SPECIAL ARTICLE

Double Fault!

Ocular Hazards of a Tennis Sunglass

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Blue-tinted lenses are currently being marketed as devices to enhance visual performance in tennis and as sunglasses for children. These include the Bollé Competivision sunglasses (Bollé, a division of Bushnell, Inc, Overland Park, Kan) and the ProSoft contact lens (Wesley Jesson, Des Plaines, Ill), both of which are intended for tennis, and the Bollé Kids Collection sunglasses. The Competivision lenses are the "official" lenses of the US Professional Tennis Association (teaching professionals), and they were given to linespersons at the 2000 French Open Championship (at Roland Garros). Tennis players of all skill levels may be purchasing these tennis lenses with the expectation of better performance—and of safety in the bright sunlight. Kids may ask for "cool-looking" blue children's glasses. However, I would argue that the spectral transmission characteristics of all of these lenses make them not only ineffective with respect to visual performance on most tennis courts (and elsewhere) but also a potential hazard to the eyes in bright sunlight.

The color of these tennis lenses derives from a patent[1] (PeakVision, Needham, Mass) that claims that the spectral characteristics of the tint "provides an increase in perceived color contrast between . . . an optic-yellow tennis ball or golf ball, and the background." The filter is designed to pass light maximally at the wavelength of fluorescence from a yellow tennis ball, with the idea that this will enhance its visibility. However, **Figure 1** shows that the blue lenses block most of the yellow light that is normally reflected off a ball (spectral yellow is near 580 nm but yellow is also perceived from a mix of all wavelengths between green and red). These lenses pass primarily blue and green light (tennis ball fluorescence peaks near 515 nm, which is perceptually blue-green rather than yellow). The Competivision lens blocks all UV light below 400 nm, and the ProSoft contact lens lets in about 10% near 400 nm; both lenses pass 30% or more of violet light and block very little of the blue light.

From the standpoint of improving the contrast or visibility of a tennis ball to enhance sports performance, this design is inherently flawed on any court with a greenish surface, which comprises most hard and clay courts in the United States. Through a blue-green lens, a yellow ball appears greenish (**Figure 2**) and thus is less visible against the green court (which will seem bright through this lens). The same would apply for a yellow or white golf ball viewed against green grass. Furthermore, blue light in general is less effective physiologically with respect to functions such as acuity, contrast detection, and motion perception.[2,3] In other words, critical perceptions are actually reduced rather than enhanced. These bluish lenses will be of no visual benefit except possibly on a reddish or amber court (such as the red clay of Roland Garros). Here, the ball may appear to be relatively light against a darker court, but these lenses still should not be worn because of the hazard associated with blue light.

A statement[4] on ocular UV radiation hazards in sunlight, endorsed by the American Academy of Ophthalmology, the American Optometric Association, and

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Prevent Blindness America, advises that sunglasses should block 99% to 100% of the full UV spectrum (UV-A extends up to 380-400 nm). The document notes that additional protection for the retina can be provided by lenses that reduce the transmission of violet-blue visible light. These recommendations follow the findings of many researchers,[5-9] and reflect concerns that both near-UV and visible blue light may contribute to macular aging and degeneration. Blue lenses do exactly the opposite: they block long wavelengths and admit the violet-blue end of the light spectrum. They are not only substandard as sunglasses but could, under some circumstances, be more hazardous than wearing no glasses at all. Because so much of the bright (yellow) end of the light spectrum is blocked, the world appears subjectively dark through blue glasses, and the wearer might spend extra time in the sun or have a relatively dilated pupil. If either of these occurs, the eyes could be exposed to more short wavelength light than without any lenses. Blue lenses for children may have additional risks because of the higher transmission of short wavelength light through the lens of a young eye.

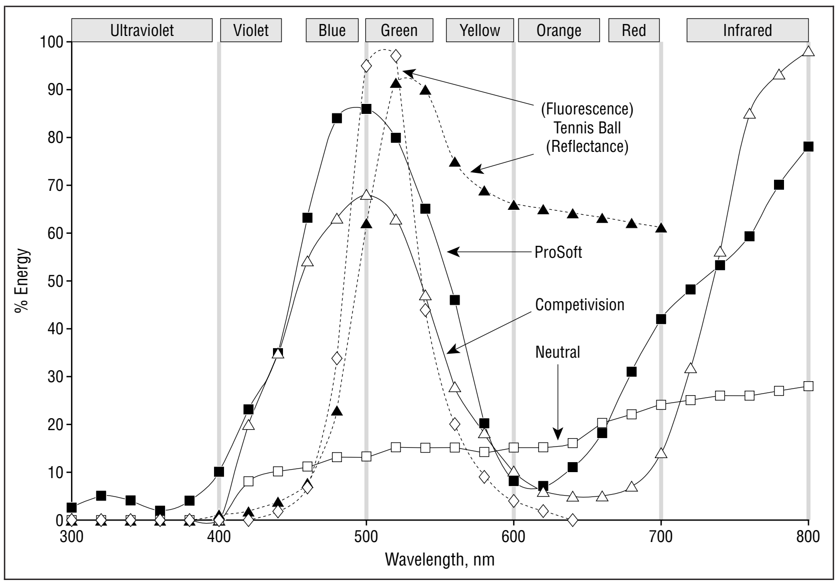

Figure 1. Spectral curves for the colors of tennis balls and for the transmission properties of Competivision, ProSoft, and a neutral color lens (Bollé) (see text for manufacturer information). The energy percentages are a transmittance for the lenses, and reflectance and fluorescence for the tennis ball. The fluorescence peak near 515 nm overlaps the transmittance peak of the blue lenses. Approximate wavelength ranges of subjective color perception are shown, along with the beginnings of the ultraviolet and infrared. Note that the blue lenses block most of the light coming from the tennis ball. Tennis ball curves were redrawn from the blue lens patent,[1] the ProSoft curve was redrawn from Wesley Jesson publicity material, and the Competivision and Bollé neutral lenses were measured on a laboratory spectrophotometer (model DU640; Beckman Coulter Inc, Fullerton, Calif).

My impression is that most of the visual problems from playing a sport in bright sunlight are a result of glare and of the brightness of the sky, which sets the general level of light sensitivity and can make a playing surface appear relatively dark. This is why a tunnel appears black inside as we approach it in sunlight. What can the ophthalmologist recommend? For tennis, wear a cap and good sunglasses. Simply wearing a cap with a visor will not only reduce glare but will also make the court appear relatively brighter (as does a tunnel once we enter it). A neutral gray or amber sunglass that blocks 99% to 100% of UV-A and UV-B light will provide additional protection and may even help slightly to make the ball stand out (depending on the color of the court). However, there is no rationale for a blue lens, whether for children, tennis players, or anyone else. Ophthalmologists should be aware of the properties and the risks of blue lenses to advise parents of young children and sports-minded patients. Tennis players in particular should be aware that a blue lens commits a double fault, and does not serve well for either perception or safety.

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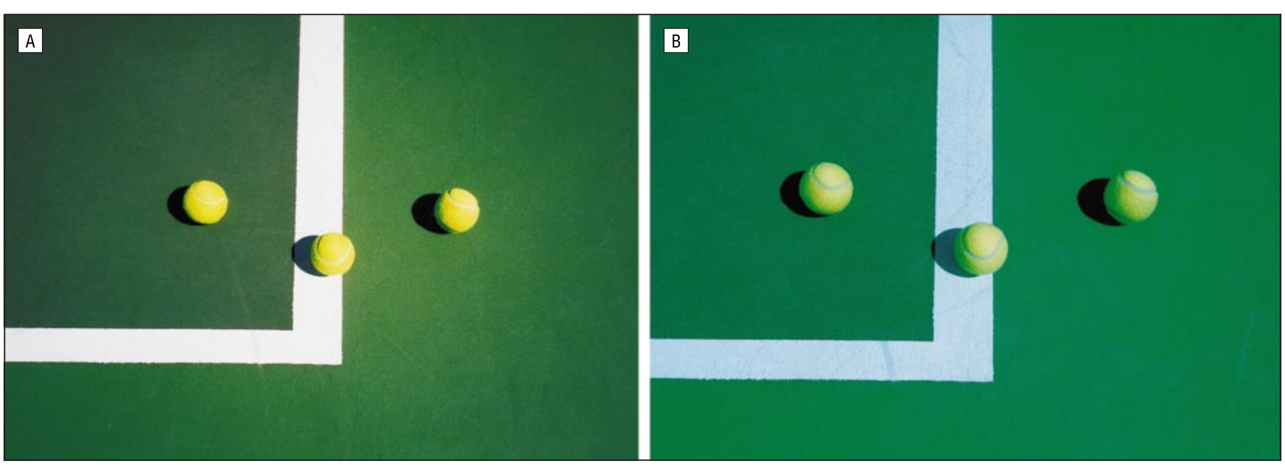

Figure 2. Photographs of tennis balls on the Stanford University (Stanford, Calif) varsity tennis courts. A, With no filter; B, through a Competivision lens.

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Ophthalmological Numismatics

A look at the past . . .

Arthur Jacob, 1790-1874, was the first Irish ophthalmologist and founder of 2 eye hospitals in Dublin. He was also a professor of anatomy and physiology at the Royal College of Surgeons of Ireland. The medal shown, which was engraved by W. Woodhouse, was presented to Jacob in commemoration of eminent services rendered to the medical profession in Ireland in 1860 on the occasion of his 70th birthday. The obverse, **Figure 1**, depicts the bust of Jacob facing left. The reverse, **Figure 2**, depicts an inscription surrounding and within a tied laurel wreath.

Courtesy of: Jay M. Galst, MD, 30 East 60th St, New York, NY 10022.

Figure 1.

Figure 2.