



Losing Sleep Over A Scleral Lens

Obstructive Sleep Apnea and Scleral Lens Fogging

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Introduction

Obstructive sleep apnea (OSA) is 10-20 times more prevalent in patients with keratoconus. Both OSA and keratoconus are associated with Floppy Eyelid Syndrome (FES), which can cause ocular surface irritation, redness, and mucoid discharge. Many patients with keratoconus rely on scleral lens wear. With the comorbidity of keratoconus with OSA and FES, ocular surface disease can develop at night and cause excess debris in the tear film and fogging with daytime scleral lens wear.

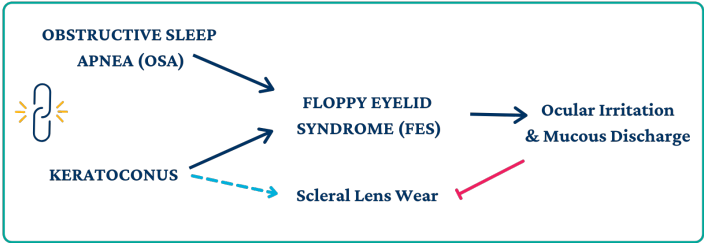


Figure 1. Association of OSA and keratoconus with FES, and impact on scleral lens wear.

Case Report

A 48-year-old Hispanic male presents with the chief complaint of foggy vision after 3 hours of scleral lens wear. Symptoms began at the same time of **starting** Continuous Positive Airway Pressure (CPAP) for OSA.



Ocular History:
Keratoconus OU
Allergic conjunctivitis OU

Medical History:
Hypertension: Medicated with Amlodipine
Severe obesity: BMI 48.1
Sleep apnea: CPAP
Family history: diabetes, hypertension

Visual Acuity Spectacles OD: 20/100 OS: 20/400
Scleral Lenses OD: 20/30+2 OS 20/40+2

Anterior Segment:
OD: 2-3+ mucous adherent to superior bulbar conjunctiva, 1+ papillae UL, lid laxity UL, Vogt's striae, partial Fleisher's ring, central scarring, pingueculas
OS: 2-3+ mucous adherent to superior bulbar conjunctiva, 1+ papillae UL, lid laxity UL, Vogt's striae, full Fleisher's ring, central scarring with elevation, pingueculas

Clinical Findings

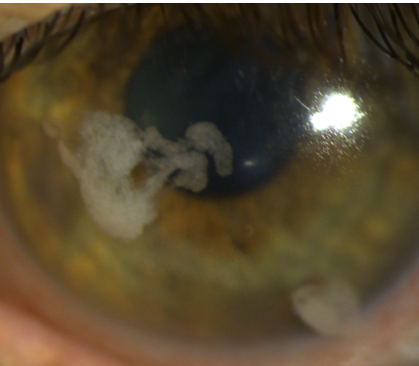


Figure 2. Hydrated mucous discharge within the scleral lens reservoir

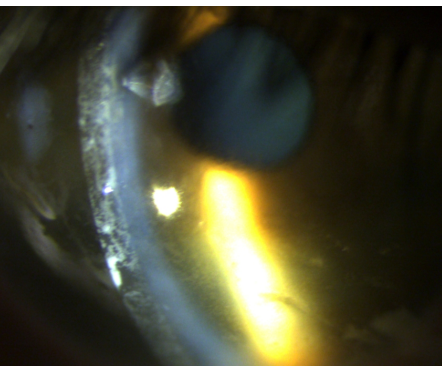


Figure 3. Mucous deposits on scleral lens surface and hazy scleral lens fluid causing fogging

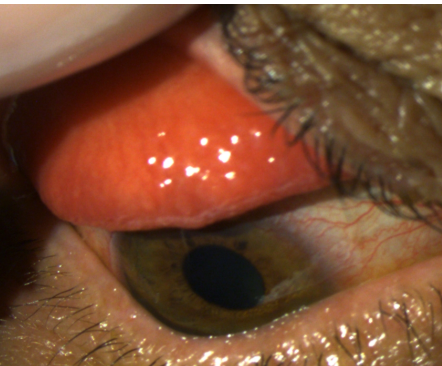


Figure 4. Papillae on upper lid eversion associated with Floppy Eyelid Syndrome



Figure 5. Lid laxity and poor lid-to-globe apposition in Floppy Eyelid Syndrome

Discussion

Obstructive Sleep Apnea (OSA) is marked by disruption of sleep for brief periods of time caused by poor dilator muscle tone, reduction in throat soft tissue elasticity, or other upper airway obstructions. OSA is often underdiagnosed, and patients with keratoconus are 10-20 times more likely to have OSA. A mutual proposed mechanism of OSA and keratoconus is systemic connective tissue deformation mediated by an **upregulation of matrix metallopeptidase (MMP-9)**. MMP9 expression is further exacerbated by hypoxia that occurs in OSA.

Another commonality is that keratoconus and OSA are associated with **Floppy Eyelid Syndrome (FES)**, which is a disorder marked by easily everted upper eyelids and papillary conjunctivitis. Nocturnal eyelid eversion can cause ocular surface disease from trauma to the cornea from the pillow, or exposure keratopathy. FES exhibits ocular irritation signs including SPK, RCE, filamentary keratitis, mucoid discharge and more.

With the association of OSA, keratoconus, and FES, a subset of patients will benefit from scleral lens wear, but special considerations are necessary to optimize contact lens wear with ocular irritation from FES.

- 1. Treat underlying FES by protecting the ocular surface at night.** Although scleral lenses can be used to treat some forms of dry eye, FES can complicate scleral lens wear since the ocular surface is exposed at night, causing dry eye and mucous discharge that can inhibit clear and comfortable daytime lens wear.
- 2. Improve scleral lens fit to minimize fogging.** Using NaFl over the lens can expose areas of edge lift and misalignment of the lens and sclera, that allows debris into the lens and cause fogging. Edge lift can also cause conjunctival irritation. Decreasing the sagittal depth of the lens can be helpful in reducing fogging.
- 3. Ensure proper CPAP fit.** CPAP mask therapy is a common treatment for OSA and can reduce hypoxia, improve sleep quality and lessen FES symptoms. However, the use of a CPAP can aggravate dry eye if it fits improperly or becomes displaced during side-sleep, as the cornea is exposed to escaping air from the mask.

Treating the underlying floppy eyelid syndrome by protecting the ocular surface at night, as well as improving the scleral lens fit during the day, synergistically improved this patient's vision and comfort in scleral lenses.

Management



Obstructive Sleep Apnea

Refer for OSA evaluation and polysomnography
Ensure proper CPAP fit
Encourage weight loss management with PCP



Scleral Lens Fogging

NaFl assessment of edge lift that may allow debris into the lens, or irritate the eyelid
Minimize sagittal depth
Viscous filling solution



Floppy Eyelid Syndrome

Ocular lubricants, especially at night
Nocturnal eye shield, or mask
Stop eye rubbing
Surgical for Full Thickness Wedge Excision

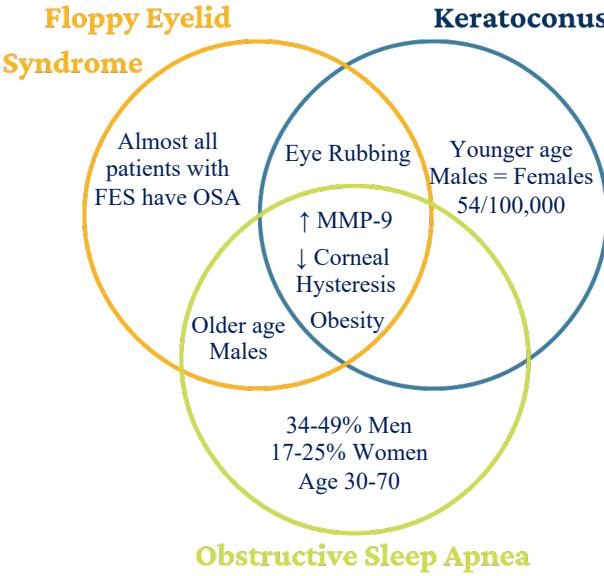


Figure 6. Comparison and commonalities between keratoconus, FES and OSA.

Scleral Lens Fit

Initial Lens

Jupiter Standard with TPC

OD: Apical clearance 315um, impinging temporal and nasal pinguecula, conjunctival prolapse
OS: Apical clearance 160um, mild impingement temporal pinguecula, tr edge lift

Finalized Lens

Zenlens Prolate with TPC and Hydra-PEG

OD: Apical clearance 105um, microvault centered at temporal pinguecula (4mm height/330um depth/axis 180)
OS: Apical clearance 270um, microvault centered at temporal pinguecula (5mm height/380um depth/axis 180)

To provide the patient with a healthier scleral fit, microvaults were added, the toric haptics were optimized, and the sagittal depth was lowered to minimize mid-day fogging.

Clinical Pearls

Keratoconic patients are more likely to have OSA.
Promote general health and consider **referral for OSA evaluation**, as it can improve quality and duration of life.

CPAP use for OSA may improve FES but if fit improperly, can exacerbate dry eye and ocular surface disease.

Apply NaFl on top of the scleral lens to evaluate NaFl uptake and flooding to identify areas of edge lift that can be optimized to prevent fogging.

References & Acknowledgements

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