

Tear film fogging with scleral lenses

In the past five years there has been a dramatic increase in the use of scleral lens designs around the world and for a great number of patients the improvements in visual performance and comfort have been nothing short of life-changing. However, with all of their advantages, scleral lenses have also presented us with some unique, never seen before, complications.

By Patrick J. Caroline

One of these complications is the accumulation of particulate matter within the fluid beneath the lens. Within hours, the particulates break down resulting in a turbid or foggy film within the reservoir (figure 1). When the post-lens fluid fogging is combined with normal scleral vault, (in excess of 100 microns) the volume of the cloudy interface can be great enough to dramatically affect the patient's visual acuity.

In our experience, the condition is usually bilateral but, is often significantly worse in one eye than the other. Patients quickly

learn that the condition is best managed by, removing the lens, rinsing the lens surfaces with preservative free saline, refilling the bowl with fresh saline, and then re-applying the lens. Following this procedure, patient's often report good vision for another four to six hours. For some patients this is the number one complication they experience with their scleral lenses. Let's then take a look at a few clinical impressions we've noted about this condition.

HOW OFTEN DOES THIS "CLOUDY/FOGGY" SUBSTANCE OCCUR IN PATIENTS WEARING SCLERAL LENSES?

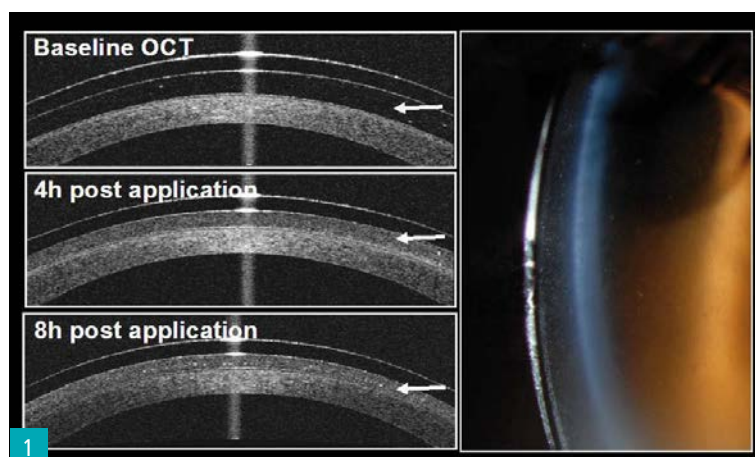
Our best estimate is that post lens fogging occurs (in varying degrees) in approximately 20 to 30% of patients.

DOES THE CONDITION IMPROVE WITH TIME?

For some patients the answer is "yes". There is no doubt that in some individuals, the first month of lens wear is the worst, then, the frequency of the required lens removal and reapplication becomes less.

DOES THE CONDITION EVER GO AWAY ON ITS OWN?

The answer in our experience is "no". While some patients experience a type of adaption and lessening of the clouding/fogging, it rarely, if ever, disappears completely on its own.



1 Post lens tear fogging

IS THE CONDITION ASSOCIATED WITH ANY DEPOSITS OR NON-WETTING ON THE SURFACES OF THE LENS?

The answer here is “no”. The lens surfaces are frequently free of any deposits or non-wetting. Following lens removal, the opaque substance seems to be completely removed with a simple saline rinse of the posterior lens surface.

IS THE CONDITION ASSOCIATED WITH ANY UNDERLYING CORNEAL EDEMA?

The answer is usually “no”, it is not. In most patients, the underlying cornea is free of corneal edema. However, post lens tear fogging does need to be differentiated from the cloudiness that is associated with corneal edema secondary to a compromised endothelium. In some patients (especially those following corneal transplant surgery) endothelial cell counts can decrease to a critical low level (i.e. less than 500 cells per square millimeter) and in this situation the subjective cloudy or foggy vision may indeed be secondary to hypoxia.

WHAT IS IT?

For a number of years our working hypothesis was that the substance was perhaps an accumulation of mucin in the post lens tear film related to excessive pressure of the haptic on the mucin rich goblet cells of the bulbar conjunctiva. More recent laboratory studies at Pacific University have shown that proteins, (and in particular mucin), “did not” appear in higher concentrations in the fogged specimens vs clear specimens we collected. However, histological lipid analysis DID show that lipid levels were significantly higher in the fogged specimens, figure 2. Is it then lipid contamination that is responsible for creating the turbid fluid? Studies are currently underway to evaluate the role of lipids in this condition.

IS THERE ANYTHING THAT CAN BE DONE TO LESSEN THE FORMATION/ACCUMULATION OF THE POST LENS TEAR FOGGING?

The answer is “yes”. Clinical experience has taught us that the condition can be lessened by a number of different techniques:

- The lens can be designed with minimal clearance across the peripheral cornea and limbus. Figure 3 illustrates such a design in which the lens (after settling) aligns rather than vaults the limbus. It is hypothesized that this fitting relationship somehow lessens the post lens lipid concentration through a yet-to-be-determined process.
- In designs that incorporate a more limbal clearance philosophy, our patients have reported a significant improvement in the fogging by simply using a more viscous application solution such as a preservative free artificial tear. The artificial tear can be diluted with preservative free solution until the patient finds the appropriate concentration (viscosity) to manage their fogging symptoms.

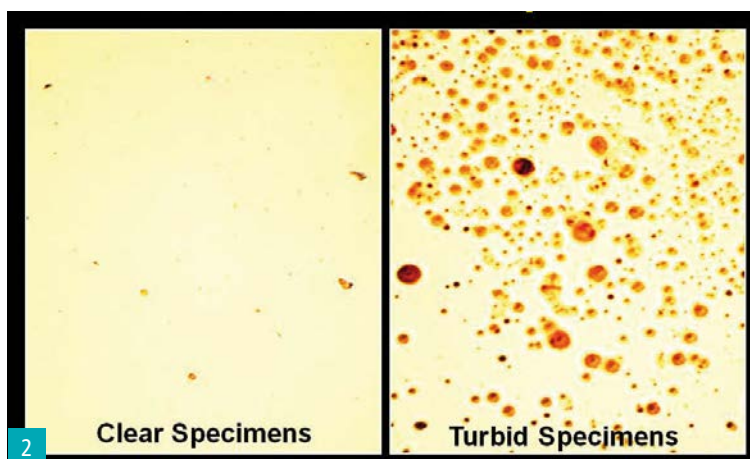


Fig. 2: Post tear lens lipids

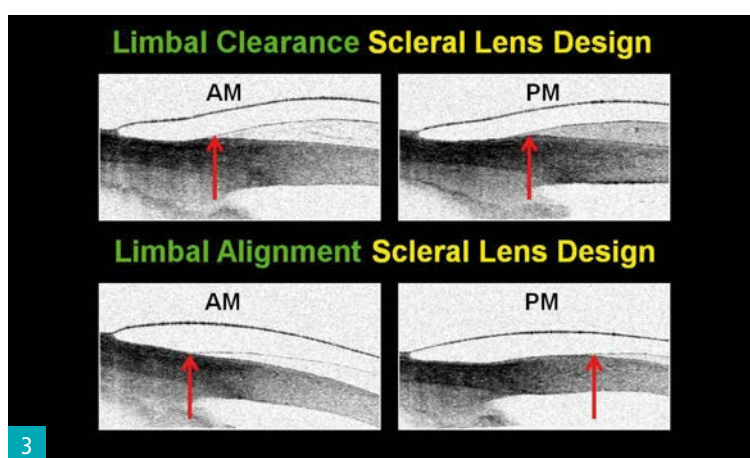


Fig. 3: Limbal clearance and alignment

- A number of patients have reported a dramatic decrease in their fogging symptoms when they irrigate their eyes with preservative free saline prior to the application of their lenses. A similar (and for some a more effective technique), is to apply the lenses to the eyes for ten seconds and then remove them. The lenses are then rinsed and re-applied. It appears that with both of these techniques, some of the offending particulate matter is being diluted, irrigated and removed from the ocular surface.

Further studies are currently underway at Pacific University that we hope will provide additional clarity to this unique scleral lens condition.

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He serves as an Associate Professor at Pacific University College of Optometry and Assistant Professor of Ophthalmology at the Oregon Health & Sciences University in Portland, Oregon. He teaches the contact lens curriculum. He is a Fellow member and Diplomat of the Cornea and Contact Lens Section of the American Academy of Optometry. He is a Council member of the International Society for Contact Lens Research as well as a member of the International Association of Contact Lens Educators and the American Association of Optometric Educators. For the past fifteen years Prof. Caroline has served as a contributing editor for the Contact Lens Spectrum and is on the editorial board for Contact Lens and Anterior Eye Journal. He is an internationally recognized lecturer and researcher on contact lenses.

