Medical Xpress

Solar eclipse: Glasses are key says ophthalmologist

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Nicole Bajic was completing her medical residency at the University of

Chicago when she briefly ducked out between surgery training classes to watch the 2017 solar eclipse darken the skies. At the time, she didn't fully appreciate how much excitement surrounded the event.

Now an ophthalmologist at the Cleveland Clinic Cole Eye Institute in Ohio, Bajic is among the eye doctors, specialists and eclipse experts advising enthusiastic viewers across the country on how they can make April's total solar eclipse as safe—and as fun—as possible.

"I'm so surprised with how big of a phenomenon this is. I feel like this is a frenzy," she told the Tribune, in what she said was perhaps her 20th interview about eye safety.

During a total solar eclipse, the moon appears to completely cover the sun, casting its shadow along its trajectory above the Earth. This year's eclipse will be the second of its kind in the 21st century to touch the contiguous United States. There won't be another one until 2044. The first one was the 2017 eclipse, which Bajic saw partially from Chicago.

This time, Bajic has carefully thought out her upcoming eclipse experience rather than leaving it to happenstance. She plans to attend a viewing party and then head to the Cleveland Guardians home opener two hours later.

Those who want to watch the eclipse on April 8 should also prepare, experts say.

Ordinary sunglasses won't do that day. Anyone looking up to the sky should be wearing a pair of safe solar viewing glasses to protect from the sun's ultraviolet radiation and infrared light, which can cause serious injury to vision and possibly blindness. Even a glance at the sun can be risky.

"You might not be aware of the damage you're doing to your eyes until it's too late," Bajic said.

Even though most people living in the United States will be able to see at least a partial solar eclipse that day, only those in the 115-mile wide path of totality—right under the moon's shadow—will be able to briefly take their glasses off for approximately four minutes. Cleveland and parts of southern Illinois will be in this path.

"The recommendation is that the absolute only time you can look at the eclipse during totality is when the moon is completely blocking the sun," Bajic said. "The second that it's moving, and you might see a tiny glimpse of the sun peeking out, it's not safe any longer. So you need to look away immediately, and put back the eclipse glasses."

An eerie shift

For specialists, safety is top of mind. But understanding how the eyes absorb light and perceive color can help viewers enjoy a short-lived, possibly once-in-a-lifetime stargazing event.

The eye will notice light begin to dim five to 10 minutes before the eclipse's totality. Two minutes before the main event, red colors will fade and contrast with greens and blues in a biological phenomenon called the Purkinje effect.

"It's very eerie," said NASA volunteer educator and eclipse chaser Gordon Telepun. "It's unexplainable because there's not really another situation where your total ambience lighting can change so it looks like everything is gray or silvery."

Normally, as day transitions into night, the eyes adjust to the dark as rod cells become more active than cone cells. This period, called dark

adaptation, can take anywhere between 30 minutes and two hours.

"But with the eclipse, this process happens too quickly," said Bajic from the Cleveland Clinic. "You don't have enough time."

So the retina takes a while to adjust to the quick change. This part of the eye has two types of photosensitive cells that convert light into signals sent to the brain that allow humans to see the world. Cones are the receptors responsible for colorful vision in the daytime. Rods are the receptors that work in low-light conditions and allow for nighttime vision.

This effect, named after the Czech physiologist who discovered it, occurs as cones struggle to absorb light under the moon's shadow and rods start activating nighttime vision. This desaturates the colors the human eye perceives, decreasing the reds, slightly increasing the greens and blues, and creating a gray hue.

During the 2017 total solar eclipse, which he saw from Tennessee, Telepun noticed the summer provided great conditions that intensified the contrast: green grass and trees and people in colorful clothes.

"It was incredible. It was really, really strong," he said. "It's extremely dramatic in the right situation."

Two years later, when he saw a total solar eclipse from Argentina during the Southern Hemisphere's winter in July, the effect was unnoticeable because of the gray landscape and the muted colors people wore.

"Tell your friends and family who you're going to go to the eclipse with to wear bright colors—ridiculously bright colors," he said. "A combination of reds and greens, maybe some blues and some yellows, if you want to see the Purkinje effect."

Sitting on a lush lawn or green grass would also offer a more vivid experience from the ground, he added. Telepun said while the main event is happening up in the sky, he would encourage eclipse viewers to also look around before totality.

"The last five minutes before totality is (an exciting) time. And there's a lot to look at, because the crescent in the sky is getting very thin, and it's kind of exciting to look at this really thin banana up there," he said.

"But look at your surroundings. … There's a lot of things to look at: For some of the stuff, you have to look at the sky. For some of the stuff, you have to look at your neighbors for the colors. For some of it, you have to look to the ground, like shadow bands."

Telepun has developed a phone app called Solar Eclipse Timer to allow observers to know the exact time of totality based on their location and let them follow the different stages of the eclipse through a series of announcements so they don't miss anything, like the Purkinje effect or the shadow bands—thin, wavy lines of light and dark that can be seen on white surfaces immediately before and after totality.

Eye health and safety

Those who want to look at the sun as the moon partially or completely hides it from view should secure a pair of safe solar glasses in advance. But there are other things for eclipse viewers to keep in mind, especially if they have eye conditions.

"There's a very subjective component to vision," Bajic said. "Also, objectively, people's experiences can be different just from pathology in their eyes. … Their contrast sensitivity might be down or they have macular degeneration or other things (are) going on. They might not experience it the same as the person standing next to them."

Often associated with eclipse viewing is a serious injury to the eye's retina that can cause temporary or permanent blurry vision from just a few seconds of looking at the sun. Those at higher risk for this retinal burn, called solar retinopathy, include people taking medication like tetracycline for acne or rosacea.

On the flip side, Bajic said those with a history of cataracts might be less sensitive to the sun because their cloudy vision would technically act as a filter. But that's not to say they shouldn't take the additional and necessary step of protecting their eyesight with viewing glasses.

Being under the influence of psychoactive drugs can also make eclipse viewers particularly sensitive to phototoxic injury, or tissue damage from chemical reactions induced by direct light absorption.

"(The eclipse) is an interesting phenomenon," she said. "Some people may be tempted to use substances to alter their mind, but that can put you a lot more at risk."

Those who prefer not to venture a peek can get creative with the easy pinhole projection method, which works best during a partial eclipse or when a total solar eclipse hasn't yet reached totality.

When sunlight passes through small holes—punched in an index card or cardboard box; on a pasta colander or straw hat; or through outstretched fingers on crossed hands—and lands on a flat surface, it will project the sun's crescent shape in a grid pattern. Spaces between tree leaves can also create pinhole projections.

Importantly, this method of indirect viewing does not entail spectators looking directly at the sun through these holes but rather at its projections as they face away from the star. An Adler Planetarium blog post at adlerplanetarium.org/blog offers instructions on making a

projector with a cardboard box.

Finding glasses

The American Astronomical Association website at eclipse.aas.org/eye-safety/viewers-filters has a list consisting mostly of North American vendors and manufacturers that sell safe solar glasses or handheld viewers. The association said the list is not exhaustive, so if sellers are not included it doesn't necessarily mean their products are unsafe, but caution should be exercised.

"There are a lot of counterfeit glasses floating around," Bajic said. "We highly recommend (that) people are getting them from verified sources."

As the big day approaches and anticipation grows across the country, veteran eclipse viewers and eye doctors suggest securing a pair of viewing glasses sooner rather than later—and start planning to wear Christmas colors in April.

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