

Article ▶ Test-Retest Reliability on the Wayne Saccadic Fixator in Professional Soccer Players

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ABSTRACT

Background: The visual system plays a crucial role in successfully accomplishing most sports activities, not only for professional athletes, but also at lower levels of competition. There has been considerable research conducted to determine the relationship between vision and athletic performance. The Wayne Sports Vision Trainer (WSVT) evaluates visually guided motor responses to a lighted target. Despite its relatively wide clinical usage, there is a lack of standardization of the protocols of its usage, and the reliability and validity of the device have not been established. The purpose of this investigation was to determine the test-retest reliability of the Proaction and Release-and-Locate programs of the WSVT in a cohort of professional soccer players.

Methods: Twenty male members of a Major League Soccer team, ages 17-35, participated in a comprehensive sports vision screening based upon the American Optometric Association Sports Vision Section protocols. The athletes performed two consecutive trials of the Proaction and Release-and-Locate WSVT programs. Testing was performed under normal room illumination with the athletes standing centered, with the middle target of the WSVT at eye level.

Results: The intraclass correlation coefficient (ICC) for both the Proaction and Locate tests were statistically insignificant. This suggests variability between the trials. The ICC was statistically significant for the Hand Speed Release test, indicating insignificant variability between trials.

Conclusion: The Hand Speed Release test appears to measure this component of eye-hand coordination reliably with a single administration. There seems to be a learning curve associated with the Proaction and Locate tests; therefore, using a single administration of these tests may not reliably measure these components of eye-hand coordination.

Keywords: eye-hand coordination, sports vision, test-retest reliability, visuomotor, Wayne Saccadic Fixator

Introduction

The visual system plays a crucial role in successfully accomplishing most sports activities, not only for professional athletes, but also at lower levels of competition.^{1,2} There has been considerable research conducted in order to determine the relationship between vision and athletic performance.³⁻⁵ The visual elements important in sports performance may be separated into software and hardware systems.^{4,6} The hardware components of vision refer to the non-task-specific mechanisms like ocular health, visual acuity, accommodation, fusion, and depth perception. The software components are the more cognitive aspects of vision, such as visual perception, visual concentration, visual reaction time, central-peripheral awareness, and visualization. The literature suggests that these software components of vision may be enhanced with training.^{5,7} While current literature and studies show conflicting reports of a direct relationship between better visual skills and

improved athletic performance, it has been hypothesized that heightened functioning of the software components of vision may lead to better execution of sports skills.^{2,3,8-13}

Historically, vision screenings have been performed to detect visual deficits in order to ensure that the visual system is not a limiting factor for safe and optimal athletic performance. More recently, this information has been used to develop and to implement vision training programs that are intended to enhance athletic performance by improving the software elements of the visual system.

The American Optometric Association Sports Vision Section (AOASVS) has developed protocols for sports vision screenings, which include procedures for evaluating both the hardware and software components of vision.⁵ Unfortunately, not all of these procedures have been evaluated for such criteria as reliability, validity, ergonomic appropriateness,

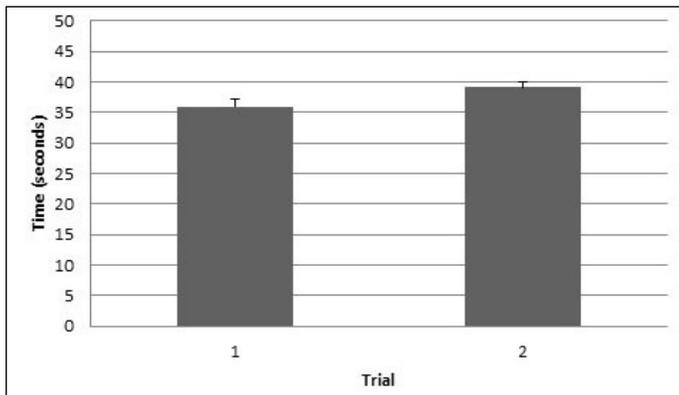


Figure 1. Mean scores on the Proaction test

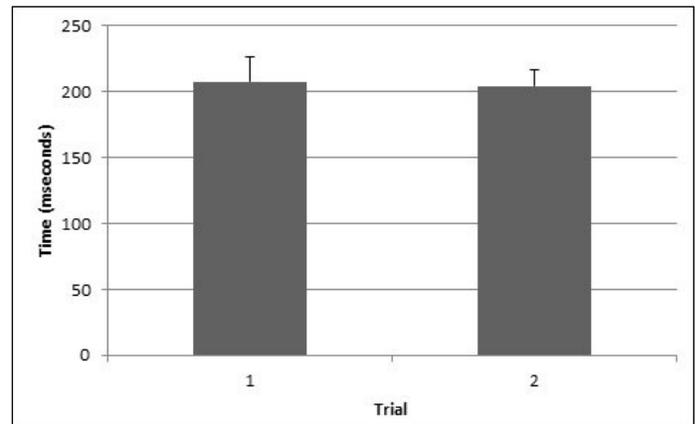


Figure 2. Mean scores on the Hand Speed Release test

ability to discriminate performance levels, affordability, availability, or practicality.

One of the instruments that has been used in athletic vision screenings to assess software aspects of the vision system (specifically, eye-hand coordination, which includes perceptual reaction time and hand speed) is the Wayne Sports Vision Trainer (WSVT), also commonly known as the Wayne Saccadic Fixator.^{7,14,15} The WSVT measures visual motor responses to visual stimuli based on a precise, visually guided motor response (i.e., a finger pressing a lighted target). Despite its relatively wide clinical usage, there is a lack of standardization of the protocols of its usage. It has been shown that the distance that the subject is located from the device and the incident illumination on the instrument are critical variables in the administration of the tests.¹⁶ Also, the reliability and validity of the device have not been established. Even though previous studies have aimed at determining norms for test administration with regard to lighting, none have investigated whether there is a learning curve associated with multiple test exposures.¹⁶ The purpose of this investigation was to determine the test-retest reliability of the Proaction and Release-and-Locate programs of the WSVT in a cohort of professional soccer players.

Methods

Twenty male members of a Major League Soccer team, ages 17-35, participated in a comprehensive sports vision screening based on the American Optometric Association Sports Vision Section (AOASVS) protocols.¹⁷ This screening included: visual acuity, testing to determine eye dominance, an internal eye health evaluation using undilated direct ophthalmoscopy, an external eye health evaluation, intraocular pressure, near point stereopsis, distance stereopsis, cover test, color vision testing, speed and span of recognition testing using a tachistoscope, eye movement assessment using the Visagraph III, peripheral vision testing with the Frequency Doubling Technology Perimeter, and eye-hand coordination and hand speed with the WSVT.

The WSVT is a visual testing device that has many applications.^{7,14,15} Only two of the programs available on this device were used in this study to measure eye-hand coordination and hand speed. Both of these programs were administered with the athletes standing centered, with the middle of the target at eye level, at a distance of 30 inches. The illumination was 20 foot-candles incident on the instrument in a dimly lit room. All subjects had best-corrected visual acuity of 20/20 OD/OS. Three of the participants needed spectacle correction to achieve 20/20 acuity; these subjects wore contact lenses to maximize peripheral vision. None of the subjects exhibited any strabismus or ocular disease. Eight of the twenty participants had prior experience with the WSVT, but it was minimal. They had simply used the device once at a vision screening the previous year.

The first program, the Proaction test, involved the subjects touching targets while maintaining a steady body posture. During this test, buttons on the WSVT would randomly illuminate one at a time. As quickly as possible, the subject pressed the button with one finger of his dominant hand, after which it would extinguish, and a new light would then illuminate in a new random location. The test score represented the number of lit targets pressed within a 30-second period. Each administration of this test constituted a single trial.

For the second program, the Release-and-Locate protocol, the subject began with a finger on an indicated peripheral target on the panel. A light then illuminated at a different location across the board. The subject moved his finger to the second light as quickly as possible. This protocol gives two types of data: the time it took the subject to release the first target (Hand Speed Release test), and the time it took the subject to press the second lit target (Locate test).

Both programs were administered twice to each athlete, with approximately one minute between administrations. Statistical analysis of the data was performed using the paired t-test. Additionally, the intraclass correlation coefficient (ICC) was calculated for each test in order to assess its test-retest reliability. This study was approved by the Institutional Review Board (IRB) of the Illinois College of Optometry.

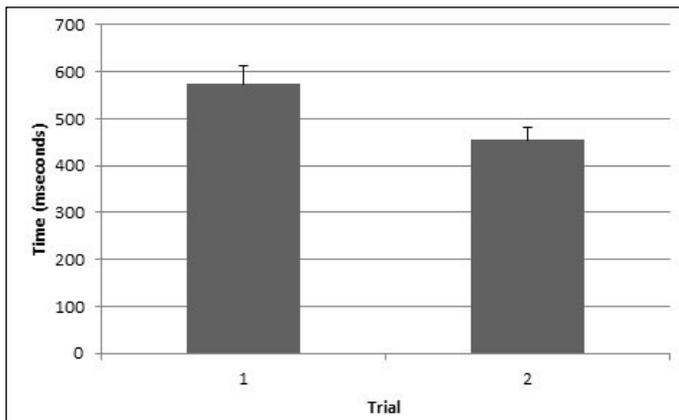


Figure 3. Mean scores on the motor speed (Locate) test

Results

The results of the Proaction test are shown in Figure 1. Subjects scored significantly better in the second trial as compared to the first administration ($t=2.97$, $p=0.011$). Figure 2 shows the results of the Hand Speed Release test. There was no statistically significant difference ($t=0.244$, $p=0.810$) between the two administrations. The Locate test results are shown in Figure 3. The subjects had statistically significantly quicker motor speed ($t=3.042$, $p=0.007$) in the second administration as compared to the first administration.

The ICC for both the Proaction test ($c=0.520$, $p=0.057$) and the Locate test ($c=0.321$, $p=0.168$) was not statistically significant. These results suggest that there was variability between the test and retest trials. The ICC was statistically significant for the Hand Speed Release test ($c=0.563$, $p=0.012$). This indicates insignificant variability between the test and retest trials for this test.

Discussion

The purpose of this study was to determine test-retest reliability of eye-hand coordination assessed with the WSVT. We looked at two different programs that are commonly used in vision screening and vision training on the WSVT.

Subjects did not improve their scores significantly the second time the Hand Speed Release test was performed; there did not appear to be a learning curve associated with this test. Therefore, this test appears to measure this component of eye-hand coordination reliably with a single administration. The other half of this particular program is the Locate test. The results showed that the subjects did better the second time that they performed this test, implying that there is a learning curve involved, and a single administration may not be reliable.

The two aspects of this program on the WSVT test separate neurological functions. The Hand Speed Release portion tests detection of the light. The light is consistently in the same location for each test, which makes any variability or change in the detection time low, perhaps due to the low complexity of the task. The Locate portion tests the speed of a guided motor response. This is a more complex task, and our results suggest

that familiarization protocols are necessary in order to establish a reliable baseline.

Despite the fact that these tests are assessing two separate parts of the visual system, they are considered one program on the WSVT. Therefore, the entire test would be considered unreliable because of the variability in the Locate test.

The Proaction test also showed subjects improving their scores the second time they performed the test. Again, this implies that there is a learning curve associated with this test, and a single administration may not be reliable. The neurological functions involved in this test include spatial localization, hand speed, and speed of motor detection. There is a moderate amount of variability in each of these components of the system, and the complexity of the task may require more practice trials.

The skills that these programs are testing—guided motor response, spatial localization, hand speed, and speed of motor detection—are all facilities that can be manipulated and trained through vision therapy.^{9,10} In order truly to determine whether there is improvement while using the WSVT, the possibility of a training curve must be taken into account when using these programs.

Conclusion

The Hand Speed Release test using the WSVT can reliably measure this component of eye-hand coordination with a single administration. Alternatively, learning curves appear to be associated with the Proaction and Locate tests using the WSVT, and single administrations of these tests may not reliably measure these elements of eye-hand coordination.

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