Case Report:

When standard designs fall short: Freeform to the win

Cian Gildea

Cian Gildea completed his bachelor's degree at the Dublin Institute of Technology where he gained his BSc Optom with honors. During his course, 6 months were spent at the University of Houston expanding his knowledge of contact lenses. He is currently working as a clinical optometrist at the Wellington Eye Clinic in Dublin, Ireland. Cian has a strong interest in specialty contact lenses and their application for irregular corneas.

Background

A 42-year-old male presented with Grade 3 keratoconus in his right eye. His history included **SimLC** (Simultaneous Laser and Cross-linking) treatment in the affected eye. Refraction and visual acuity:

OD +7.50 / -3.50 x 87 VA: 6/24 (0.25, 20/80) | **OS** +1.75 / -2.75 x 70 VA: 6/6 (1.0, 20/20)

Epithelial mapping showed central thinning consistent with keratoconus, and slit-lamp examination revealed pronounced stromal haze in the right eye.

Fitting challenges

An Eye Surface Profiler (ESP) scan revealed several anatomical considerations making the fitting particularly challenging (Figure 1):

1. **Highly irregular cornea** with a steep superior-to-inferior gradient. The marked asymmetry in corneal height data suggests low probability of success with standard corneal GP lenses.
2. **A large pinguecula**, which requires precise vaulting to avoid discomfort and compression.
3. **An oval limbus shape**, with a significant discrepancy between the horizontal and the vertical visual iris diameters. A traditional lens would provide insufficient clearance in the horizontal meridian, leading to uneven limbal clearance and the risk of conjunctival prolapse.

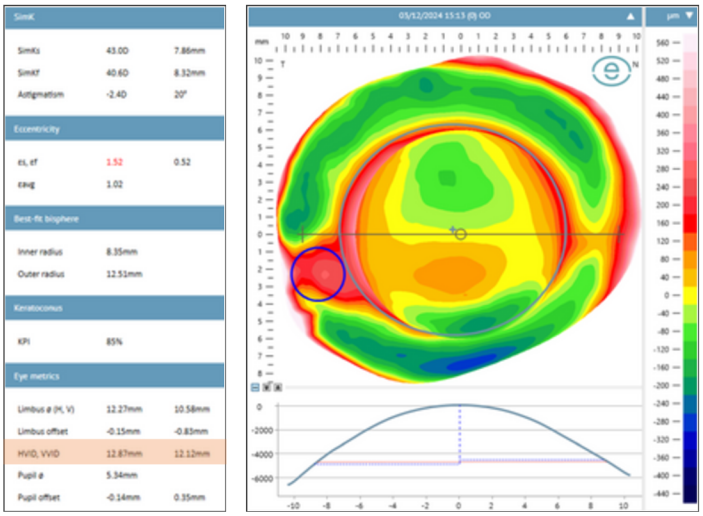

Figure 1 ESP eye metrics and elevation map showing an HVID different and larger than VVID (left) and a temporal pinguecula (right).

Solution: Profilometry-based freeform lens design

Given the complexity of the case, a **freeform scleral lens i-Shape** (Appenzeller Kontaktlinsen, Switzerland) was designed using data from the ESP. This elevation-based technology allowed for a highly customized lens to be created (Figure 2), ensuring a comfortable and precise fit. This approach made it possible to account for the patient's unique anatomical features, offering a level of customization beyond what is achievable with traditional lens designs.

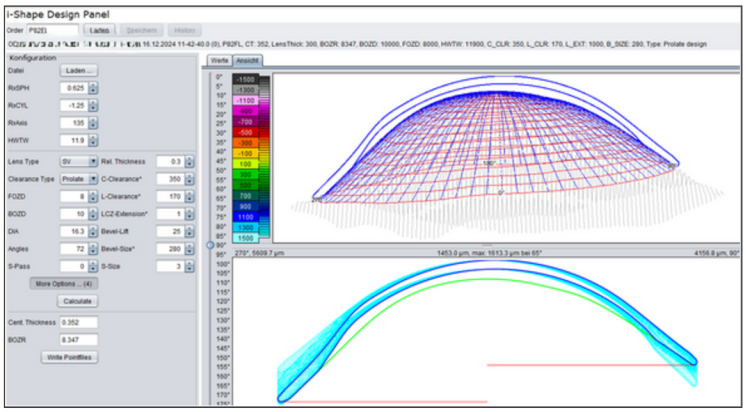

Figure 2 Software-based fitting of an i-Shape freeform scleral lens based on individual ESP profilometry measurement data of the cornea and sclera.

Patient experience and outcome

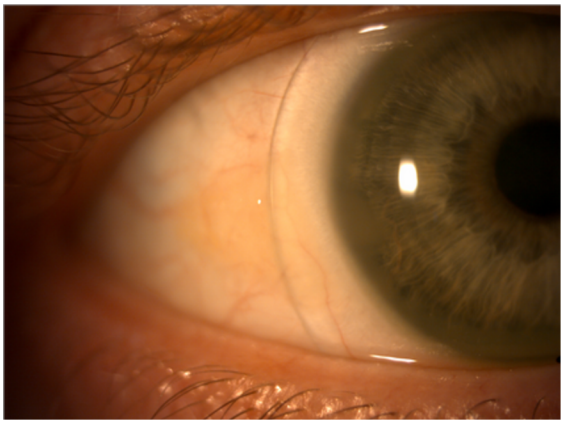

Figure 3 Lens over the pinguecula.

Key fitting outcomes:

- Compensation for the high height asymmetry, with a broad, even landing zone that distributes the weight evenly and supports stable centration.
- The lens vaulted the pinguecula without compression or blanching (Figure 3).
- Precise limbal alignment for the oval-shaped limbus, allowing the lens to land evenly across both horizontal and vertical meridians (Figure 4).

The customized design allowed for a level of precision that led to an outstanding clinical and patient-reported outcome.

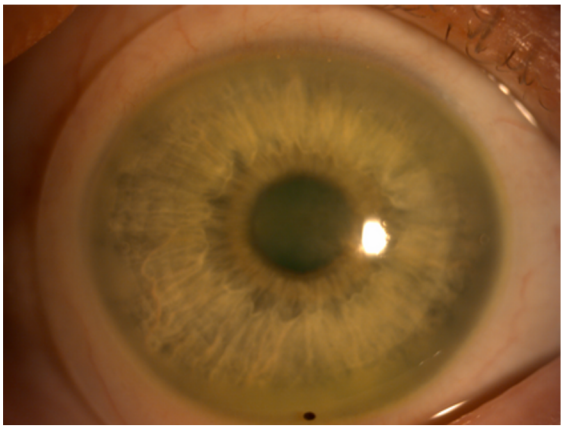

Figure 4 Lens vaulting over the pinguecula to prevent impingement or discomfort.

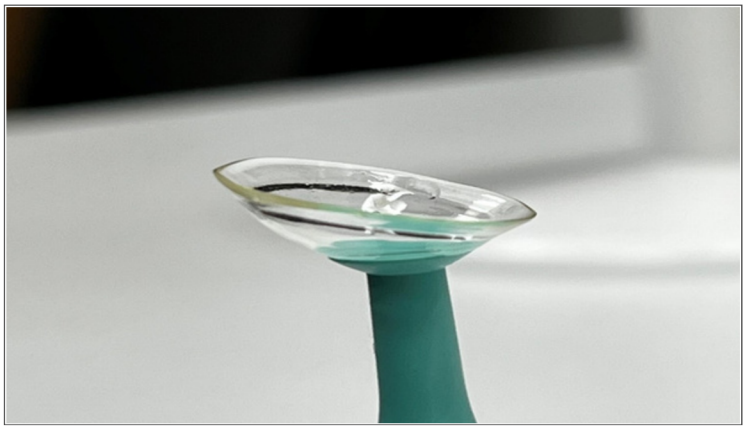

Figure 5 Final lens tailored to the exact shape of the patient's eye.

Conclusion

This case underscores the critical role of corneo-scleral Profilometry and freeform lenses in fitting complex ocular cases. By leveraging true elevation data, the ESP facilitates precise, fully customized freeform lens designs, providing superior fit, comfort, and vision correction. The patient not only experienced exceptional outcomes but also felt empowered by understanding how their lens was tailored to their unique eye shape.