Endothelial dysfunction after scleral lens use in patients with herpetic eye disease

Herpes simplex virus and varicella zoster virus (VZV) affect approximately 4 billion individuals globally. When the infection involves the ophthalmic division of the trigeminal nerve (V1), they are termed "herpetic keratitis" (HK) and "herpes zoster ophthalmicus" (HZO). The estimated incidence of VZV is 4/1000 people, with approximately 10–20% of cases demonstrating ocular involvement.[1] HK has been approximated to affect 1.5 million people with an estimated incidence of 11.8/100,000. Together, these are thought to be the leading cause of infectious ocular blindness in the developed world.[2] HK/HZO can impact every component of the ocular apparatus, including endothelial cells. Once damaged, these cells do not regenerate, with the only definitive treatment being corneal transplantation.

Scleral lenses are large-diameter lenses that rest on the sclera, while vaulting the cornea and limbus. A fluid reservoir is created that acts to correct irregular astigmatism while hydrating the anterior surface of the eye. These lenses are indicated for use for ocular surface diseases (e.g., dry eye), as optical correction in cases of irregular corneal astigmatism (e.g., ectasias) or after corneal transplantation.[3]

Recently, we have found anecdotal evidence suggesting endothelial dysfunction after scleral contact lens use in patients with a history of HK/HZO and whose disease was quiescent.

Charts of 4 patients who demonstrated this after scleral lens use for ectasias were reviewed retrospectively. The natural history of HSV/VZV infection and associated sequelae of the disease were examined along with ocular comorbidities, visual acuity, type and duration of scleral lens use, ocular and systemic medications, as well as surgical intervention for definitive treatment (see Table 1). This study was approved by the Research Ethics Board at the University of Toronto and was conducted in compliance with the tenets of the Declaration of Helsinki.

We hypothesize that the following possible etiologies may underlie this clinical phenomenon:

1. Subclinical endothelial dysfunction: The increased fluid load created by the scleral lens via fluid reservoir interface may overwhelm the already susceptible cells.
2. Relative hypoxia: There has been evidence to suggest that oxygen permeability through the lens is dependent on many factors, including the intrinsic diffusion coefficient of the material, thickness of the material, as well as the thickness post-lens tear film.[4] It is possible that history of HK/HZO may have compromised endothelial function in our patients, increasing corneal susceptibility to relative hypoxia.
3. Contact lenses independently cause morphological changes in the corneal endothelial cells.[5] This, compounded with known endothelial dysfunction in HK/HZO, may explain the rapid and significant onset of corneal edema in our patient population.
4. Lastly, it is possible that scleral contact lens use could cause the HK/HZO endothelial disease to flare up independently or in conjunction with any of the above-described mechanisms.

Table 1—Data for patients included in this study

Patient	Age, y	Sex	Virus (Eye)	Ocular Comorbidities	Scleral Lens	Time to Edema	Treatment	Transplant
1	62	M	HK (OS)	Cataract extraction (OU) Chemical injury Previous PKP (OS)	Zenlens: −1.75 −6.00 × 63; OAD = 15.4; BC = 7.42; Sag = 4.400; CT = 0.25 (Bausch & Lomb Specialty Vision Products, Rochester, NY)	5 mo	Cyclosporine Prednisolone Moxifloxacin Acyclovir	Repeat PKP (OS)
2	72	F	HK (OU)	Keratoconus Cataract extraction (OU) Previous PKP (OU) Blepharoplasty (OU)	Zenlens: +2.75 −3.50 × 152; BC = 8.6; OAD = 17.00; Sag = 6.0; CT = 0.42 (Bausch & Lomb Specialty Vision Products)	1 wk	Prednisolone Valacyclovir	DSAEK under PKP (OD)
3	73	M	HZO (OU)	Keratoconus Glaucoma Cataract extraction (OD) Conjunctival resection with glue reconstruction (OD)	Zenlens: 8.00 −1.00 × 124; BC = 9.0; sag = 4.7; CT = 0.58; OAD = 16.0 mm; BXO2 (Bausch & Lomb Specialty Vision Products)	4 mo	Loteprednol Hypertonic NaCl Famciclovir	N/A
4	51	F	HK (OS)	Blunt trauma	Zenlens: FT; BC = 9.5; sag = 4.5; CT = 0.42; OAD = 16.0; BXO (Bausch & Lomb Specialty Vision Products)	1 wk	Prednisolone Hypertonic NaCl Valacyclovir	N/A

HK, herpetic keratitis; HZO, herpes zoster ophthalmicus; PKP, penetrating keratoplasty; OAD, overall diameter; BC, base curve; Sag, sagittal depth; CT, centre thickness; DSAEK, Descemet Stripping Automated Endothelial Keratoplasty; N/A , not applicable; FT, front toric; BXO, Boston XO.

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This is the first report to demonstrate clinical endothelial dysfunction associated with scleral contact lens use in patients with dormant HK/HZO. Eye care providers should be aware of this clinical scenario, as well as the potential for need of corneal transplantation. Caution should be exercised when fitting scleral lenses on these patients.

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References

1. Liesegang TJ. Herpes zoster ophthalmicus natural history, risk factors, clinical presentation, and morbidity. Ophthalmology 2008;115:S3–12.
2. Farooq AV, Shukla D. Herpes simplex epithelial and stromal keratitis: an epidemiologic update. Surv Ophthalmol 2012;57:448–62.
3. van der Worp E, Bornman D, Ferreira DL, et al. Modern scleral contact lenses: a review. Cont Lens Anterior Eye 2014;37:240–50.
4. Compan V, Oliveira C, Aguilella-Arzo M, et al. Oxygen diffusion and edema with modern scleral rigid gas permeable contact lenses. Invest Ophthalmol Vis Sci 2014;55:6421–9.
5. Liesegang TJ. Physiologic changes of the cornea with contact lens wear. Eye Contact Lens 2002;28:12–27.

Footnotes and Disclosure:

The authors have no proprietary or commercial interest in any materials discussed in this article.