Expert Opinion

Light Sensitivity in Migraineurs

Case History Submitted by Randolph W. Evans, MD
Expert Opinion by Kathleen B. Digre, MD

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Ictal and interictal light sensitivity in migraineurs is a common but poorly understood symptom.

CLINICAL HISTORY

This 32-year-old woman has a history, since a teenager, of migraine with and without aura occurring about twice a month. Triggers include bright lights and glare. Even when she does not have a headache, she is very sensitive to light and always wears sunglasses whenever there is any sun.

Questions.—Are migraineurs more sensitive to light interictally than nonmigraineurs? She also wants advice about purchasing sunglasses. Is the price important? Would designer sunglasses be better than those purchased in a drugstore? Should she get polarized lenses? Does the color of the lens make a difference?

EXPERT COMMENTARY

Photophobia is a common symptom with almost all forms of migraine, and it is included as one of the major criteria for that diagnosis in the International Headache Society classification. For such a common symptom, little understanding of its origin exists. Even the term *photophobia* is something of a misnomer, derived from the Greek photo (light) and phobia (fear or dread of)—hence, "fear of light." In medicine, photophobia has come to be regarded as a symptom of "abnormal sensitivity to light, especially of the eyes in measles and certain eye conditions."[1]

Address correspondence to Dr. Randolph W. Evans, Suite 1370, 1200 Binz, Houston, TX 77004 or Dr. Kathleen B. Digre, Department of Ophthalmology and Visual Science, John Moran Eye Center, University of Utah, 50 North Medical Drive, Salt Lake City, UT 84132.

Other terms have been used to describe light sensitivity. *Photo-oculodynia* implies discomfort in the eye but usually not from a painful light source.[3] *Dazzling* describes abnormal light scatter without ocular adaptation and, like the terms, *hemeralopia* and *day blindness*, may be used to describe blurring of vision due to light.[3] This is a frequent complaint in patients with retinal disorders or more rarely, optic neuropathy. Some investigators have divided photophobia into pain on exposure to light or an uncomfortable sense of glare.[4] The patient does not appear to have pain on exposure to light, and light does not induce glare or blindness. We, thus, are left with the term *photophobia* to describe her ocular discomfort from light exposure.

What Do We Understand About Light Exposure and Migraine?—First, bright lights and glare can precipitate a migraine attack. Three quarters of patients with migraine with aura list light (bright lights, flickering lights, glare) as their most common trigger.[5] Furthermore, light exposure can worsen acute migraine, and affected individuals typically escape to a dark place. Photophobia is described by 66% to 88% of individuals with migraine.[6] Woodhouse and Drummond found that patients with migraine have a lower discomfort threshold to light exposure testing than migraine-free subjects.[7] Vanagaite et al confirmed that patients were more photophobic during an attack than outside an attack, leading her to conclude that photophobia is an intrinsic property of migraineurs.[8] Besides initiating and exacerbating migraine, light and especially flickering light, can be uncomfortable between attacks. Several authors have found that light sensitivity exists in the attack-free intervals.[9] Flickering lights caused visual stress in 81% of patients with migraine with

aura and 57% with migraine without aura, compared to only 15% of patients without migraine histories.[10] This sensitivity may be related to an overall enhancement of input from the visual cortex to the trigeminal system.[11] Other studies have shown that patients with migraine with and without aura are more likely to wear sunglasses in normal daylight than healthy nonmigraine controls.[5] Furthermore, individuals with cervicogenic, as well as tension-type headache, also have significantly increased photophobia between attacks when examined via luminance threshold testing.[12]

The specific type of light exposure experienced by patients with migraine may be important in the production of photophobia. Main et al found that individuals with migraine had lower discomfort thresholds in both the low and high wavelengths compared with controls and those with tension-type headache.[9] High wavelength lights are red in color, and low wavelengths are blue.[9] In addition, light with a flickering component (eg, fluorescent lights) seems to precipitate migraine and induce visual discomfort more readily.[10,13]

What Is the Pathophysiology of Photophobia?— Photophobia is present in many eye conditions that affect the uvea (the pigmented portion of the eye), such as iritis, uveitis (intraocular inflammation), and corneal disease. Presumably, the mechanism of photophobia in these conditions is discomfort generated by irritation of the rich innervation to the eye supplied by the first division of the trigeminal nerve. The trigeminal nerve connection to the midbrain and thalamus is implicated in the pathophysiology of migraine.

Patients with blepharospasm often present initially with a complaint of photophobia and eye irritation leading to an excessive blink reflex. This form of photophobia may be related to sympathetic overdrive, since stellate and superior cervical ganglion blocks can ameliorate the symptoms.[14]

Acute meningeal irritation causes photophobia as well, and after meningitis or subarachnoid hemorrhage, photophobia is a common complaint.[15,16] Pituitary apoplexy and tumors also have been described as causing photophobia,[17] presumably due to irritation of the basal meninges around the diaphragma sellae.[18]

Photophobia also has sought to be a psychiatric disorder. In many neuroophthalmic clinics, patients present with severe forms of photophobia and photooculodynia wherein they have virtually retreated from society, living in dark chambers with draperies drawn,[18] wearing multiple pairs of sunglasses.[19] Some patients may have associated migraine. Authors report a high incidence of anxiety and panic disorder in these patients.[18] Even so, although there may be underlying psychiatric disease, photophobia is a real symptom often neglected in medical practice.

Where Could the Source of Photophobia Be Localized?—Little is understood in this regard. In 1934, Lebensohn reported that a functioning optic nerve and trigeminal nerve were necessary for photophobia to occur.[19] A functioning optic nerve is unnecessary, however, since even those with a damaged optic nerve complain of light sensitivity.[20] Photophobia can occur with diseases of the optic nerve; it is an infrequent complaint in optic neuritis but can occur in papilledema due to elevated intracranial pressure.[21] Harold Wolff thought that there were 3 independent sources for photophobia—the iris, the brain stem, and the cortex. He proposed, "The entire central mechanism of sensory trigeminal nerve including the mesencephalic root and nucleus constitute together with the optic nerve the neural mechanism for photophobia."[22] Other contributions from the central nervous system must exist, given case reports of the sudden onset of photophobia with strokes of the inferior medial thalamus.[23,24] Malecaze et al found that patients who experience glare, photosensitivity, and photophobia after laser-assisted in-situ keratomileusis (LASIK) corrective surgery had increased activity with light stimulation in the visual association cortices during functional magnetic resonance testing.[25] Recent studies by Aurora and others have suggested that the visual cortex is hyperexcitable and a major contributor to the symptom of photophobia, with input into the mesencephalic migraine generator.[6,26] The precise localization of photophobia, however, remains unknown.

What Treatments Exist for Light Sensitivity?— Even though Lebensohn admonished "tinted glasses as a symptomatic remedy for chronic photophobia are to be condemned, because of both their ineffectiveness and their habit forming tendency,"[19] sunglasses do make sense in the bright sunlight for patients with migraine, tension-type headache, and light sensitivity. Sunglasses with ultraviolet (UV) protection have the

further benefit of protecting individuals from macular degeneration and cataract.[27]

In ophthalmology clinics, patients are routinely urged not to wear sunglasses indoors. Sunglasses cause a dark adaptation such that when one goes into the sunlight, the light is experienced even more intensely. This would indicate that staying in the dark would only make going into the light that much more painful. Think of how many people without migraine wince coming out into the light after a matinee movie.

There have been reports that certain tinted lenses can reduce migraine. In their study in England, Good et al found that FL-41 tint, a rose-colored tint, reduced migraine frequency in children by over one half.[28] The authors contend that the FL-41 tint filters 80% of short wavelength 50-Hz flicker light produced by fluorescent lights, and that this reduces the number of headaches in patients with migraine.

A recent study showed that gray sunglasses that reduce all light transmittance improved photosensitivity thresholds for patients with migraine and blepharospasm.[29] In this preliminary study, FL-41 tint did not improve light sensitivity over traditional sunglasses.[29]

In answer to the questions posed regarding this 32-year-old woman, she demonstrates the photosensitivity known to be prevalent in the pain-free intervals of migraine. She should purchase a pair of sunglasses with UV protection. Polarized lenses probably are not necessary. The color of the lens, as far as we know, does not make a definite difference, but she may wish to try the FL-41 tint glasses reported in the study by Good and colleagues.[28]

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REFERENCES

1. Webster's New World Dictionary. Cleveland, Ohio: The World Publishing Company; 1968.
2. Fine PG, Digre KB. A controlled trial of regional sympatholysis in the treatment of photo-oculodynia syndrome. *J Neuroophthalmol*. 1995;15:90-94.
3. Lowenfeld I. The dazzling syndrome. In: The Pupil. Detriot: Wayne State University Press; 1993:1200-1202.
4. Lebensohn JE. Photophobia: mechanism and implications. *Am J Ophthalmol*. 1951;34:1294-1300.
5. Mulleners WM, Aurora SK, Chronicle EP, Steward R, Gopal S, Koehler PJ. Self-reported photophobic symptoms in migraineurs and controls are reliable and predict diagnostic category accurately. *Headache*. 2001;41:31-39.
6. Aurora SK, Cao Y, Bowyer SM, Welch KM. The occipital cortex is hyperexcitable in migraine: experimental evidence. *Headache*. 1999;39:469-476.
7. Woodhouse A, Drummond PD. Mechanisms of increased sensitivity to noise and light in migraine headache. *Cephalalgia*. 1993;13:417-421.
8. Vanagaite J, Pareja JA, Storen O, White LR, Sand T, Stovner LJ. Light-induced discomfort and pain in migraine. *Cephalalgia*. 1997;17:733-741.
9. Main A, Dowson A, Gross M. Photophobia and phonophobia in migraineurs between attacks. *Headache*. 1997;37:492-495.
10. Hay KM, Mortimer MJ, Barker DC, Debney LM, Good PA. 1044 women with migraine: the effect of environmental stimuli. *Headache*. 1994;34:166-168.
11. Chronicle EP, Mulleners WM. Visual system dysfunction in migraine: a review of clinical and psychophysical findings. *Cephalalgia*. 1996;16:525-535.
12. Vanagaite Vingen J, Sovner LJ. Photophobia and phonophobia in tension-type and cervicogenic headache. *Cephalalgia*. 1998;18:313-318.
13. Congdon PJ, Forsyth WI. Migraine in children: a study of 300 children. *Dev Med Child Neurol*. 1979; 21:209-216.
14. McCann JD, Gauthier M, Morschbacher R, et al. A novel mechanism for benign essential blepharospasm. *Ophthalmol Plast Reconst Surg*. 1999;15: 384-389.
15. Lamonte M, Silberstein SD, Marcelis JF. Headache associated with aseptic meningitis. *Headache*. 1995; 35:520-526.
16. Welty TE, Horner TG. Pathophysiology and treatment of subarachnoid hemorrhage. *Clin Pharm*. 1990; 9:35-39.
17. Kawasaki A, Purvin VA. Photophobia as the presenting visual symptom in chiasmal compression. *J Neuroophthalmol*. 2002;22:3-8.
18. Trobe JA. Photophobia in anterior visual pathway disease. *J Neuroophthalmol*. 2002;22:1-2.

19. Lebensohn JE. The nature of photophobia. *Arch Ophthalmol*. 1934;12:380-390.
20. Custer PL, Reistad CE. Enucleation of blind, painful eyes. *Ophthalmol Plast Reconstr Surg*. 2000;16:326-329.
21. Friedman D. Photophobia in pseudotumor cerebri [abstract]. *J Neuroophthalmol*. 2002;22:178.
22. Wolff HG. Headache and Other Head Pain. New York: Oxford University Press; 1948.
23. Jankovic J, Patel SC. Blepharospasm associated with brainstem lesions. *Neurology*. 1983;33:1237-1240.
24. Cummings JL, Gittinger JW. Central dazzle. A thalamic syndrome? *Arch Neurol*. 1981;38:372-374.
25. Malecaze FJ, Boulanouar KA, Demonet JF, Guell JL, Imbert MA. Abnormal activation in the visual cortex after corneal refractive surgery for myopia: demonstration by functional magnetic resonance imaging. *Ophthalmology*. 2001;108:2213-2218.
26. Welch KM, Nagesh V, Aurora SK, Gelman N. Periaqueductal gray matter dysfunction in migraine: cause or the burden of illness? *Headache*. 2001;41:629-637.
27. Fishman GA. Ocular phototoxicity: guidelines for selecting sunglasses. *Surv Ophthalmol*. 1986;31:119-124.
28. Good PA, Taylor RH, Mortimer MJ. The use of tinted glasses in childhood migraine. *Headache*. 1991;31:533-536.
29. Adams W, Digre KB, Katz B, Warner JE, Patel B. Light sensitivity in patients with blepharospasm [abstract]. *J Neuroophthalmol*. 2002;22:192.