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# Ocular mechanism key to light therapy for seasonal affective disorder

The optometrist can conduct a specifically structured eye exam before a patient seeks this treatment option.

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Supplementation of light, particularly in the early hours of the day, has been known to have a salutary effect on major depressive disorders, as well as mood disorders that fall short of a psychiatric diagnosis. Light therapy was originally intended as a treatment specifically for seasonal affective disorder (SAD), but has since been found to be beneficial in treating depression at any time of year.

“[Lack of light] is a pervasive problem in our contemporary living and working environments,” Michael Terman, PhD, said in an interview with *Primary Care Optometry News*. “We are not exposed to outdoor levels of light, even when it is available. In this situation, the internal biological clock, or circadian rhythm, is allowed to drift out of its appropriate position in the day/night cycle.”

Dr. Terman, a professor in the Department of Psychiatry at Columbia University, director of the Center for Light Treatment and Biological Rhythms at New York-Presbyterian Hospital and director of Clinical Chronobiology at New York State Psychiatric Institute, said an ocular mechanism plays a key role in the absorption of light therapy into the body.

“We now know from 20 years of research that it is an ocular mechanism; we are not responding to light stimulation through the skin,” he said. “We are not responding to ultraviolet radiation. This is an important point, because we still see commercial claims that it is important to the therapeutic effect. Not only is UV not important, but it poses a long-term cumulative hazard to skin, lens and cornea.”

Dr. Terman said the latest generation of light therapy apparatus is designed to screen out ultraviolet radiation, which is counter to popular claims that “full-spectrum light” is desirable as a treatment for depression.

**Definition of seasonal affective disorder**

Also known as recurrent winter depression, SAD is a clinical subtype of major depression. Patients experience a recurrent pattern of major depressive episodes during winter and remission of symptoms during summer, in the absence of seasonal psychosocial stressors.

Source: Diagnostic and Statistical Manual of Mental Disorders, 4th edition

## Outdoor-quality light necessary

Cheryl Lynn Bergin, OD, told PCON that indoor lighting does not provide the necessary intensity for photo effectiveness. “I recommend natural light exposure over indoor lighting,” she said. “It is better for overall health and mental well-being to be outside and active for some period every day rather than to ‘hibernate’ indoors for 3 months

out of the year.”

Dr. Bergin is an optometrist who writes on the topic of SAD. She is certified by the American Association of Suicidology to assess the risk for suicide/homicide and to initiate the necessary interventions, referral and care.

“Typical indoor lighting does not provide the benefits of daytime outdoor light levels,” Dr. Terman added. He said this affects the neurological system that drives hormone cycles and periods of alertness up and down.

“The ‘internal clock’ modulates when we go to sleep and when we wake up,” he said. “When we allow the clock to drift out of synchrony with external day and night, it is a formula for depression. The specific physiological event that corrects this problem is exposure to adequately timed early morning light.”

When light therapy resets the internal clock to an earlier phase synchronized with the day-night cycle, extremely rapid reversals in clinical depression may result. This differs from conventional medication treatment, Dr. Terman said. “The depression can lift within days, as opposed to lifting within weeks or a few months with standard medications,” he said.

### The ocular mechanism

Artificial bright light therapy enters the eye through a retinal receptor mechanism, Dr. Terman said. “Recent results show that it is not exclusively the rods and cones,” he said. “In addition, there is a novel receptor system that lies in the ganglion cells of the retina, which projects through the optic nerve a direct connection to the internal biologic clock. That clock is located in the hypothalamic suprachiasmatic nucleus, which lies directly above the optic chiasm.”

The suprachiasmatic nucleus then sends a critical on/off timing signal to the pineal gland, a small gland lying deep within the brain. The hormone melatonin is produced by the pineal gland, starting in mid- to late evening and lasting throughout the night.

“The amount of light at night determines how much melatonin is released from the pineal gland and secreted into the bloodstream,” Dr. Bergin said. “An inverse relationship exists between the intensity of light exposure and the amount of melatonin secreted. The more light there is, the more melatonin release is suppressed.”

### Setting the internal clock

Dr. Terman said an individual’s internal clock is genetically predetermined, and often does not run on an exact 24-hour cycle. “It tends to run slower than that, more like 24 hours and 15 minutes,” he said. “The implication is, if you are not exposed to adequate day/night cues from the solar cycle, you are vulnerable to drifting later and later, and you go to bed later and later.”

Therefore, he said, people who are vulnerable to depression related to light deprivation have a critical need for regular light exposure to allay oversleeping and depression.

“We absolutely need this ocular signal in the morning to stay in synch with our external world,” he said. “We have to subtract that 15 minutes of physiological time each day.”

In determining which would be the best time in the morning for each patient to receive light therapy, Dr. Terman said he and his colleagues divide patients into chronotypes. Dr. Terman supervises a Web site, [www.cet.org](http://www.cet.org), which provides a free online assessment questionnaire.

“If we can determine your chronotype quantitatively, we can immediately advise you regarding when would be the best time to use the light in the morning,” he said. “This is called the Automated Morningness-Eveningness Questionnaire.”

### Light intensity, spectrum



Dr. Terman said an adequate light therapy lamp should have a smooth diffusing screen, such that the contour of the bulbs is not visible. The lamp should present a broad spectrum of visible illumination, which will appear white to the eye, rather than specific-colored lights, he said.

"If you spend 10 minutes on the Internet, you will see a load of ads for specifically colored lights," he said. "Not only have they not been adequately clinically evaluated, but the short wavelength region of far blue presents a potential hazard."

Dr. Terman said cumulative exposure to this narrow band of the visible spectrum might exacerbate the progression of age-related macular degeneration.

He added that patients older than 40 years universally develop cloudiness in the ocular media. When short wavelength light hits those cloudy surfaces, it refracts randomly within the eye and causes aversive glare sensations and reduced acuity. "Some interesting work has shown that when that narrow band of wavelength is filtered out with eyeglasses, the world immediately seems brighter, and vision is sharper," he said.

Dr. Bergin agreed that UV light should be avoided in light therapy.

"UV light, which can damage eyes and skin, must be filtered out," she said. "Although more research is needed, what we do know is that short wavelength light can predispose one to choroidal damage."

Dr. Terman said, however, that some blue light exposure is important to the body's circadian rhythm.

"We don't currently have apparatus that does this, but what I'm advising now to the manufacturing companies is that the very shortest wavelength blue light, (450 nm and below), right next to the ultraviolet region, be completely removed from light therapy," he said. "But I also advise that we retain a modest amount of blue light (from 450 nm to 500 nm) to adequately input the circadian clock."

Dr. Terman also discussed the recommended intensity of light exposure. He said with bright light therapy, light is being produced indoors that would only be experienced if walking outdoors in an unshaded environment about 40 minutes after sunrise.

"So, that is an early morning daylight level, which is 10,000 lux," he said. "Intensity and exposure are the primary dosing dimensions of light therapy."

Treatment with a light intensity of 10,000 lux usually calls for a duration of 30 minutes per day, he said. "That is a feasible home treatment regimen that can be done at the breakfast table," he said.

### **Structured eye examination**

Dr. Bergin said optometrists are able to play a role in noticing signs of SAD and guiding patients toward proper treatment. "It is not our job to diagnose SAD," she said. "However, we can listen and guide our patients in the proper direction."

In addition, Dr. Bergin recommends that a patient considering light therapy obtain a pre-retinal examination. "Fluorescein angiography and a retinal evaluation are recommended if there is a threat of age-related macular degeneration," she said. "Follow patients at 3- to 12-month intervals."

Dr. Terman said a group of mental health experts and ophthalmologists have created a structured eye examination with a chart that is recommended for all patients before light therapy (available at [www.cet.org](http://www.cet.org)). "This is for two reasons: The first is to identify any pre-existing ocular pathology that may contraindicate the use of light therapy or may mandate a schedule of repeated eye examinations," he said. "The second is, if there is some unknown pre-existing pathology, we don't want to attribute it to light therapy."

Dr. Terman said optometrists can administer the structured eye examination. Tests include: best-corrected visual acuity, ocular motility (nine cardinal directions of gaze), intraocular pressure, Amsler grid, direct and indirect pupillary reactions, slit lamp examination and funduscopy.

Dr. Bergin emphasized the need for the optometrist to be aware of the signs of SAD, such as fatigue, greater need for sleep, cravings for carbohydrates and depression.

When a patient is at an immediate high risk for suicide, which means they have a plan, time, place and means for suicide, phototherapy is not a first line treatment, Dr. Bergin stressed. "We have to make sure the person is not a threat to himself or herself first," she said. "This requires immediate intervention, hospitalization, at a minimum, and a 72-hour assessment in a safe place, typically a psychiatric setting. Once suicide risk is lessened and the risk to life is not imminent, then I endorse phototherapy as a wonderful adjunct to medical and psychological care.

"If there is one clinical pearl I can suggest, it is this: Listen to your patients," she continued. "You may be the only professional he or she feels comfortable telling about his or her struggle with depression. Be approachable."

**For more information:**

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