Proposed Method to Eliminate Debris in the Scleral Post-Lens Tear Reservoir: Case Report

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Background: Mid-day fogging is a complication of scleral lens wear that has plagued patients and practitioners for years. When non-wetting of the front surface is ruled out, the clinical sign associated with mid-day fogging is debris in the post-lens tear reservoir (PLTR). Debris in the PLTR has been linked to misalignment of the haptic against the sclera and is present in approximately 20-30% of scleral lens patients. Historically, scleral lenses in the US have been made with symmetrical peripheral landing zone which did not properly align with the irregular sclera along the entire circumference of the lens. More recently, manufacturers have incorporated toric haptics to more closely align with the irregular sclera.

One of the newer scleral lens designs in the US is the SynergEyes VS (SynergEyes, Carlsbad, CA). The VS design allows the evaluator to change the alignment of the haptic to the sclera in two separate meridians. Optical coherence tomography (OCT) can be used to observe the alignment of the haptic in four quadrants, providing a means to actively manipulate that alignment. Aligning the haptic to the irregular scleral shape eliminates the production of debris in the PLTR and can reduce scleral lens dropouts.

Case Description: A 43-year old university professor with stable keratoconus was referred by an optometrist for a contact lens evaluation. He had been wearing Purevision 2 soft contact lenses with a poor visual result. Topography and pachymetry are shown in Figures 1 & 2.

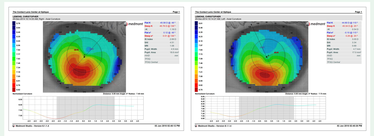

Figure 1: Topographical maps of the patient's corneal ectasia (a) right eye (b) left eye. Sim K's showing mild staging of the keratoconus is visible in both eyes.

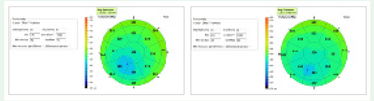

Figure 2: Pachymetry maps showing the corneal thinning (a) right eye (b) left eye. With 476u OD, 483u OS minimum corneal thickness, this is considered mild keratoconus.

Lens Fitting: We first fit him with vaulting hybrid lenses in 2015. After two visits, we determined that the lenses exhibited excessive settling onto the cornea due to probable high hysteresis. He told us that he did not want try corneal GP lenses. We determined that scleral lenses may be a better option.

We fit him with a second generation scleral lens design with first spherical, then toric peripheral curves. We noted debris in the post-lens tear reservoir (PLTR), but the patient elected to wear the lenses (Figure 3).

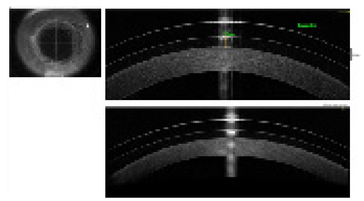

Figure 3

The patient returned seven months later with complaints of filming and fogging of both lenses. The lenses felt dry and itchy and the vision had declined. Visible on OCT, the haptic was impacting the limbus in both eyes (Figure 4). We elected to try and change the toricity in the haptic before trying another lens design.

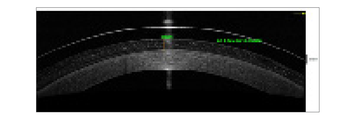

Figure 4: A line scan anterior segment OCT showing the haptic in one quadrant. The haptic lands right at the edge of the cornea not allowing any vault over the limbus.

With an additional haptic change, there was no improvement in debris in the PLTR. The patient was switched into two other commercially available scleral lens design with toric haptics. Again, when optimally fit with these designs, there was significant debris in the PLTR (Figures 5 & 6).

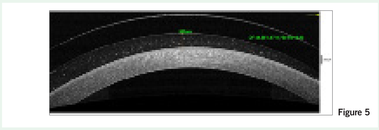

Figure 5

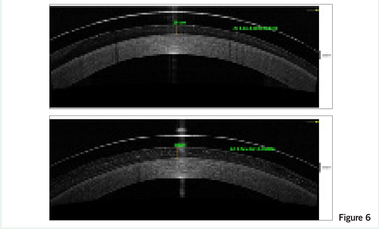

Figure 6

Figure 6: The second commercially available scleral lens design with toric haptics yielded debris in the PLTR.

Finally, the patient was switched into a third generation scleral lens design, the Visser Scleral (VS) Lens (SynergEyes, Carlsbad, CA).

The VS Lens allows the practitioner to modify the landing angle of the haptic in two meridians. This allows for precise control of the relationship of the haptic to the scleral shape in these principal meridians. As such, our process for evaluating the haptics with OCT has changed. We take a central vault line scan and four haptic peripheral OCT line scans, corresponding to the flat and steep axes designated by the rotation hash markers (on the flat meridian).

SynergEyes VS™ Scleral Lens Fitting:
The patient was trial fit with lenses:
3600/plano/16.0/38-44 OR -1.75sph 20/20-2
3600/plano/16.0/40-46 OR -1.50sph 20/25-2

At the next visit, we dispensed lenses:
3600/-1.75/16.0/38-44, VA 20/25
3600/-1.50/16.0/40-44, VA 20/20-1

Sphero-cylindrical over-refraction showed no need for improvement. There was no debris in the PLTR OU (Figure 7).

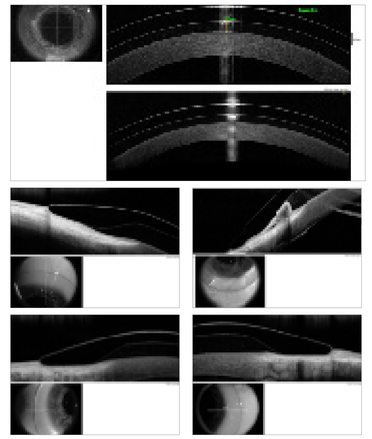

Figure 7: Central OCT cross scan, surrounded by four line scans at each haptic quadrant of the VS Lens on the left eye.

Follow Up: The patient returned in three weeks with no complaints. Visual acuity had improved to 20/20 OD, 20/20 OS, 20/20 OU.

Conclusion: Haptic alignment seems to be the critical factor in eliminating debris in the post-lens tear reservoir. Although current standard technology does not allow for perfection in aligning the haptic with the scleral shape at all points of contact, it appears that debris in PLTR can be minimized or eliminated by having a very close fit.

The SynergEyes VS design gives the practitioner a tool to first observe with trial lenses, then manipulate haptic alignment. This is different than almost all other scleral lens designs on the market where toricity in the haptic is set by the manufacturer and not easily modified by the practitioner. Toricity of the haptic in the VS design is modified by changing the alignment of the "foot" of the lens to the scleral tissue and is specified in two meridians (ex: 36-42). To make a steeper landing, the "toe" of the lens is lowered by increasing the corresponding meridian number. Each primary meridian can be separately controlled. By using this technique, the haptic can be precisely aligned in the two primary meridians.

Although it is possible with experience to judge the haptic landing angle using biomicroscopy, as is the standard in the Visser clinics in the Netherlands (designer of the lens), the easier method to judge haptic alignment is with OCT evaluation. Imaging the lens haptic alignment with OCT in four meridians allows the practitioner to better design a lens that can eliminate debris in the PLTR. This technique has been demonstrated in multiple other cases not presented here.