

Restoring Vision in a Patient with an Open-Globe Corneal Laceration Injury

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BACKGROUND

Open-globe injuries are classified as a full-thickness wound of the eye resulting from blunt force or projectile foreign objects. If there is no damage to any ocular structures behind the cornea, then a hard contact lens can help resurface an irregular cornea and restore vision.

CASE HISTORY

A 24-year-old Caucasian female was referred to our clinic for specialty lens fitting. Three months ago, she was in a terrible car accident and sustained an open globe injury with an almost limbus to limbus corneal laceration of her right eye. By history, she is healthy and has no other medical issues. Patient's unaided acuities were 20/80 OD with no improvement with pinhole or refraction and 20/20 OS. With both eyes open, she is 20/25- with ghosting images. Her goal was to help restore depth perception and improve vision quality. Entrance testing was unremarkable, (-) APD OD with sluggish irregular pupil was noted.

CLINICAL FINDINGS

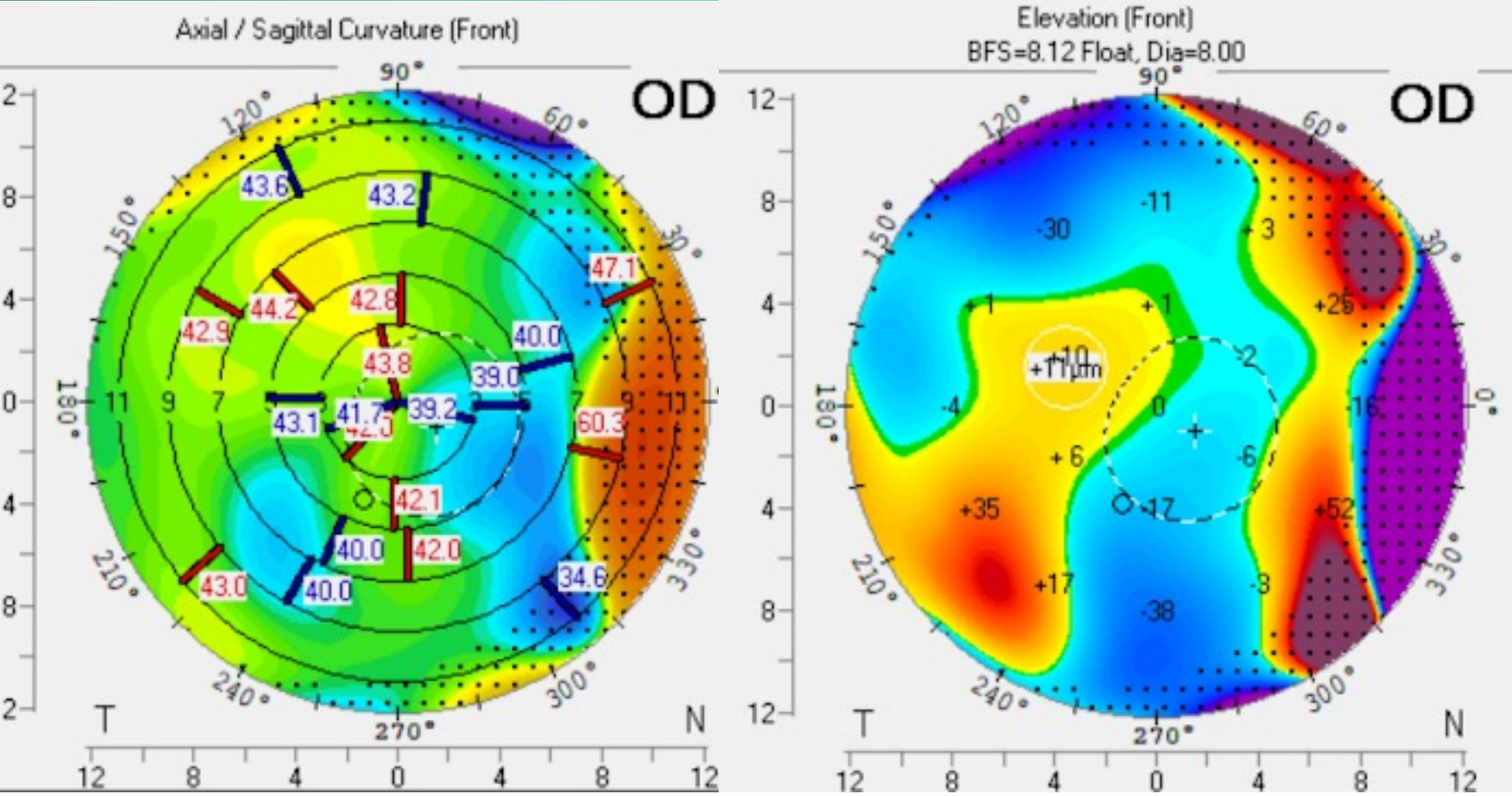


Figure1: (Left) Axial curvature – significant areas of flattening where the corneal repair occurred (Right) Elevation front – areas of steepening are consistent with the areas of flattening

EXAM FINDINGS

Initial visit

Upon slit lamp examination right eye shows a corneal scar originating at the nasal limbus and running through the inferior nasal pupil, nasal scleral scar tissue extending to nasal cornea with 4 buried sutures. Peaked pupil after traumatic iris blowout repair and a traumatic cataract. Zonular dialysis with loss of zonules to the lens involving at least 6 clock hours. Dilated exam reveals no retinal holes or tears.

Scleral Lens trial

Zenlens Z10 16mm, 467 CC, adequate clearance over the entire cornea. Nasal edge of the lens landing on nasal sutures which caused conjunctiva staining after trial with only 30 minutes of wear.

Visit 2 : Another Scleral Trial

An 18.5mm BostonSight PROSE lens was also trialed but with the position of the sutures running diagonally across the nasal sclera no matter the size of the scleral lens the edge is landing on the suture. A channel was also trialed but was unsuccessful.

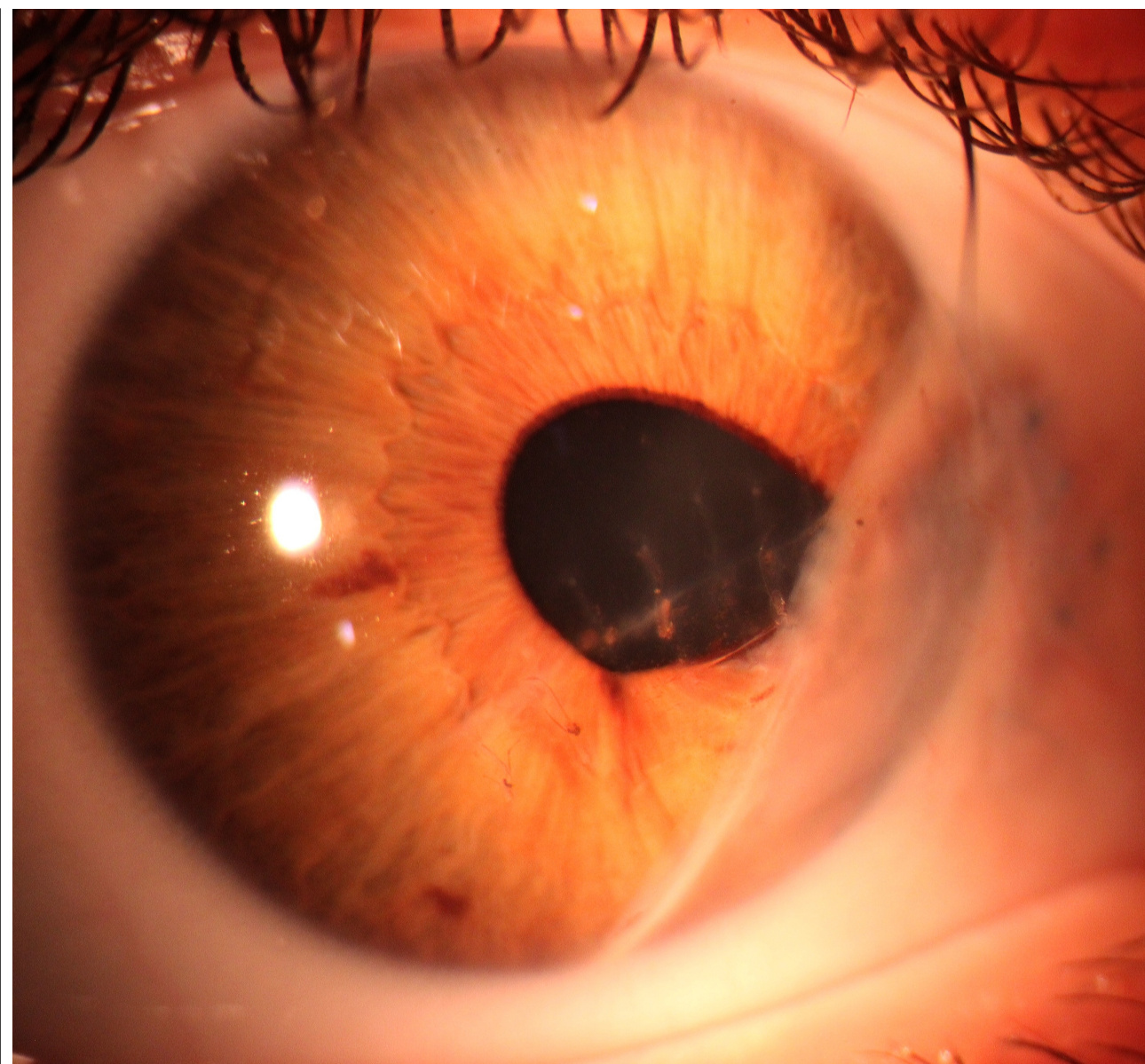


Figure 2: Right eye showing post sutured cornea, scleral scarring over nasal limbus of cornea, sutures on sclera.

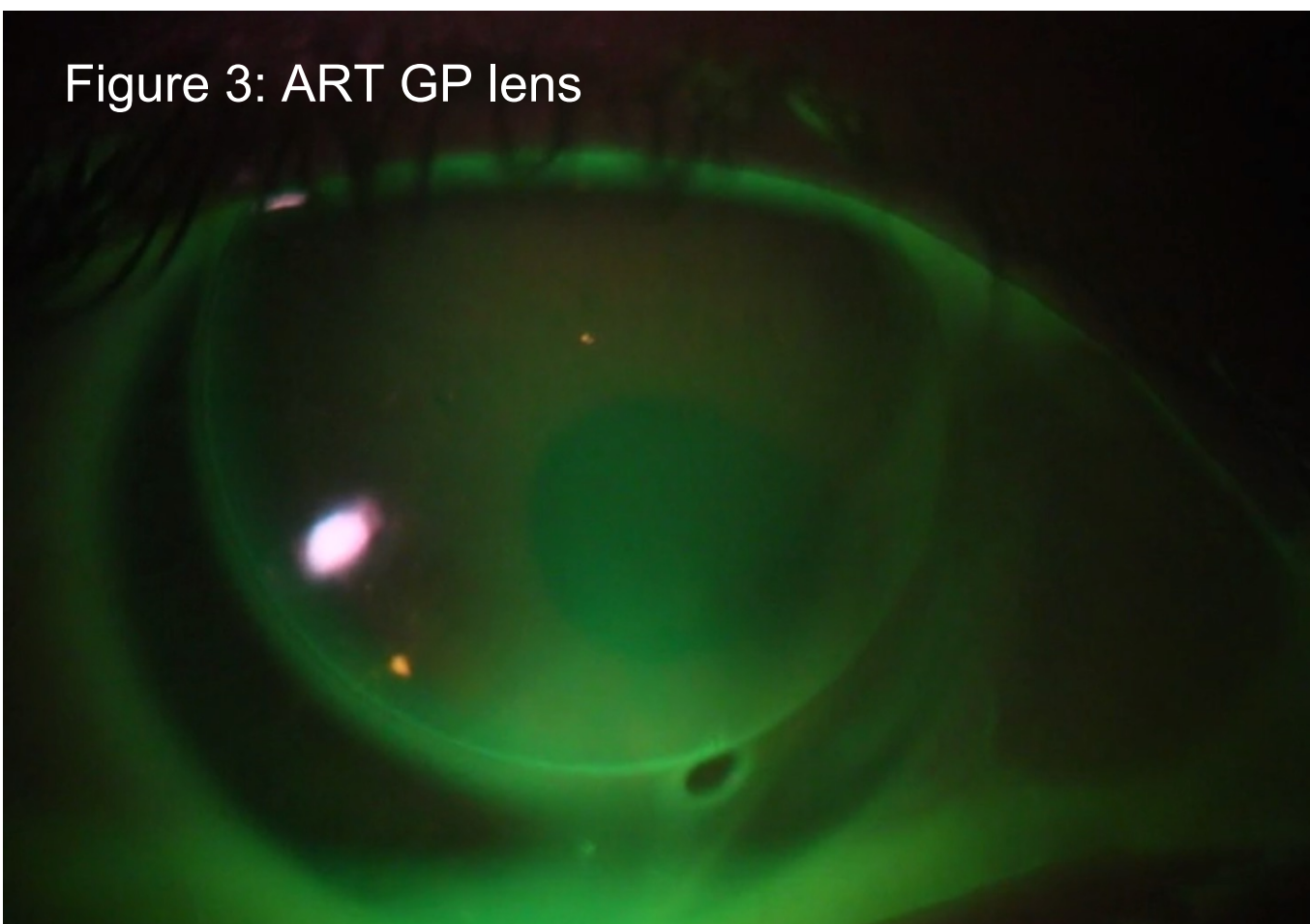
EXAM FINDINGS CONT.

Visit 3: Rigid Gas Permeable (RGP) Lens Trial

Due to the highly irritable nature of the injured eye, the patient returned for a RGP trial after empirically ordering the lens. Lid attached fit, however due to peaked pupil, vision was poor. Inferior edge fluting causing bubble between blinks as seen in Figure 3 to the right.

Art Optical – Art Custom Eccentric design

BC 8.00, Power -1.75sph, Diameter 10.00mm
OR: plano – 2.25 x105 5L rotation no 20/40 with ghosting
Plan: Since there is a large amount of asymmetry in each semi-meridian, try a more customizable lens.
Used a topography guided RGP.



Visit 4: Wave CorneaLens Trial

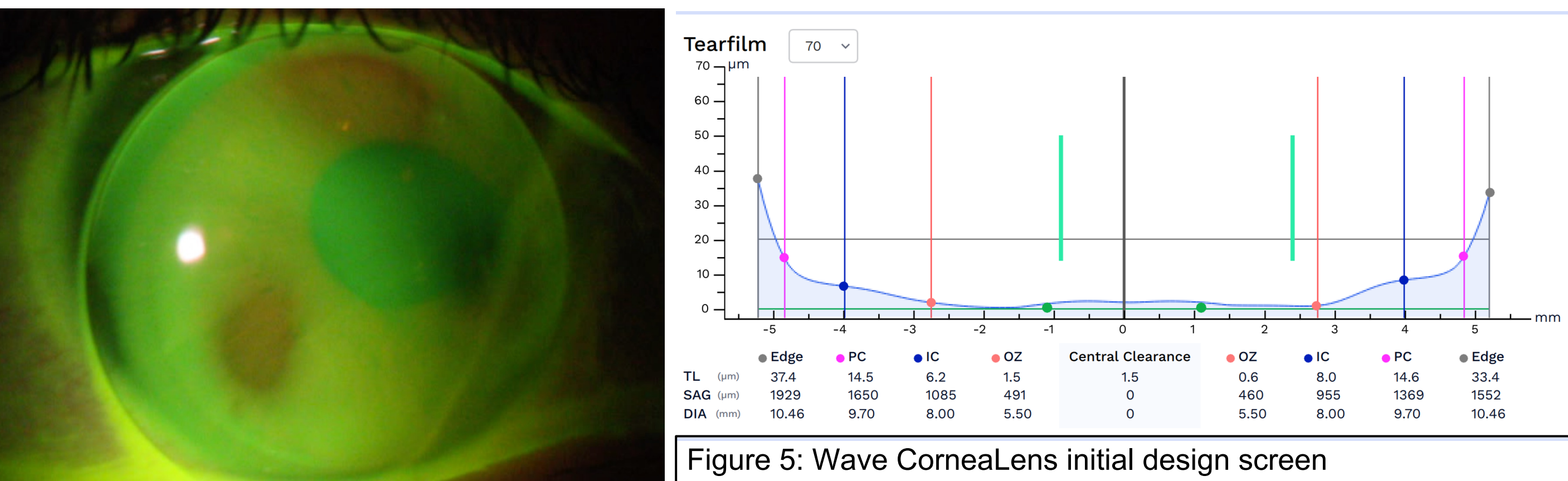
An initial lens designed off a central topography scan.
VA OD: 20/30 with plano -1.25x105 OR – still ghosting. When lens is centered by lid manipulation patient is able to see 20/25 with no OR.
SLE: Lid attached on blink, however the lens drops inferiorly and there is slight touch inferior temporal and superiorly which matches the areas of elevation. 15 degrees rotation to the left. Patient reports discomfort after blink. First time GP wearer.

Wave CorneaLens

Freeform design BC: 8.13 +/- 0.49, Power: -1.70D, Diameter: 10.70mm

Plan: Try to center the lens on the eye by decreasing the outer peripheral curve (pink), to alleviate baring by steepening the base curve.

New Lens order: Freeform design, BC: 8.03+/-0.48, Power – 2.66D



Visit 5: New Wave Lens Trial

OD:20/25- no OR
SLE: a more lid attached fit, slight nasal decentration but centers on pupil. Still visible baring on inferior temporal however, on blink there is touch with flush. No rotation of new contact
Plan: Patient to RTC in 1 month to ensure no staining on areas of touch

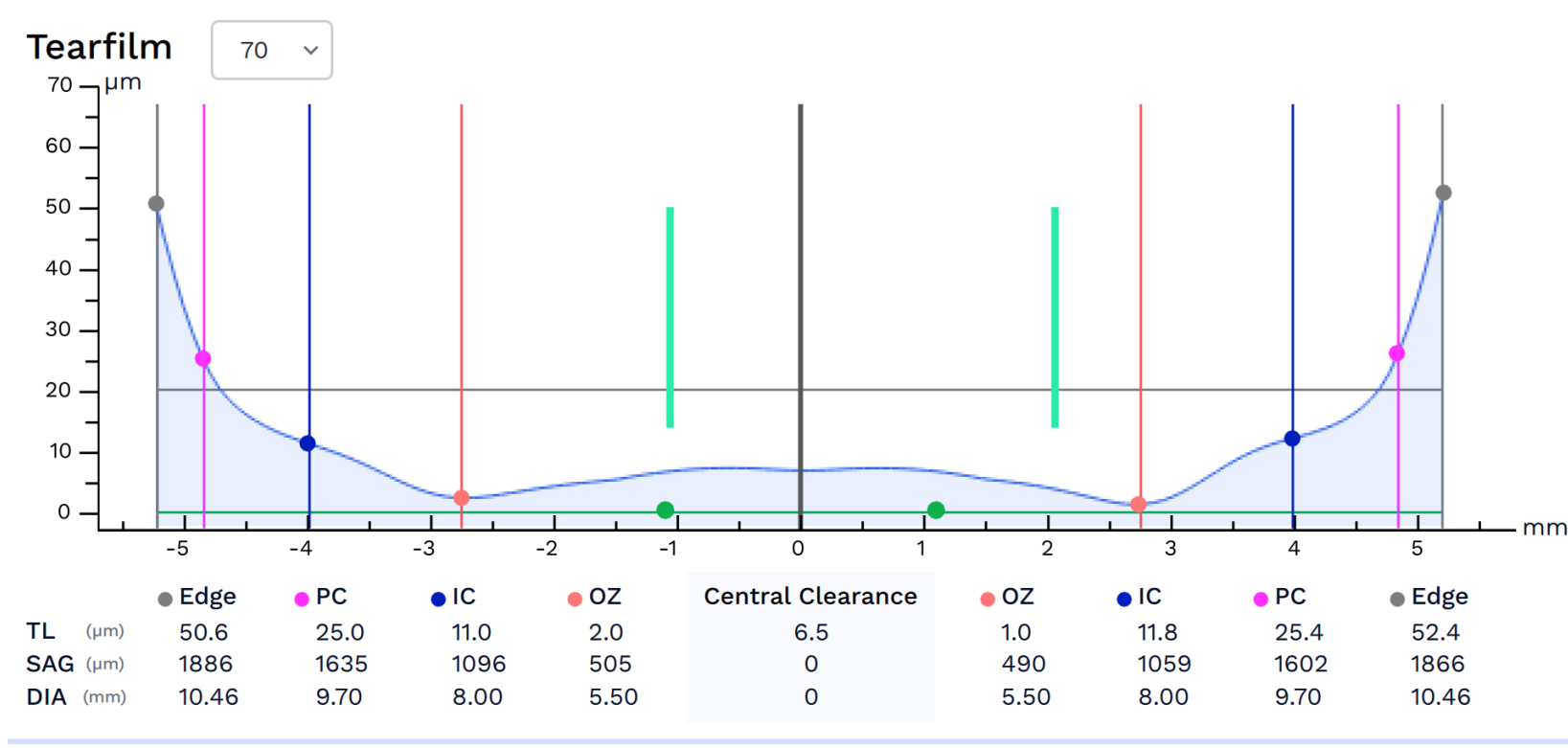


Figure 6: Wave CorneaLens Final design screen

Visit 6: 1 Month follow up in new Wave Cornealens

OD: 20/25- Vision stable with mild ghosting. Patient reports better comfort with new lenses and can wear them for about 4-6 hours at a time, slowly building up wearing time. Improved noticeable depth perception.
SLE: good lens movement, no corneal staining after 4 hours of wear.

Discussion

Two main types of lenses can be used to improve vision in a patient with irregular corneas: scleral lenses or corneal GP lenses.

Scleral lenses are preferred for their comfort. Since they land on the conjunctiva, which is significantly less innervated than the cornea, patients often have less lens awareness.¹ This correction method avoids some complications present with corneal GPs, such as 3 and 9 o'clock staining, the development of vascularized limbal keratitis, and less likely for mechanically-caused papillae.² Given the many benefits of scleral lenses, they also come with their own set of drawbacks. The thicker nature of the scleral lens and tear layer results in a more hypoxic environment for the cornea, which causes chronic edema.³ Other common complications of scleral lens wear include; an increase in intraocular pressures and midday fogging leading to decreased vision.^{4,5}

Corneal GP lenses have great optics and help improve vision in patients with irregular corneas. Unlike the closed system of sclerals, GPs provide tear exchange to help maintain an oxygenated and healthy cornea.⁶ Many GPs nowadays have the option for customization, allowing for a more closely-knit cornea-lens relationship.⁶ The downfall of GPs lies in the comfort of the lens, however, this is usually an adaptable situation where the patient prioritizes their vision over the discomfort.

Usually, scleral lenses are preferred when the corneal elevation difference is greater than 350um from the apex of the cornea to the lowest point.⁷ In our case with our patient the high point of elevation was +120um and the lowest point was -48um at the 9-10mm chord. Initially, a scleral lens design was chosen due to the highly irregular meridians all around the cornea. However, staining of the suture points on the scleral can lead to more harm than benefit.

Wave's CorneaLens GP design, is an extremely unique design that gives the user the ability to customize almost everything on the lens.⁸ It allows for manual modification of the back optic zone and the size of the different peripheral curves.⁸ In the freeform lens design, there are eight semi-meridians that can be modified individually.⁸ Modification to any of these curves is independent of the base curve changes.⁸ Wave's freeform design allows for a better cornea-lens relationship therefore, producing the best-fitted GP lens for this patient.⁸

CONCLUSION

Although scleral lenses are great and can solve most of our corneal problems, never forget about the corneal GP lenses, as they are great tools to have in the office. The patient was happy to gain quality vision back in the right eye which also gave her back some depth perception.

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