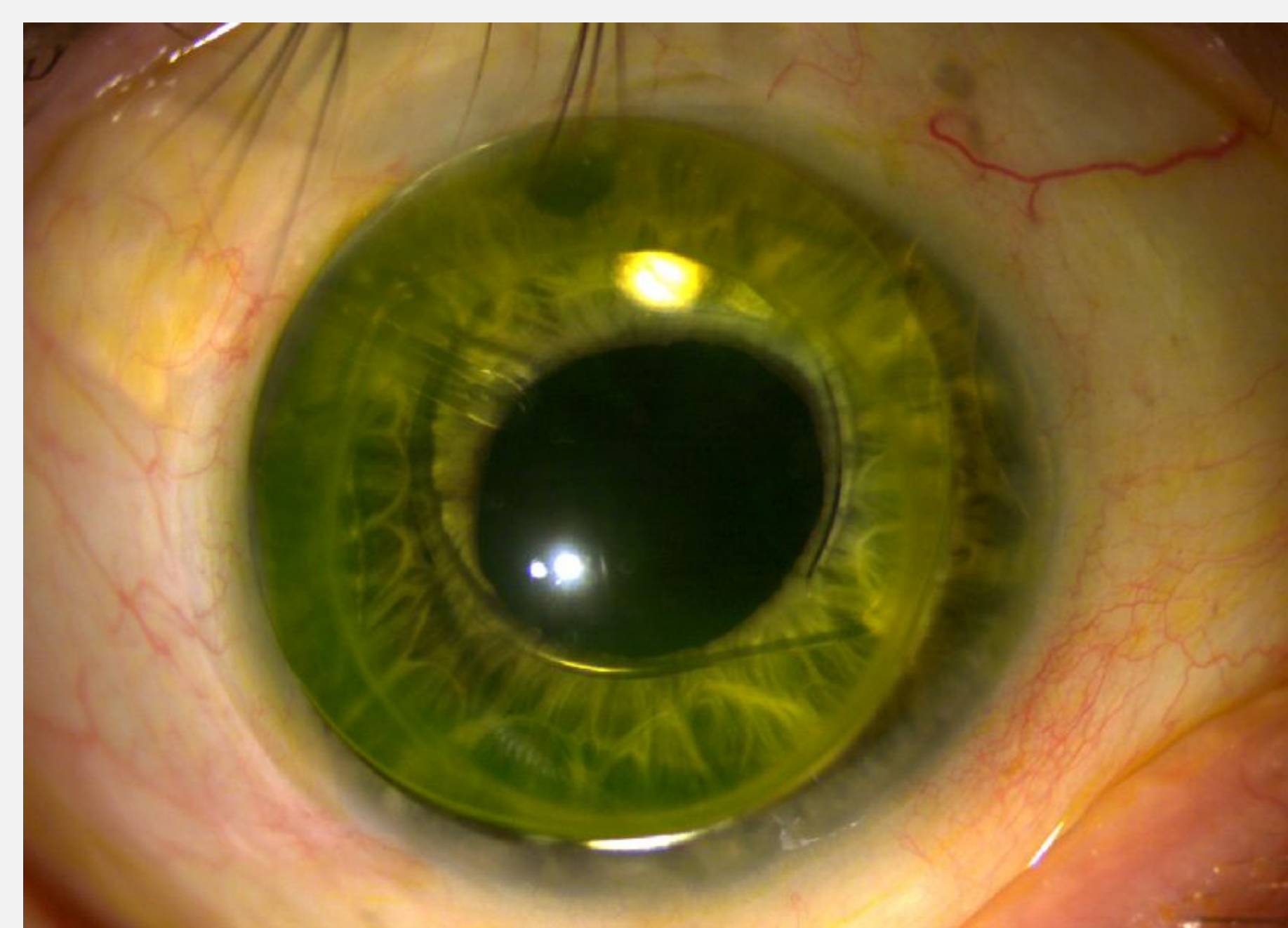


Figure 3: GP lens on eye. Note lens is not rubbing against scleral graft. NaFI is pooling around graft-host junction, indicating good fit. VA out of lens was 20/25+.

Discussion:

While scleral lenses are indicated for irregular corneas, as seen in this patient, they can be contraindicated for a number of reasons, including ease of handling, severe glaucoma, interaction of the lens haptic with a GDI, and low endothelial cell counts.

It is debated whether scleral lens wear increases intraocular pressure (IOP). Recent studies using transscleral IOP measurement have shown an increase in IOP during the course of normal scleral lens wear³. In prior studies IOP was measured before and after but not during the course of lens wear. These studies have yielded conflicting results as to the effect of scleral lens wear on IOP^{4,5}. In a patient with severe glaucoma, a scleral lens may be contraindicated due to potential IOP increase during wear.

Additionally, scleral lens wear may be contraindicated in eyes with low endothelial cell counts, such as some post-PKP eyes. Scleral lenses must be fit with minimal clearance to ensure oxygen availability to the graft. The patient must have a high enough endothelial cell count (at least 800-1000 cells/mm²) to decrease chances of corneal edema leading to graft failure⁶. While this patient had an acceptable endothelial cell count, it should be monitored and considered for future fittings.

Corneal GP lenses, when fit well, provide higher oxygen availability to the cornea due to constant tear exchange and have not shown to have an effect on IOP during the course of normal wear. Therefore, if the cornea is appropriate for GP lens wear, it provides a safe and effective option for vision and health of the eye.

Conclusions

While scleral lenses are often indicated in highly irregular corneas, sometimes a GP is better fit for the patient. Scleral lenses may induce higher IOP during wear, which is a concern in a patient with severe glaucoma, and when notched, must be inserted in a specific orientation. The intralimbal GP provided less complicated handling and was a healthy option for the patient's eye.

References

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