Managing Dysphotopsias From Cataract Surgery

Dysphotopsias are a particular form of visual disturbance caused by certain optical properties of the IOL. Although the word was first defined by Tester and colleagues[1] as "any light-related visual phenomenon encountered by phakic and pseudophakic patients," it is usually used to refer to a specific set of subjective visual phenomena experienced by pseudophakic patients after cataract surgery.

Dysphotopsias are an understudied surgical complication, but they are important because they can be very frustrating for patients and are a leading cause of patient dissatisfaction after otherwise uncomplicated cataract surgery.

Postoperative dysphotopsias can be divided into two broad categories based on differing symptomatology and etiology[2]: positive dysphotopsias and negative dysphotopsias. There are pre-, intra-, and postoperative considerations for the cataract surgeon to bear in mind regarding the prevention and management of bothersome dysphotopic symptoms.

Overview

Positive dysphotopsias. Positive dysphotopsias (PD) are perceived as bright phenomena, typically described as streaks, rays, arcs, or flickers of light in the peripheral vision that are induced by an external light source. They are understood to be caused by glare from the edge of an artificial lens implant, whereby light coming from one side of the visual field, or even from outside of the visual field, is reflected on the opposite edge of the lens. This light is then detected in an unrelated part of the retina, causing the patient to perceive peripheral flashes that do not appear to originate from the actual light source (Fig. 1).

Negative dysphotopsias. In contrast, negative dysphotopsias (ND) are subjective symptoms of shade or darkness in the peripheral vision and are most commonly described as arc-shaped and on the temporal side of the visual field.[3] Their characteristics may change as the direction of gaze changes, typically worsening when the eye is in adduction and becoming less severe when the eye is in abduction. (These peripheral defects can be mapped out either monocularly or binocularly on formal field testing.)

The causes of ND are less well-understood than those of PD and may be multifactorial. One leading theory is that they may be caused when rays of light directed toward the peripheral retina pass undisturbed just anterior to the IOL while neighboring rays of light that pass through the IOL are refracted posteriorly, leading to a gap in illumination onto the retina between the two paths.

Other dysphotopsias. It is worth noting that multifocal and extended depth-of-focus IOLs may also cause optical disturbances such as halos, glare, or starbursts around light sources, particularly at nighttime. These phenomena are sometimes called "diffractive dysphotopsias" or "multifocal dysphotopsias" because they are unwanted visual phenomena caused by the diffractive properties used for these multifocal lenses, but they should not be confused with positive or negative dysphotopsias.

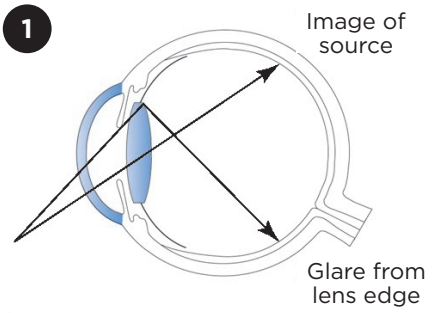

DIAGRAM OF DYSPHOTOPSIA. *Light striking the edge of the IOL (not drawn to scale) may be reflected to another site on the retina, resulting in dysphotopsias.*

Prevalence. Positive and negative dysphotopsias are very common, with as many as 49% of patients experiencing some degree of dysphotopsia early in the postoperative period.[1] Fortunately, most patients experience improvement of symptoms over time, likely due in part to neuroadaptation.[4] Symptoms often improve at around four to six weeks postoperatively, but in some cases, neuroadaptation can take up to a year.

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Preoperative Considerations

Patient education. Perhaps the most important preoperative consideration regarding the management of dysphotopsias is simply discussion with patients. Given their prevalence, dysphotopsias should be mentioned as a common complication with all patients who are being evaluated and consented for cataract surgery.

Choice of IOL. The other important preoperative consideration is IOL selection, as lens design can have a significant effect on the incidence of positive dysphotopsias. Consistent with the hypothesis that PDs are caused by reflections from the edge of the IOL, data from the 1990s first showed that rounded-edge IOLs result in fewer PD symptoms than square-edge IOLs.[5] On the other hand, rounded-edge IOLs are more likely to result in posterior capsular opacification (PCO), as they allow for greater posterior migration of lens epithelial cells.[6]

To minimize the risk of both dysphotopsias and PCO, many newer lens designs now utilize a square-edge profile with a textured or frosted edge rather than a smooth edge.[7] These square-but-textured-edge lenses have less risk of PCO compared with rounded-edge designs and less risk of PD compared with traditional smooth square edges.

Another IOL design factor that may help to minimize the incidence of dysphotopsias is the index of refraction (IR) of the lens material. For example, silicone has a lower IR than acrylic polymers, which means that silicone lenses have less internal reflection and thus fewer dysphotopsias than acrylic lenses. Another consideration is the curvature of the anterior surface of the lens: a more rounded anterior surface leads to fewer PDs.[8]

Operative Considerations

Historically, dysphotopsias were not described prior to the advent of the modern continuous anterior capsulorrhexis technique. Somewhat ironically, negative dysphotopsias only occur when the anterior capsule edges overlap the optic edges, a result which in other respects is considered the ideal orientation for an IOL.[9] In fact, there is no general association between malposition of the IOL with either positive or negative dysphotopsias.[9]

For single-piece acrylic IOLs, one study did find a reduced likelihood of ND when the IOL was placed with horizontal rather than vertical orientation of the optic/haptic junction, but this effect was only present on postoperative day one and had disappeared by one week after surgery.[10] For PD, there is no evidence that rhexis size, overlap of capsulorrhexis and IOL, or haptic orientation have any effect on the incidence of symptoms.

Postoperative Considerations

A diagnosis of exclusion. If a postoperative patient complains of new visual phenomena, it is important to rule out other etiologies, such as flashes of light secondary to vitreoretinal traction, a linear streak from posterior capsular striae, or streaks of light from astigmatism. Dysphotopsias are diagnoses of exclusion; there are no confirmatory tests for either positive or negative dysphotopsias, so a thorough examination for other etiologies is crucial.

A need for patience. Even after other diagnoses have been ruled out, dysphotopsias can still be frustrating or anxiety-inducing for patients. However, because they are benign and do not affect visual acuity, ultimately the primary method of management is empathetic reassurance. Patients should be encouraged that in most cases symptoms will resolve spontaneously over time. Generally, patients and physicians should allow plenty of time for neuroadaptation and symptom improvement before considering invasive treatment for difficult dysphotopsias.

In the meantime, standard measures should be taken for correction of residual refractive error and appropriate optimization of the ocular surface to ensure that other forms of glare, blurring, or distortions are minimized to help improve the overall quality of vision after surgery.

Treatment. Evidence for specific treatment of dysphotopsias is generally limited and largely anecdotal. Nonetheless, there are treatment options that can be attempted when dysphotopsias are both persistent and bothersome. Pharmacologically, it has been suggested that there may be benefit to the use of topical miotic agents for PD, such as pilocarpine or brimonidine eyedrops, but most practitioners feel that these methods do not significantly alleviate patient symptoms.

In rare cases, it may be reasonable to attempt repeat surgical intervention for symptom alleviation. Documented approaches include IOL exchange, either bag-to-bag exchange for an IOL with a lower index of refraction for PD[11] or bag-to-sulcus exchange with reverse optic capture for ND.[9] Other surgeons have reported success in reducing ND symptoms with surgical truncation of

Dysphotopsia Clinical Pearls

- Communication with the patient is very important. Warning the patient about dysphotopsia symptoms prior to surgery and repeating this information at the first postoperative visit can go a long way to reassure patients.
- Make sure to manage all residual refractive error and dry eye disease. Also, consider other diagnoses such as flashes from retinal traction or linear streaks from posterior capsular striae before attributing symptoms to dysphotopsia.
- Emphasize to patients that ND only occurs with correct in-the-bag IOL placement and that symptoms often improve after four to six weeks, although complete neuroadaptation may take up to a year.
- Consider delaying YAG capsulotomy until it is clear that no other surgical intervention is needed in a patient with dysphotopsia.
- If needed, exchange of an acrylic IOL with a silicone or copolymer IOL may be very successful in patients with chronic PD.

the nasal edge of the IOL optic, with laser anterior capsulotomy, or by using "piggyback" or add-on secondary sulcus-fixated IOLs.[12] Because these surgeries are generally warranted only after a patient has had a significant time to demonstrate that their dysphotopsia symptoms are persistent, it may be wise to delay other procedures on the same eye, such as Nd:YAG capsulotomy, in patients with bothersome dysphotopsias, at least until it is clear that no other surgical intervention is needed.

Conclusion

Dysphotopsias are an understudied but very common side effect of uncomplicated cataract surgery. Positive and negative dysphotopsias represent two distinct categories of IOL-related optical disturbances with different causes and symptoms. During discussion of the risks and benefits of cataract surgery, all patients should be informed that dysphotopsia symptoms are common. Different IOL designs can have very different rates of association with dysphotopsias, and while many factors must be balanced by the surgeon and patient during lens selection, the rate of dysphotopsias between IOLs should be among those considerations. Postoperatively, patients who develop dysphotopsias should be reassured that symptoms generally improve. At this time, the evidence for treatment of dysphotopsias is limited, but in refractory cases several surgical management options have been proposed.

The last two decades have brought a much greater understanding of the underlying mechanisms that lead to dysphotopsias, and manufacturers have begun to better incorporate this understanding into improved IOL design. Hopefully, future research will focus on treatment for refractory dysphotopsias to better compare outcomes between the variety of approaches that have been proposed so far.

1 Tester R et al. *J Cataract Refract Surg.* 2000;26(6):810-816.
2 Masket S, Fram NR. *Ophthalmology.* 2021;128(11):e195-e205.
3 Davison JA. *J Cataract Refract Surg.* 2000;26(9):1346-1355.
4 Osher RH. *J Cataract Refract Surg.* 2008;34(10):1699-1707.
5 Holladay JT et al. *J Cataract Refract Surg.* 1999;25(6):748-752.
6 Nishi O. *J Cataract Refract Surg.* 1999;25(1):106-117.
7 Meacock W et al. *Arch Ophthalmol.* 2002;120(10):1294-1298.
8 Erie JC et al. *J Cataract Refract Surg.* 2001;27(4):614-621.
9 Masket S, Fram NR. *J Cataract Refract Surg.* 2011;37(7):1199-1207.
10 Henderson BA et al. *J Cataract Refract Surg.* 2016;42(10):1449-1455.
11 Masket S et al. *J Cataract Refract Surg.* 2020;46(11):1474-1479.
12 Makhotkina NY et al. *J Cataract Refract Surg.* 2018;44(2):209-218.

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