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Football players' contrast sensitivity comparison when wearing amber sport-tinted or clear contact lenses

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KEYWORDS
Contrast sensitivity;
Contact lenses;
Sports equipment;
Visual performance;
Nike;
Bausch & Lomb;
Sports vision

Abstract

BACKGROUND: Many experiments are conducted each year in the sporting world to try and improve the existing technology and equipment in an effort to positively influence athletic outcomes. These studies, at times, are concerned about vision and how athletes can improve their visual inputs to respond most advantageously. Sports vision aids are becoming a more integral part of an athlete's equipment. Recently, sport-tinted contact lenses have become available to athletes of various sports. The purpose of this study was to compare football players' contrast sensitivity when wearing specially designed sport-tinted contact lenses to that when wearing clear contact lenses or no contact lenses in the case of an emmetropic athlete.

METHODS: Participants were fitted with either clear contact lenses or sport-tinted contact lenses. Spherical equivalent refractions were used because sport-tinted contact lenses are not currently available for astigmatic prescriptions. Contrast sensitivity was measured monocularly on a sine-wave grating chart of 4 spatial frequencies, each with decreasing contrast. Testing then was repeated with the other contact lens. Comparison was made to determine if statistically or clinically significant data would support the claim of increased contrast enhancement for the athletes while wearing the sport-tinted contact lenses.

RESULTS: Thirty-five subjects participated (35 left eyes), ranging in age from 18 to 32 years. All subjects were professional or collegiate football players. Testing done at 3, 6, 12, and 18 cycles per degree (cpd) of spatial frequency found statistically significant improvement with the sport-tinted contact lenses where $P < 0.05$. With an examination of the emmetropic-only subgroup, these same results were confirmed at 3 and 6 cpd. Although most of the results were statistically significant, it is questionable whether there is any clinically significant improvement in contrast enhancement while wearing these lenses.

CONCLUSION: Sport-tinted contact lenses appear to have a statistically significant effect on contrast sensitivity when worn by a relatively low astigmatic or spherically refracted patient. These results also hold true for enhancing sensitivity in the emmetropic athlete. This information is dampened, however, when considering clinical significance. Overall, there does not appear to be overwhelming evidence that the sport-tinted lenses provide any clinically significant difference when considering contrast enhancement. There are always exceptions to any study; therefore, each case would have to be evaluated by the individual practitioner and the athlete.

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A new contact lens has recently come on to the optometric scene. In the spring of 2005, Bausch & Lomb (Rochester, New York) manufactured the MaxSight (polymacon) sport-tinted contact lens for Nike (Beaverton, Oregon). In the making for more than 8 years, this lens first gained steam in the spring of 2005 with a select group of doctors and high-profile sports teams. It was then available to general practitioners for fitting in the fall of 2005. It is

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available in base curve 8.7 mm, diameter 14.3 mm, spherical powers from +4.00 diopters (D) to −9.00 D and comes in 2 tints: an amber tint recommended for fast-moving sports such as baseball, football, soccer, and tennis, and a grey-green tint recommended for comfort with sports such as golf, running, and cross-country skiing.

Many experiments of all aspects related to sports are conducted each year to try and improve the existing technology and equipment in an effort to positively influence athletic outcomes. These studies, at times, are concerned with vision and how athletes may improve their visual inputs to respond most advantageously. Sports vision aids are becoming a more integral part of an athlete's equipment. The contact lens provided by Bausch & Lomb for its ability to enhance an athlete's perception of contrast and reduce glare on the playing field filters out specific wavelengths of light that may deter optimal visual performance. As is common, the manufacturer of a new product will show testimonial evidence of subjective approval for the product. We set out to measure whether the claim of contrast enhancement was measurable. The claim of reduced glare is not addressed in this study.

Methods to increase contrast with the use of various tinted spectacle lenses have long been embraced by athletes in the shooting sports, pistol and clay pigeon shooting. Studies have found improved contrast with certain tinted spectacles for patients with[1] or without[2,3] cataracts as well.

Research has found for high myopia, nystagmus, keratoconus, or other corneal diseases resulting in an imperfect optical surface that contact lens correction provides increased contrast sensitivity when compared with best spectacle corection.[4-8] Conflicting reports from other studies have found a decrease[9,10] or no loss[11] in contrast sensitivity when wearing cosmetic contact lenses versus clear contact lenses.

Methods

From October 2005 through March 2006, we conducted a study of contrast sensitivity testing on 35 collegiate and professional male football players (35 left eyes) aged 18 to 32 years with no ocular pathology, only a refractive error (or no refractive error at all). Our testing was conducted as part of a full eye examination at our office during this period. Of the 35 participants, 68.6% were white and 31.4% were African American. Thirteen of 35 (37.1%) eyes were emmetropic.

A careful entrance examination and refraction was performed followed by the fitting of either the amber MaxSight or its nontinted sister lens, the Bausch & Lomb Soflens 38 (polymacon) contact lens (base curve, 8.7 mm; diameter, 14.0 mm). If an athlete was emmetropic, nonprescription sport-tinted contact lenses were utilized. Currently, the sport-vision contact lenses are not available in astigmatic prescriptions, so if visual acuity could be maintained with a

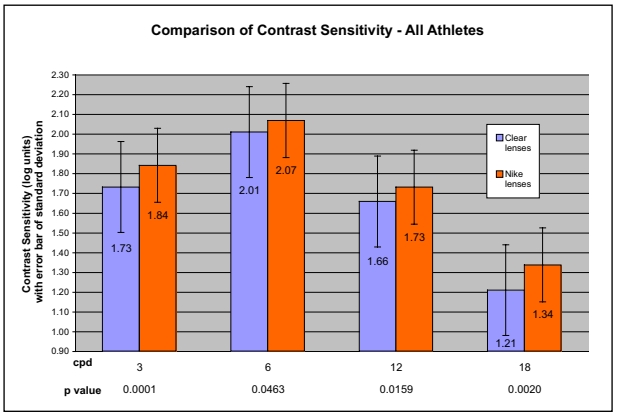

Figure 1 Comparison of contrast sensitivity—all athletes.

spherical equivalent lens, eyes with low astigmatic refractive errors were included in the comparative study. Those patients who could not maintain 20/20 visual acuity were excluded from the study but were given the option of keeping the trial lenses if they so desired. Fitting was performed to allow for 0.25 mm to 0.75 mm movement in primary gaze, while maintaining proper centration and corneal coverage with the lens. Half of the test group received the sport-tinted lenses first; the other half received the clear lenses first. Players were allowed to let the contact lens settle for 5 minutes after insertion before initiating contrast sensitivity testing. After testing contrast sensitivity in the initial lens, the athlete then switched to the other lens, allowed 5 minutes of settling time, and repeated the testing.

We measured contrast sensitivity on the CSV-1000 from Vector Vision (Dayton, Ohio). The CSV-1000 is a test chart with isochromatic sine-wave gratings used to measure contrast sensitivity at 4 spatial frequencies. These gratings have assigned log unit contrast values associated with each pair and were converted to those values before analysis.[12] With this test, the athlete has the choice of identifying the sine-wave grating in 1 of 2 circles or a third choice of electing that there is no sine-wave grating in either circle. For each of 4 frequencies, there are 8 sets of 2 circles with decreasing contrast. As was given in the instructions for the CSV-1000, the last correct response in each row was used to determine threshold at each frequency. Testing was stopped in each row at the first incorrect response.

Testing was done while the patient was seated comfortably, 8 feet from the chart, in a moderately lit examination room, with the instrument light level at 85 cd/m^2. Patients were tested monocularly. The monocular results were recorded and compared using a paired *t*-test to determine any difference in contrast sensitivity when the players wore the Nike MaxSight versus the Soflens 38 or no lens option if the patient was emmetropic. Confidence was determined at $P < 0.05$. Completion of the ocular examination and internal evaluation was then commenced. This was delayed to avoid bleaching the photoreceptors during posterior pole evaluation and thereby possibly influencing the results of the contrast sensitivity comparison.