HOW SERIOUS A PROBLEM ARE GLISTENINGS?

The subtle presence of IOL glistenings highlights the importance of checking for easily found problems first.

BY KENNETH J. ROSENTHAL, MD, AND NANDINI VENKATESWARAN, MD


We recently saw a 75-year-old patient who had undergone cataract surgery with bilateral implantation of AcrySof IQ SN60WF IOLs (Alcon) 2 years earlier performed by another ophthalmologist. The surgery had been uneventful. The patient presented with a complaint of "hazy" vision, especially in dim light, along with increased glare at night. "I can't see anything at dusk or after sunset," she said. She had some residual refractive error (+1.00 D OU), yet her BCVA was 20/20 OU. The patient reported that her vision was not clear, even with glasses.

Upon examination, the lid margins, cornea, optic nerve, and fundus were all normal. The IOLs were well centered within the capsular bag. Within the substance of the lenses, however, were microvacuoles that resembled a field of stars on a dark night, with 4+ glistenings covering 80% of the surface of the lens in the right eye. In the IOL in the left eye

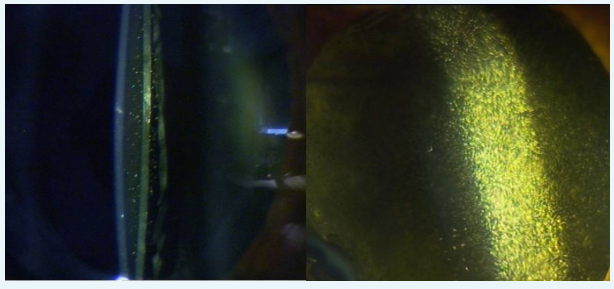

Figure 1. A slit-lamp examination reveals 3+ glistenings in the IOL that are causing the patient's visual disability.

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IOL glistenings can be impressive upon observation without having a significant impact on patients' visual function.

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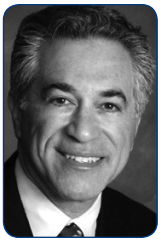

Glistenings are water-filled microvacuoles that form within the IOL's optic during the postoperative period.[1] They were first observed in the injection-molded poly methyl methacrylate (PMMA) IOLs in1984.[2] Since then, glistenings have been observed in most IOL materials, including silicone, hydrogel, PMMA, and hydrophobic acrylic.[1-3] The microvacuoles are visible because of the difference between the refractive index of water droplets and that of the IOL material, and their prominence grows with the increasing refractive index of the IOL material. The first foldable hydrophobic acrylic IOL (AcrySof; Alcon) has the highest refractive index (1.555) and has been the platform for more than 90 million implants worldwide since its introduction.

The etiology and potential impact of IOL glistenings on patients' visual function have been extensively studied and reported in the scientific and clinical literature since the mid-1990s.[1] This article summarizes the highlights of published studies and shares my personal experience and clinical perspective on the impact of glistenings on patients' visual function.

THE IMPACT OF GLISTENINGS ON VISUAL FUNCTION

A large number of clinical reports generally agree that patients' distance BCVA is not affected by the clinically observed level of glistenings.[4-8] Most published scientific evidence has concluded that the severity of clinically observed glistening is not associated with an adverse effect on patients' visual function, including mesopic contrast sensitivity.[4-8] Hayashi et al reported that visual function, including mesopic contrast sensitivity, was comparable among eyes that received acrylic, silicone, and PMMA IOLs more than

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were 3+ glistenings, corresponding to the severity of the patient's reported visual disability (Figure 1). She was scheduled for contrast sensitivity testing and will likely undergo an IOL exchange to remove the defective lenses.

Before seeing us, this patient had been to four other ophthalmologists, including a retina specialist and a neuro-ophthalmologist, and she had undergone a battery of diagnostic tests, all of which failed to identify the glistenings. One doctor recommended LASIK to address the residual ametropia, but it was our opinion that refractive correction alone would not solve her problem. Although a corneal refractive procedure could certainly correct the residual hyperopia, it would not address the internal light scatter from the glistenings and could actually worsen the situation by introducing ocular surface dryness and/or changes in spherical aberration.

AN EARLIER CASE

The case just described was very similar to that of a patient we treated in 2013. That 74-year-old woman also complained of poor-quality vision, both at distance and at near, especially at night. She had undergone uneventful cataract surgery about 12 months earlier with bilateral implantation of SN60WF IOLs (aspheric, yellow chromophore). Her postoperative BCVA was 20/20 OU, and her cataract surgeon had therefore been unwilling to consider explanting the IOLs.

Snellen visual acuity is an irrelevant measure in such cases. It is generally tested in a 100% contrast/high-luminance environment, which does not simulate the setting during which this patient was experiencing problems. To understand a patient's visual deficit, one needs to measure ocular stray light—not practical in most clinical settings—or mesopic contrast sensitivity.

Using low-contrast testing (Precision Vision) and a calibrated light meter, we noted a significant deficit in mesopic low-contrast acuity. The slit-lamp examination showed 2+ glistenings in the right eye and 3+ in the left eye (Figure 2). We explanted both lenses sequentially and replaced them with aspheric one-piece monofocal IOLs. The patient immediately reported better color vision and full resolution of her mesopic vision complaints. "Now I remember what the color white looks like!" she exclaimed.

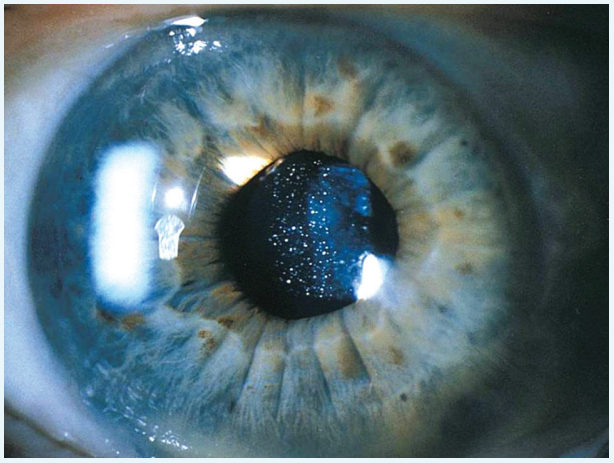

Figure 2. A slit beam illuminates the density of glistenings in the substance of the IOLs. The glistenings caused retinal stray light, and light scatter contributed to the patient's poor quality of vision.

LESSONS LEARNED

A key takeaway point is that these two patients underwent thousands of dollars' worth of extensive diagnostic testing as well as the stress of repeat visits and that doctors implied to these patients that the problem was "all in their heads."

Our patients' quality-of-vision complaints were real and could be objectively tested. Moreover, the glistenings were easy to see and, in the earlier case, resolved completely with IOL exchange. Clinicians sometimes only see what they are looking for, so we are not entirely surprised that retina specialists or neuro-ophthalmologists looked closely at the retina and the brain scan and then declared that everything was fine. Much as ocular surface problems can be missed if one does not examine the meibomian glands or tear film, a defective IOL can go undetected if the possibility is not considered during the postoperative examination.

In a pseudophakic patient with good Snellen acuity who is complaining of a poor quality of vision, lens glistenings are high on our differential diagnosis list, along with meibomian gland/tear film dysfunction (another condition that is often overlooked). Only when we rule out both do we start looking for neurological or other explanations.

THE IMPACT OF GLISTENINGS

Glistenings are fluid-filled microvacuoles (10-20 µm) that can appear within the IOL's optic as early as 1 week after surgery, and they typically grow in both size and density over time.[1] No known human biochemical factors, light exposure, or other risk factors have been associated with microvacuole formation. Rather, the problem is thought to be related to temperature variations during manufacturing or storage and may be associated with injection molding methods of IOL manufacturing.

The effect of glistenings on visual function such as visual acuity and contrast sensitivity is a subject of controversy. Glistenings are thought to cause retinal stray light and light scatter and to consequently negatively affect the quality of vision.[2] Although microvacuoles can occur in any lens material, they are significantly more prevalent and dense in AcrySof blue-light–filtering hydrophobic acrylic IOLs.[3,4] Colin et al reported the formation of glistenings in 86.5%

> "The clinical observer is likely to underestimate the impact of glistenings on patients' visual function by examination alone."

of eyes implanted with AcrySof lenses, and the majority of the microvacuoles were moderate to dense in subjective severity.[4] In addition to decreased visual acuity and contrast sensitivity, some investigators have suggested that this type of lens may negatively affect driving habits.[5] Although it has not been conclusively proven that these difficulties are related to either the yellow chromophore pigment or the impact of glistenings on retinal stray light and disability glare, no other explanation has been offered.[5] It is likely that both significantly contribute to visual disability.

Many studies also conclude that, in cases of pronounced light scatter, it is not always possible to identify any significant impact of glistenings on visual function (ie, visual acuity or contrast sensitivity).[6-10] It is important to realize, however, that these scientific investigators did not conduct contrast sensitivity testing under mesopic lighting conditions but rather under high-luminance conditions. Our case examples highlight a diminution in contrast sensitivity, specifically in mesopic lighting conditions, and clinicians should be attentive to this when listening to their patients' visual complaints and forming a differential diagnosis. Longitudinal observational studies by Dhaliwal and Waite also show a correlation between the presence of IOL glistenings and reduced contrast sensitivity, particularly at higher spatial frequencies.[11,12] In addition, it is worth mentioning that the forward scattering of light (which is what the patient sees) can be as much as 300 times the magnitude of the back scattering of light (which is what the clinician notes).[2] Thus, the clinical observer is likely to underestimate the impact of glistenings on patients' visual function by examination alone.

Whether owing to some feature of the glistenings, patients' personalities, or their heightened perception or expectations, some patients will be extremely bothered by microvacuoles. In my (K.J.R.) 20 years of implanting hydrophobic acrylic IOLs, a large number of patients have been referred to me for further evaluation of their visual disability, and in many of these cases, glistenings have been deemed the cause. Although many patients may have coexisting pathologies, IOL explantation and exchange for a clear lens has alleviated the patients' symptoms and has proven that, to some degree, glistenings contribute to the patients' visual dysfunction. Matsushima et al conducted a study in which IOLs with glistenings were explanted and exchanged for clear IOLs, with a subsequent improvement in patients' visual acuity, visual function, and level of satisfaction as well as findings of decreased light transmission in the explanted lenses.[13]

We, too, have explanted these lenses in a small series of patients, all of whom have experienced a subsequent increase in their contrast sensitivity as well as an objective improvement in their visual quality. We are currently conducting an IOL explantation/exchange study (like-kind monofocal vs multifocal lens with yellow chromophore and glistenings for a clear IOL). Our initial results show that patients with complaints of poor vision prior to the procedure, particularly in the mesopic range, note a marked improvement in these symptoms as well as an objective improvement in mesopic and low contrast sensitivity conditions after IOL exchange.

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10 years postoperatively.[7] Although the acrylic group had a significantly higher number of glistenings, the mean corrected visual acuity in this group was significantly better compared with that of the PMMA and silicone groups.

Mönestam and Behndig studied the impact of glistenings on the visual function of patients who had received AcrySof IOLs 10 years earlier.[4] The investigators found no detectable impact of glistening severity on BCVA and low-contrast visual acuity 10% and 2.5%. Another prospective, randomized clinical study with 5 to 7 years of follow-up compared two hydrophobic acrylic IOLs (the AcrySof SA60AT one-piece IOL and the Sensar AR40e three-piece IOL [Abbott]).[8] Each eye of 80 patients was randomized to receive either the one- or three-piece IOL. Visual function was similar between the groups. There was no correlation between the severity of the glistenings and BCVA, low-contrast visual acuity 2.5%, and contrast sensitivity.

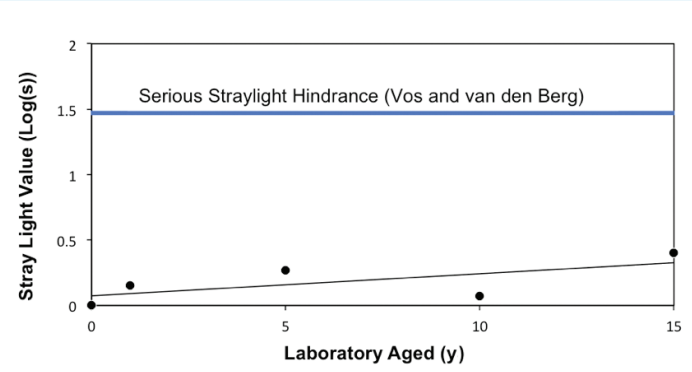

Figure. Stray light values for new and artificially aged AcrySof Natural IOLs (Alcon) calculated from measurement of light scattering.[10] Adapted with permission from Das et al and from data on file with Alcon.

THE IMPACT OF GLISTENINGS ON INTRAOCULAR STRAY LIGHT

The subject of glistenings' impact on intraocular stray light is controversial. Based on laboratory simulations, it has been suggested that glistenings could cause retinal stray light and light scatter and consequently negatively affect quality of vision.[9] That said, another laboratory study concluded that the stray light value for the aged hydrophobic acrylic lenses simulating 15 years of implantation was comparable to that for a young eye and was well below the suggested stray light hindrance level (Figure).[10]

In a more pertinent study to physicians, Colin et al clinically evaluated the effect of glistenings on visual function and stray light.[6] The investigators measured stray light or intraocular light scattering using the C-Quant instrument (Oculus). They found that glistenings had no association with BCVA and contrast sensitivity at any spatial frequency. The mean stray light values were similar for all glistening levels from zero to severe. The researchers found no association between any grade of glistening and intraocular stray light.

PERSONAL CLINICAL EXPERIENCE

I have been implanting hydrophobic acrylic IOLs for more than 20 years. Although I have observed glistenings in the implanted hydrophobic acrylic IOLs in my clinical practice, the phenomenon has never been associated with decreased visual function or dissatisfaction on the part of my patients. That said, many patients with complaints about their vision may have coexisting pathology, which sometimes makes it difficult to determine whether glistenings are indeed the source of their visual problems. Macular degeneration and posterior capsular opacification can both affect mesopic contrast sensitivity.[11]

CONCLUSION

The observation of glistenings during a postoperative examination could be impressive to the clinician, but a vast majority of the published scientific and clinical studies report that glistening severity is not associated with decreased optical performance or visual function, including mesopic contrast sensitivity. After more than 90 million AcrySof lenses have been implanted, only a small number of explantations and exchanges due to glistenings have been reported.[1] ■

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