Researchers find that chromatically simulated myopic blur may be useful as a myopia control therapy

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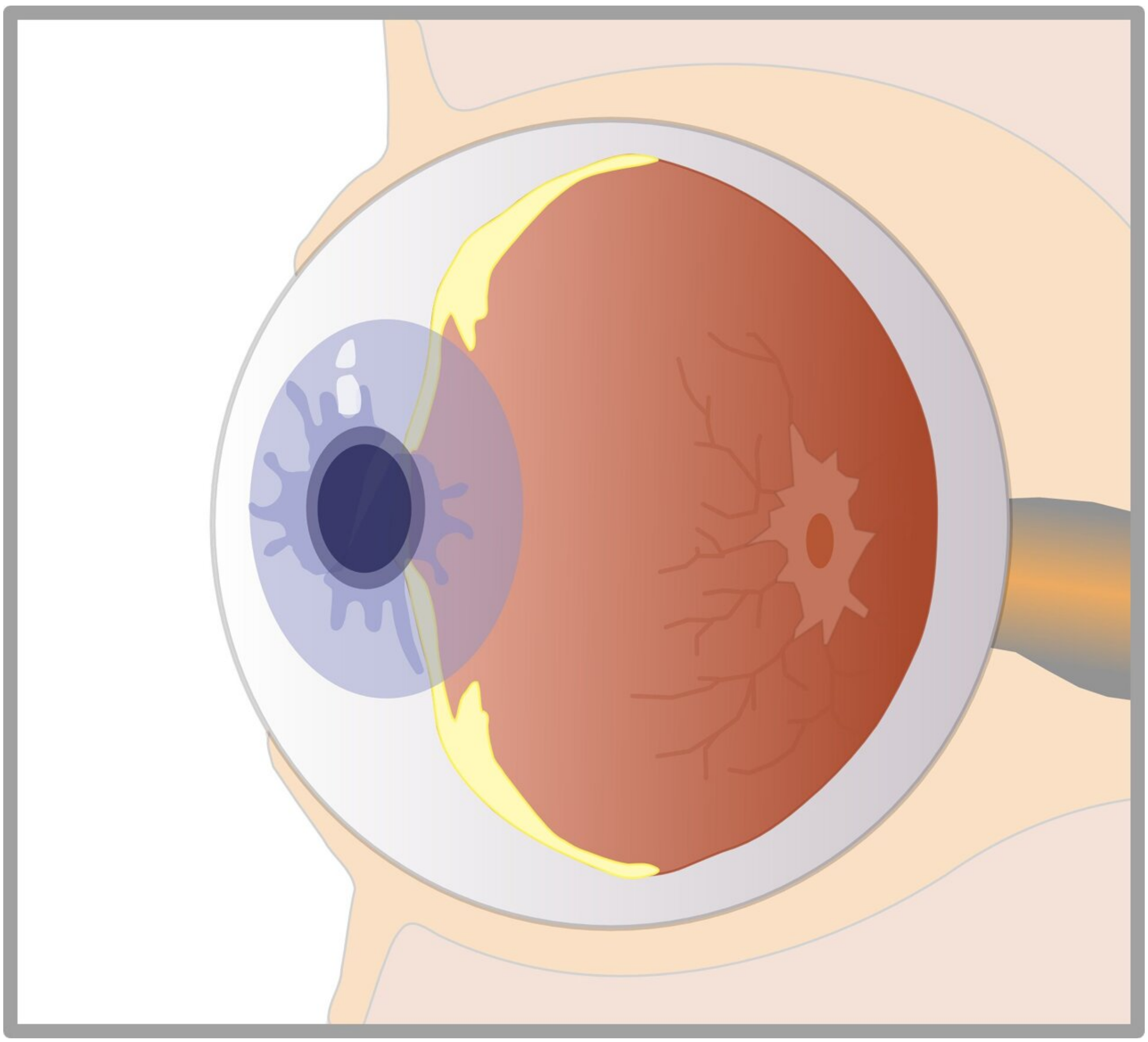

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In the last 50 years alone, the number of Americans who are nearsighted has increased from about 25% to 42%, and researchers predict this trend will continue in the future. University of Alabama at Birmingham researchers published a study in *Experimental Eye Research* that they believe could provide a basis for future treatments to control or prevent the development of myopia.

Otherwise known as nearsightedness, myopia mostly occurs when the eyeball is too long relative to the focusing power of the cornea, known as the clear front of the eye, and lens, producing images that are out of focus on the retina. Critically, a myopic eye stretches the retina and is a major risk factor for later sight-threatening diseases. Spectacles, contact lenses and refractive surgery can allow myopic people to see clearly; but they do not reduce the risk of eye disease.

Although certain genetic factors play a role in the development of myopia, Timothy Gawne, Ph.D., professor, and Thomas Norton, Ph.D., professor emeritus, both in the UAB School of Optometry, say the modern visual environment is the primary cause of the myopia epidemic and suggest their recent findings predict that the risk for myopia can be reduced by altering certain visual cues in childhood.

"Our study further proved that myopia is not primarily genetic and can be manipulated," Norton said. "We think that, by changing the chromatic structure of an image on a computer display, we can almost talk to the eye and tell it to stop getting longer. We hypothesize that the risk of myopia can be reduced by altering visual cues during childhood."

Visual cues play a large role in eye development. During postnatal development, the emmetropization feedback mechanism, which is a regulatory mechanism that helps guide eyes to grow into good focus, uses visual cues to regulate eye growth. If visual cues indicate the eye is too short, the mechanism generates "go" signals that accelerate the eye elongation. If they indicate the eye has become too long, the mechanism generates "stop" signals to slow eye growth and elongation.

For this study, Gawne and Norton examined how the wavelengths of light can affect eye growth. Although all electromagnetic radiation is light, the human eye can see only a small portion of this radiation. Cone-shaped cells in the eyes act as receivers and are tuned to the wavelengths of light. Light separates into different colors, which each have different wavelengths and can impact the growth of the eye during the developmental years.

"The eye is like a telescope and has to constantly adapt to its environment," Gawne said. "The length of the eye must be precisely adjusted to the optical power of the eye, and it does this primarily by using chromatic cues for defocus. Eyes typically start out too small for their own optics, but the key is to not let the eye get significantly longer than it should be."

Gawne and Norton studied a preclinical animal model to learn how adjusting visual cues may slow the progression of myopia. Prior to this study, the researchers say, a majority of myopia research used broadband light. For their research, they studied the effect narrow bands of light may have on eye development and found that the cues for defocus were critically important for eye growth.

"Unlike the lenses in cameras and cellphones, the eye does not focus light of all colors at the same point," Norton said. "Shorter wavelengths, such as the ones found in blue, focus in front of longer wavelengths, such as the ones found in reds. Thus, by comparing the relative sharpness at short and long wavelengths, the eye can determine whether it is too long or too short and, ideally, adjust its growth to achieve and maintain good focus."

In their latest study, they used a video display that simulated the chromatic signals that would be generated by an eye that was too long, or myopic, and showed that this overcame the effects of a myopia-inducing environment. The researchers say these results demonstrate the high potency of chromatic cues in refractive regulation and may provide the basis for treatments to prevent or slow myopia development in children.

More information: Timothy J. Gawne et al, Chromatically simulated myopic blur counteracts a myopiagenic environment, *Experimental Eye Research* (2022). DOI: 10.1016/j.exer.2022.109187

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