Novel treatment for a fixed dilated pupil: iris occluding prosthetic lens worn over a scleral contact lens

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Background

Soft prosthetic contact lenses can improve the cosmetic appearance of disfigured eyes and reduce visual glare due to pupil abnormalities. (1, 2) While the role of a soft prosthetic contact lens for the completely scarred cornea is cosmetic, there are situations where refractive correction is also needed for vision improvement. For such cases, soft prosthetic contacts are available with spherical and toric correction. But what if rigid optics are needed because of high corneal astigmatism or corneal irregularity? This case report follows a high astigmatic patient with pronounced visual glare due to a fixed dilated pupil.

Case Description

VISIT 1. L.J., a 49-year old female, presented to clinic on 9/6/2019 complaining of poor vision and glare in the left eye. Her ocular history was noteworthy for acute angle closure OS ~2010. She then had prophylactic laser peripheral iridotomy OD and trabeculectomy OS. Due to failure of the trabeculectomy, she had an aqueous shunt implanted OS and cataract extraction with IOL implantation OS. YAG capsulotomy was performed in April 2019 OS. Health history was non-contributory.

Best spectacle-corrected visual acuity was 20/20 OD with +2.00-6.50X005 and 20/50 OS with +1.50-4.75X057. Pinhole OS improved to 20/25 OS. Corneal topography showed HVID of 11.14 mm OD and 11.00 mm OS, with simulated keratometry of 44.06/48.81@095 OD and 43.88/49.44@105 OS (**Figure 1**). The left pupil was fixed dilated, with no APD in either eye. Intraocular pressure was 11 mmHg OD and 10 mmHg OS with rebound tonometry. Biomicroscopy showed healthy corneas, grade 1 Van Herick angles nasal and temporal OU, with a superior patent laser peripheral iridotomy OD. An aqueous shunt was visible in the anterior chamber OS, draining to the peripheral supero-temporal bulbar conjunctiva. The crystalline lens was clear OD with an IOL OS where the opacified capsular bag was visible through the fixed dilated pupil OS (**Figure 2**). Cup-to-disc ratios were 0.2 OU with no obvious disc damage OS.

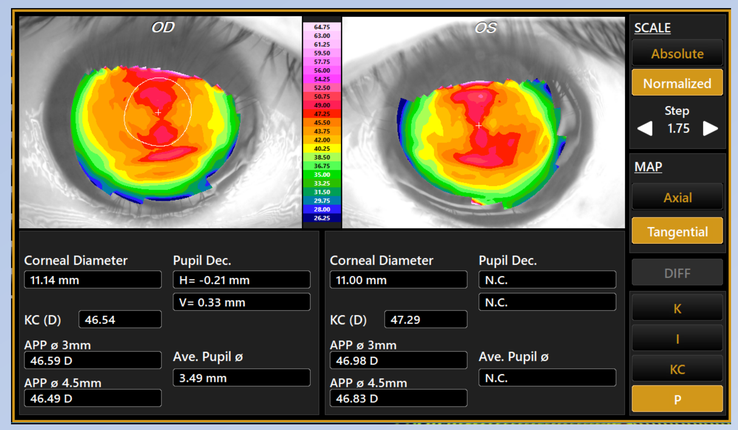

Figure 1

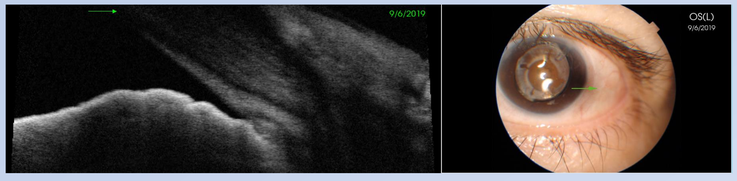

Figure 2

Visit 2. On 9/13/19, L.J. returned for contact lens prescribing for an iris-occluding prosthetic contact lens for the left eye. Scleral lens prescribing was also performed for both eyes, to give her the option of wearing the prosthetic lens as a reverse piggyback over the left scleral lens. For the left eye, an ABB Prosthetic Opaque Colors lens was ordered with Methafilcon A (55% water), Plano DS, 8.6 base curve, 14.3 mm diameter, and 11.0 mm occluding iris with 3.3 clear pupil. A U2 underprint with a 56X (dark cocoa) overlay was specified.

Diagnostic evaluation was also performed with Alden Zenlens 16.0 mm diameter Scleral (Prolate) OU with 4200 SAG, 8.20 BC, -2.00 DS, STD APS. Fluorescein evaluation showed approximately 250 microns of even vault over the corneal surface with adequate limbal clearance OU. The scleral haptic landing showed conjunctival impingement in the horizontal meridian and edge clearance in the vertical meridian in both eyes, but OS > OD. Spherical over-refraction of +5.75 DS OD yielded 20/30 OD and +4.25 DS OS yielded 20/50.

The following Zenlens Prolate lenses in 16.0 mm diameter, 4200 SAGs, in XO2 Blue and Tangible HydraPEG OU were ordered:

OD +4.50 DS, BC 8.20, toric APS Horizontal FLT2, Vertical STP2
OS +3.00 DS, BC 8.20, toric APS Horizontal FLT3, Vertical STP3

Visit 3. On 11/14/2019, L.J. returned for contact lens dispensing. Scleral lenses provided visual acuities of 20/30 OD and 20/40. Both lenses demonstrated an even post-lens tear film approximately 250 microns thick. The right scleral lens haptic landing was appropriately flush against the conjunctiva, but the left scleral haptic mechanically interacted with the conjunctiva adjacent to the aqueous tube and was judged to be an unacceptable risk for conjunctival erosion even with further lens modification. The prosthetic contact lens was briefly applied over the left scleral lens. (**Figure 3B**). The prosthetic lens drifted inferiorly after blink with variable subjective vision and equivocal reduction of glare symptoms.

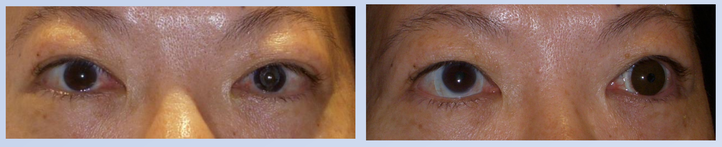

Figure 3A. Uncorrected. 3B. Wearing scleral lenses OU with prosthetic soft over OS.

Patient L.J. was counseled how it may not be safe to wear the left scleral lens. Rather than wearing the right scleral lens alone, she sought completion of the prosthetic lens prescribing OS to be worn with glasses over.

The prosthetic lens on the left eye showed good centration with minimal movement. The iris color diameter appeared to be too large, as did the clear pupil, relative to the right eye Spherocylindrical over-refraction gave +2.00-4.00X040, yielding 20/30. A new prosthetic lens was ordered with the same parameters as previous but a 10.5 mm occluding iris and 2.8 mm clear pupil, both smaller diameters.

Due to delays and remakes by the lab, the newest prosthetic soft contact lens was not ready for dispensing by the GSLS final poster submission deadline of December 6, 2019.

Conclusion

This case describes the outcome of a prosthetic iris-occluding soft lens intended as a reverse-piggyback lens over a scleral contact lens. L.J. experienced significant glare in the left eye, due to a fixed dilated pupil allowing light to pass through an opacified capsular bag. The prosthetic lens was intended to establish a smaller functional pupil. However a conventional scleral lens in the left eye was judged to pose an unacceptable risk for conjunctival erosion over the aqueous tube. A prosthetic lens alone was prescribed for use with eyeglasses.

It appears plausible for a prosthetic contact lens to be piggybacked over a scleral lens yet concern over shunt tube conjunctival erosion derailed completion of this strategy for L.J. Future treatment may include an impression-based scleral lens (EyeprintPRO) with the prosthetic soft lens worn over.

It is worth discussing three physiological concerns for scleral lens wear with a reverse-piggyback soft lens in L.J's case: corneal hypoxia, intraocular pressure elevation, and conjunctival erosion over the aqueous tube.

- *Potential corneal hypoxia*

  The soft prosthetic lens was chosen to go over the scleral lens, not the other way around, to maximize oxygen flux to the cornea. Since the 14.5 mm diameter of the soft lens (Dk = 18) is smaller than the 16.0 mm diameter of the scleral lens (Dk = 141), the XO2 material serves as a lateral conduit of oxygen from the scleral lens periphery. The transverse oxygen flux through the stack of methafilcon, post-lens tear film, and XO2 material, is limited by the lowest Dk layer, the methafilcon. For some irregular corneas it is possible that the soft lens has a better fitting relationship when placed over the scleral lens instead of directly on the irregular ocular surface.

  The prosthetic soft lens material originally desired was the Definitive lathe-cut silicone hydrogel material to maximize oxygen transmission. ABB consultation (Patti Ryan, NCLEC) reported that this material is no longer available for their prosthetic applications.

- *Potential intraocular pressure elevation*

  Recent data suggests that scleral lens wear may increase intraocular pressure. (3, 4) This is particularly relevant for patients with glaucoma and those at risk for it. While personal communication with a glaucoma specialist confirmed that aqueous tubes are not readily collapsible (e.g. by an overlying scleral lens or with digital pressure), careful monitoring of IOP is still a conservative measure.

- *Potential conjunctival erosion over the aqueous tube*

  Tube exposure from conjunctival erosion occurs in 2-3% of cases with aqueous drainage shunts. (5) In turn, tube exposure is a risk for endophthalmitis. (6) While a review of the literature does not yield any case of conjunctival erosion attributable to scleral lens wear, this is nonetheless a possibility as tube exteriorization can occur even in the absence of contact lens wear. There are strategies to minimize interaction of a scleral lens against a tube. A prior report described lens notching to clear a glaucoma tube. (7) Other possibilities include using Microvaults (Bausch + Lomb Specialty Vision Products) and impression-based scleral lenses (EyePrintPRO Prosthetics). Another alternative is incorporating a prosthetic print onto a scleral lens, according to consultation with Ocular Prosthetics Lab (Dr. Chandrashekhar Chawan, DOpt, PhD, FSLS).

References

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