Contact Lens Update
CLINICAL INSIGHTS BASED IN CURRENT RESEARCH

Use of a scleral contact lens to manage a patient with a persistent epithelial defect due to neurotrophic keratitis

April 28, 2022

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Background

Neurotrophic Keratitis (NK) is a degenerative corneal disease related to alterations in trigeminal corneal nerve sensory function, with consequent breakdown of the corneal epithelium, impairment of healing, and development of corneal ulceration, melting, and perforation.[1, 2] The hallmark of NK is decreased or absolute absence of corneal sensation.[1-3] This case report will describe a patient with a history of a persistent epithelial defect (PED) in his right cornea that had no success with healing after use of multiple topical therapeutics, amniotic membranes, and soft bandage contact lenses. The PED resulted from NK, acquired by damage of the right trigeminal nerve from a percutaneous ganglion balloon compression rhizotomy procedure for treatment of trigeminal neuralgia. A scleral contact lens was able to heal the defect completely within one week.

History

A 60-year-old male was referred to our clinic for a scleral contact lens fitting in the hopes of healing a PED in his right eye. The patient had a history of right trigeminal nerve neuralgia which was treated with a right percutaneous balloon compression rhizotomy (PBCR) two years prior.[4-7] This procedure helped relieve his pain from the trigeminal neuralgia, however, he developed right facial anesthesia. The anesthesia affected his right eye, in which he stated he lost complete corneal sensation. Two months prior, he noticed his right eye was getting red and blurry, so he presented to an ophthalmologist who diagnosed him with NK and a central PED of his right eye secondary to right trigeminal nerve damage from the PBCR procedure.

His ophthalmologist was treating his NK and PED with Lotemax (Bausch + Lomb) ophthalmic suspension twice a day, Vigamox (Alcon) three times a day, autologous serum tears (AST) four times a day, and artificial tears (Systane Ultra Preservative Free, Alcon) every hour. Additionally, the ophthalmologist placed an amniotic membrane transplant over his right eye two times consecutively when the PED first occurred, although this did not heal the defect. At the time of presentation, the patient was dosing the topical medications listed above over an extended wear soft bandage contact lens which was changed every 2 weeks by his ophthalmologist. Additionally, his ophthalmologist asked him to tape his right lid shut at night to keep the defect from worsening in case of lagophthalmos. Originally, he was asked to place lubricating ointment (Systane Nighttime ointment, Alcon) into the right eye before taping it shut, however the patient felt like the ointment was making his eyes more red. Thus, his ophthalmologist discontinued the ointment. The patient related that his eye was always red, but it was not painful since he could not feel it due to the NK. The patient was referred specifically for a scleral lens fitting to see if it would heal the central PED.

His entering visual acuity was OD 20/50 and OS 20/20 at distance and J7 and J1 at near respectively with a

spectacle prescription of OD plano/-1.00×065 and OS -0.75/-0.50×065 with a +2.25 Add in both eyes. The patient was wearing OD an Air Optix Night & Day (Alcon) bandage contact lens with base curve (BC) of 8.60 mm, power of -0.25, and diameter of 13.80 mm.

The bandage lens was removed and anterior biomicroscopy was performed in both eyes. His lids, lashes, and adnexa were unremarkable in both eyes. The patient showed moderate hyperemia of the bulbar conjunctiva OD and the conjunctival tissue OS was clear. The cornea was clear OS, however, OD showed diffuse stromal haze centrally with an overlying epithelial defect 5 mm wide by 3 mm long paracentral inferior (**FIGURE 1**). Intraocular pressure measured with non-contact tonometry was 15mmHg in both eyes.

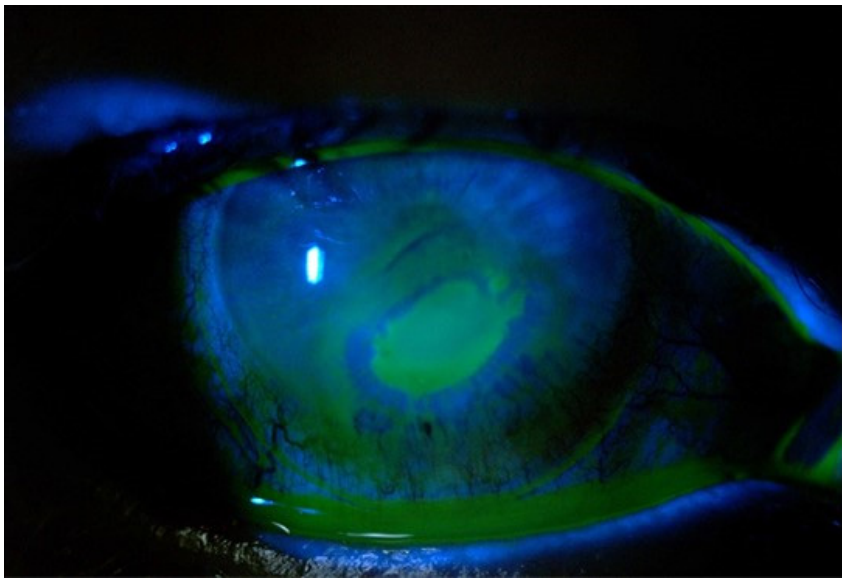

Figure 1: Right persistent epithelial defect (PED) caused by neurotrophic keratitis (NK) secondary to damage of trigeminal nerve from a right percutaneous trigeminal ganglion balloon compression procedure.

At this visit it was discussed that a scleral contact lens could help heal his PED since the lens continually bathed the eye in preservative free saline, and or lubrication drops, and other topical medications such as AST. Additionally, it was explained that the lens would protect his cornea from mechanical interaction from his lids, which may be exacerbating the PED.

Keratometry values were OD 42.64 @ 176 / 49.28 @ 086 and OS 40.79 @ 034 / 41.51 @ 124. Axial topography showed an irregular against-the-rule (ATR) astigmatism pattern, with inferior central steepening OD and regular minimal with-the-rule (WTR) astigmatism OS (**Figure 2**). The corneal irregularity OD was due to the severe surface disease and PED. The patient's HVID in both eyes was 11.80 mm.

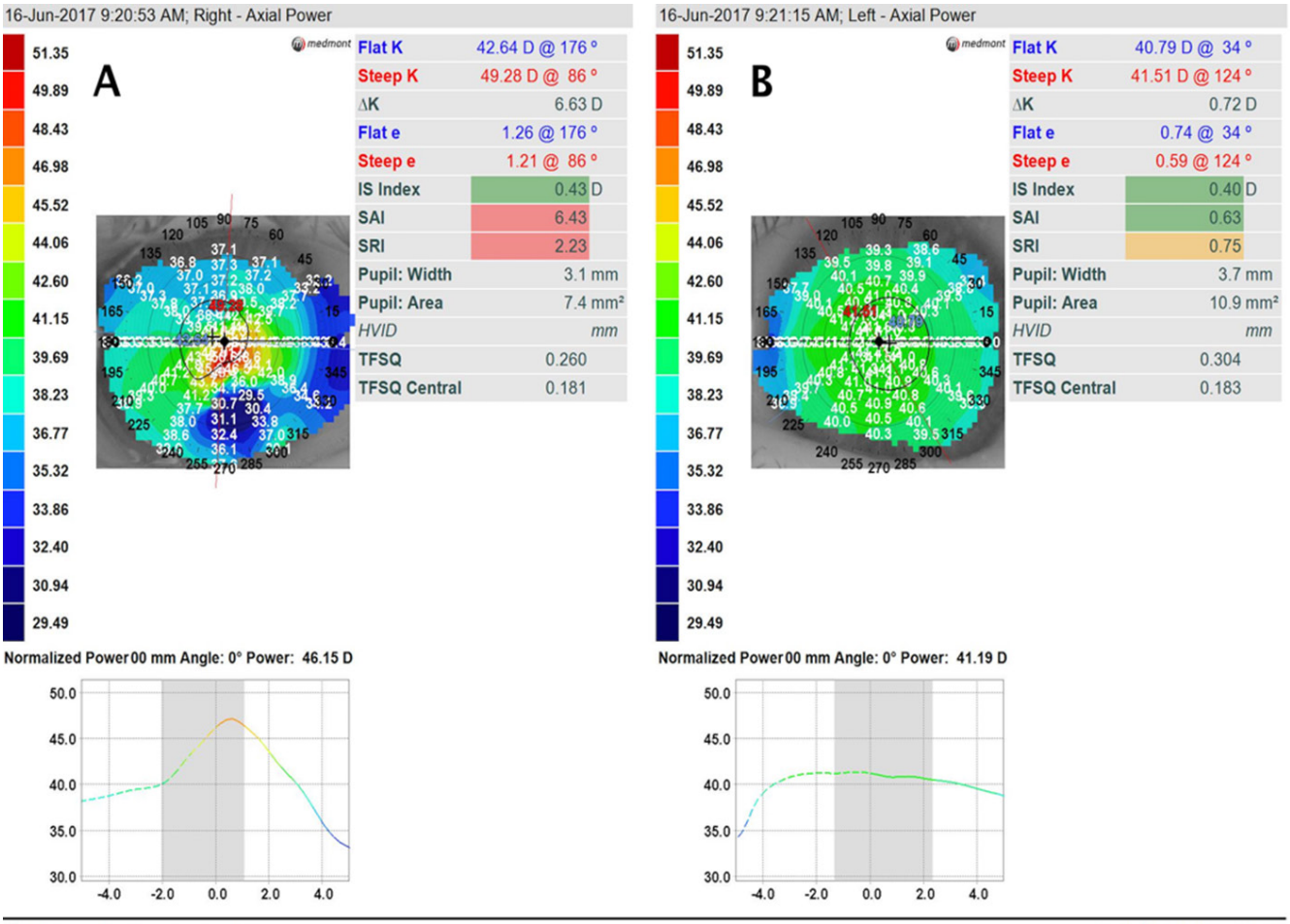

Figure 2: Right eye axial topography in the presence of PED caused by NK. The topography shows irregular against-the-rule astigmatism pattern with inferior central steepening OD **(A)** and regular with-the-rule astigmatism OS **(B)**.

A large diameter 18.00 mm scleral lens was chosen for the first trial lens so that it would cover as much of the ocular surface as possible, to help heal the patient's PED and manage his NK. A Europa scleral (Visionary Optics) was the first lens trialed. The Europa scleral lens has a reverse geometry design in which the peripheral curve adjacent to the BC is comparatively steeper. The remainder of the peripheral curves flatten from the vault into the haptic landing and the edge lift curve. The manufacturer states that the reverse geometry design allows easier fitting over post surgically altered oblate corneal contours. Additionally, the company states that its proprietary landing zone allows for better alignment with the scleral conjunctival contour, and less haptic impingement, thus allowing for easier removal in comparison to its earlier regular geometry scleral lens predecessor, the Jupiter (Visionary Optics) scleral lens. The first Europa trial lens placed on the patient's right eye was: BC 46.00 D, -2.00 power, and diameter 18.00 mm with a standard periphery. Right after application, the lens showed complete clearance over the cornea, however, it was decentered inferiorly. Since the lens was decentered the central vault of the lens was asymmetrical, with less vault in the superior periphery (350 microns) and more vault in the inferior periphery (600 microns). The central vault was approximately 500 microns thick. Taking into account potential scleral lens settling of about 80 to 100 microns after 8 hours of wear, [8] this lens was judged to have an acceptable vault. Despite the decentration, the lens haptic appeared to be well aligned with the scleral conjunctival shape and conjunctival vasculature. A -3.00 D refraction over the lens gave the patient 20/30 vision. Overall, the lens fit was judged to be acceptable. Since the primary goal of this lens was to see if it would help heal the PED, this

lens was dispensed to the patient. The patient's vision through the lens without an over refraction was 20/100, however with both eyes open and his presenting spectacles over the lens, he was able to see 20/20 distance and read J1 are near with both eyes open. The patient related that this vision was acceptable while wearing both the scleral lens and his spectacles.

The patient was taught careful insertion and removal of the scleral contact lens. He was dispensed Unique pH Solution (Menicon America) for cleaning, disinfecting, and storage. Perseverative free, and buffer free sodium chloride inhalation solution 0.9% was dispensed to the patient as a filling and rinsing solution for the scleral lens. The lens was dispensed for daily wear only.

The patient asked if his topical medications would change with the wear of the scleral lens. Instead of his original four drops a day of AST without his lens on, he was instructed to place 3-4 drops of the AST in the bowl of his scleral contact lens and fill the remainder of the lens with the perseverative free saline. Additionally, he was instructed to decrease his Lotemax and Vigamox drops to twice a day, in the morning and before bedtime while not wearing his scleral lens. Also, he was told to continue his preservative free tears as much as he needed over his scleral contact lens and without the lens on. Lastly, he was still to continue taping his lid shut at night after his scleral lens was removed. The patient was asked to return to clinic in 1 week for a progress evaluation. The lens parameters trialed and dispensed during this visit are noted in **Table 1**.

Table 1: Lens Trial and Dispensed

Brand/Manufacturer	Europa/Visionary Optics
Power (D)	-2.00
Overall Diameter (mm)	18.00
Central Optic Zone Radius/Width (D/mm)	46.00/9.00
Peripheral Curve 1 Radius/Width (mm)	7.15/2.00
Peripheral Curve 2 Radius Width (mm)	10.00/1.00
Peripheral Curve 3 Radius/Width (mm)	13.00/1.00
Peripheral Curve 4 Radius/Width (mm)	15.00/0.50
Anterior Optic Zone Width (mm)	8.00
Sagittal Depth (mm)	5.45
Center Thickness (mm)	0.40
Material	Boston XO

Follow-up

The patient presented for a medical progress visit of his right PED. The patient related that he noticed his right eye was less red with the use of the scleral contact lens. He stated that the lens was comfortable and that there were no changes in his vision since last visit. The patient had been wearing his scleral contact lens everyday as instructed with no problems with insertion, however, it was mildly difficult to remove. He was using the AST mixed with preservative free saline in the bowl of this contact lens. Additionally, he stated he decreased his Lotemax and Vigamox drops as instructed last visit. Also, he stated that he had reduced his preservative free tears to every 2 hours since he was dispensed his scleral contact lens. He was still taping his lid shut at night after removing his scleral lens.

The scleral contact lens was removed and biomicroscopy performed. The scleral lens was noted to have mild resistance to removal. The patient showed mild hyperemia of the bulbar conjunctiva OD and the PED was

completely epithelized (**Figure 3**).

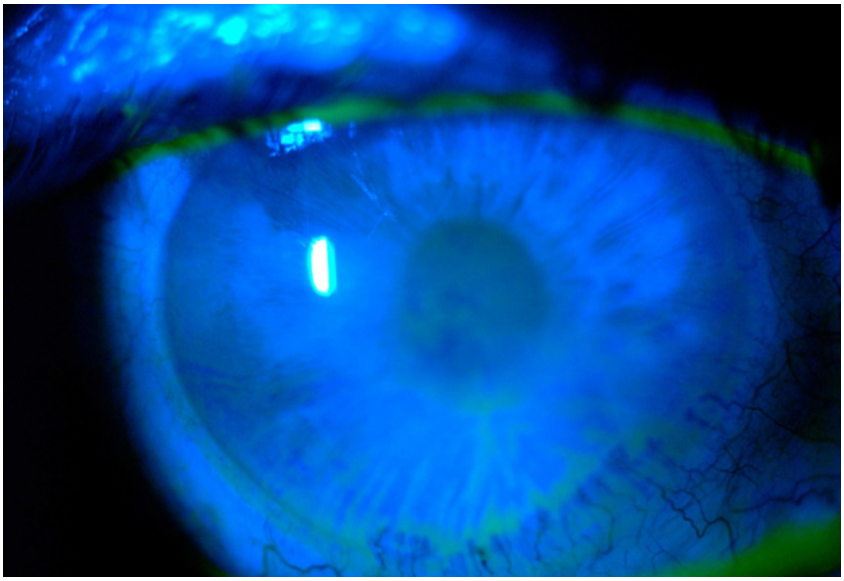

Figure 3: Right eye PED was completely epithelized after scleral lens treatment.

Since healing of the PED was seen with the scleral contact lens, another lens was ordered with the above over refraction and a modified haptic was chosen to improve ease of removal. The following Europa lens was ordered for the patient: BC 48.00 D, -9.00 power, and overall diameter 18.00 mm with a 3.00 D flat peripheral curve 2 and 2.00 D flat peripheral curve 3. According to the manufacturer, flattening the peripheral haptic landing curves by 3.00 D in peripheral curve 2 and 2.00 D in peripheral curve 3 would decrease the sagittal depth by 100 microns. Also, for every 1.00 D of decrease in the base curve, this would decrease sagittal depth of the lens by 80 to 100 microns.

Thus, with all the changes made, the net decrease in sagittal depth was approximated 60 microns less in the new scleral contact lens in comparison to the current lens. The patient was to continue wearing the presenting scleral contact lens and still dose his topical medications over the right eye as usual. The new lens parameters ordered are noted in **Table 2**. The patient has been stable with this scleral lens for the last 4 years.

Table 2: Lens Ordered

Brand/Manufacturer	Europa/Visionary Optics
Power (D)	-9.00
Overall Diameter (mm)	18.00
Central Optic Zone Radius/Width (D/mm)	48.00/9.00
Peripheral Curve 1 Radius/Width (mm)	7.00/2.00
Peripheral Curve 2 Radius Width (mm)	11.00/1.00
Peripheral Curve 3 Radius/Width (mm)	14.00/1.00
Peripheral Curve 4 Radius/Width (mm)	15.00/0.50
Anterior Optic Zone Width (mm)	8.00
Sagittal Depth (mm)	5.353
Center Thickness (mm)	0.40
Material	Boston XO2

Conclusions

NK is a degenerative corneal disease related to alterations in trigeminal corneal nerve sensory function with resultant breakdown of the corneal epithelium, impairment of healing, and development of corneal ulceration, melting, and perforation. [1-3] The hallmark of NK is decreased or total absence of corneal sensation.[1-3] The trigeminal nerve provides corneal sensation and supplies trophic factors to the cornea, therefore, maintaining the anatomical integrity of the ocular surface. The ocular surface epithelium, tear-producing glands, and sensory and autonomic fibers come together to influence their various structure and functions by the release of cytokines, neuropeptides, and neuromodulators.[1-3] Impairment of corneal trigeminal innervation causes alterations in morphological and metabolic function, thus leading to the development of recurrent or PEDs.[9]

The clinical presentation of NK ranges from superficial punctate keratopathy to full PED, which may progress to stromal melting and corneal perforation. Since those affected with NK have decreased or absence corneal sensation, they rarely complain of significant symptoms.[1-3] Prompt diagnosis and classification of the disease is key to initiating the appropriate treatment, to heal the ocular surface and prevent further progression of disease. Treatment of NK should be based on disease severity. Stage 1 treatment aims to improve corneal epithelial quality and prevent further breakdown. Stage 2 focuses on healing the PED and avoiding corneal ulceration. In severe stage 3 cases, where corneal ulceration and stromal melt are present, treatment is aimed at preventing stromal lysis and corneal perforation. [1-3, 10]

Scleral contact lenses can be used to promote healing of PEDs and help protect and heal the ocular surface in those affected with NK.[11, 12] Severe ocular surface disease is a primary indication for scleral lenses since they protect the surface from external dehydration and help heal the surface by enclosing it within a fluid filled reservoir.[13, 14] The PED in the patient described in this case report did not heal despite multiple topical treatments and the use soft bandage lenses. Wearing a scleral contact lens combined with AST healed the case patient's ocular surface in just one week. The healing rate of PEDs in scleral lenses filled with AST as compared to AST in the presence of a soft bandage contact lens appears to be increased, as seen in this case report. This may be due to the fact that scleral lenses are able to directly deliver and constantly hold the AST over the corneal surface. Additionally, the scleral lenses provide superior mechanical protection that that afforded by a soft bandage lens.

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