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Abstract

This study investigated the relationship between performance on the Eyespan 2064, Wayne Saccadic Fixator and Accuvision 1000. Additionally, this study investigated whether a correlation exists between measures of reaction and response times as measured by the Reaction Plus, and eye hand coordination as measured with these three devices. In Phase I, forty four subjects were assigned a random order of testing for the Eyespan, Wayne and Accuvision. Phase II consisted of testing all forty four subjects on the Reaction Plus. Statistical analysis did not show a significant relationship for performance on the Accuvision versus the Eyespan or Wayne. However, a significant correlation did exist between reaction time and performance on all three instruments. Response time showed a correlation with the Eyespan and Accuvision, but not with the Wayne. These results indicate that although there is some relationship between eye-hand reaction and/or response speeds with all three of these instruments, performance cannot reliably be compared between these eyehand devices.

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*CORRELATION OF PERFORMANCE
BETWEEN EYESPAN, WAYNE
SACCADIC FIXATOR, ACCUVISION,
AND REACTION PLUS*

By:

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A thesis submitted to the faculty of
the College of Optometry
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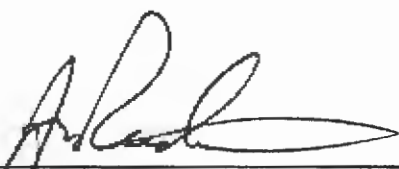
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Dan Perdue graduated from Brigham Young University in 1994 with a Bachelor of Science degree in Biology. He attended Pacific University College of Optometry from 1993 to 1997; and is a candidate for the degree Doctor of Optometry in May 1997. Dan plans to be an associate in private optometric practice; then when appropriate, buy into a practice. He will practice full scope optometry with special areas of interest in sports vision and contact lens care.

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ABSTRACT

This study investigated the relationship between performance on the Eyespan 2064, Wayne Saccadic Fixator and Accuvision 1000. Additionally, this study investigated whether a correlation exists between measures of reaction and response times as measured by the Reaction Plus, and eye hand coordination as measured with these three devices. In Phase I, forty four subjects were assigned a random order of testing for the Eyespan, Wayne and Accuvision. Phase II consisted of testing all forty four subjects on the Reaction Plus. Statistical analysis did not show a significant relationship for performance on the Accuvision versus the Eyespan or Wayne. However, a significant correlation did exist between reaction time and performance on all three instruments. Response time showed a correlation with the Eyespan and Accuvision, but not with the Wayne. These results indicate that although there is some relationship between eye-hand reaction and/or response speeds with all three of these instruments, performance cannot reliably be compared between these eye-hand devices.

INTRODUCTION

Eye-hand coordination and reaction/response times are fundamental requirements of many activities.^{1,2} With modern instrumentation we have the ability to quantitatively measure performances of eye-hand coordination as well as reaction/response times. Over the past several decades these measurements have been used to aid in assessment of some of the specific skills required by different sports and activities.^{2,3} However, the correlation of results between different instruments is not well known.

This study was designed to determine the relationship, if any, on eye-hand coordination between the Accuvision, Eyespan, and Wayne Saccadic Fixator. In addition, the correlation between eye-hand reaction and response times, as measured with the Reaction Plus, and each of the three instruments was evaluated.

The Pacific Sports Visual Performance Profile (PSVPP), a state-of-the-art standardized testing battery for evaluation of visual performance factors felt to be related to the task demands of sport, was developed at Pacific University by Dr.'s. Bradley Coffey and Alan W. Reichow in 1985.⁴ Since then over 2000 elite level athletes have been evaluated with

this profiling system. The data base consists of eye-hand performance norms utilizing the Eyespan and/or Wayne Saccadic Fixator.

The Accuvision is the newest and most sophisticated eye-hand coordination device available. Since the PSVPP data base consists of Wayne and Eyespan data only, it is necessary to determine if correlation exists between these instruments and the Accuvision.⁴ It will also be determined what, if any, relationship exists between performance on each of these instruments and performance on the Reaction Plus.

The Accuvision, Eyespan, and Wayne Saccadic Fixator all measure eye-hand coordination speed and accuracy. All three are based upon the principle of the subject responding to a light stimulus with a hand response as quickly as possible. Each instrument has a vertical panel that displays a two dimensional array of lighted switches. The subject is asked to depress each lighted switch, when lit, as quickly as she/he can. After a light is depressed by the subject the instrument immediately presents another light, in a random order.

The Reaction Plus measures reaction and response times. Reaction time is defined as the time required to initiate a motor movement in response to a stimulus, in this situation a light.^{4,5} Response time is defined as the total time required to initiate and then complete a motor movement, in this case, to respond to the lit switch and then move the subject's hand a short lateral distance from one switch to another.⁴

METHODS

Forty four subjects, 29 males 15 females ranging in age from 18 to 31, were recruited on a volunteer basis from Pacific University's College of Optometry. Participation requirements were limited to no known pathology or gross motor defects which may have interfered with performance.^{6,7} Testing took place at the Sports Vision Lab of Pacific University College of Optometry in Forest Grove, Oregon. Participants were provided and signed an informed consent form. In Phase I, subjects were assigned a random testing order for the Eyespan, Accuvision, and Wayne Saccadic Fixator. Phase II consisted of Reaction Plus testing. The Eyespan 2064 and Wayne Saccadic Fixator were set in such a manner that the subject was able to pace him/herself. That is, the stimulus light remained lit until depressed by the subject, regardless of the time required. The Accuvision 1000 is limited to an instrument paced function only. In this case, the stimulus light remains lit for the preset amount of time, or until the switch has been successfully depressed, whichever occurs first.

Each of the instruments were in separate rooms within the Sports Vision area of the Vision Therapy Clinic. Room 1 consisted of the Accuvision 1000. Sixty lights were set to flash, each light remaining lit for 1.33 seconds or until depressed, whichever occurred first. The Accuvision was set at Full-field 60, speed 2, sound on, fixation off. Each

subject was given an explanation of the instrument and testing procedure. A practice trial was directly followed by one trial after which the individual's score was recorded. The highest possible score in this mode is 60.

Room 2 contained the Eyespan 2064. The Eyespan was set on mode A for 30 seconds with the sound on. In mode A the stimulus light stays lit until depressed, regardless of the time required. The goal is to turn off as many lights as possible in 30 seconds. The subject is instructed to depress the stimulus buttons as quickly as possible when each is lit. Again, a practice trial preceded the one trial in which a score is recorded.

The Wayne Saccadic Fixator was in Room 3. For this study, the instrument was set on 91, with fixation off and sound on. In this setting, similar to the Eyespan, the subject is able to set his own pace. Again there were two 30 seconds trials, a practice and recorded trial, in which the subject depressed the maximum number of lights possible.

After each subject was tested on the Eyespan, Accuvision, and Wayne Saccadic Fixator, in one of the six random testing orders, they were taken to room 4 for testing on the Reaction Plus. All participants were given one practice trial and six timed trials. After each of the timed trials both the reaction and response times were recorded.

All test conditions were in accordance with the protocol of the

Pacific Sports Visual Performance Profile (PSVPP).^{4,5,8-11} For specific testing protocols and a copy of the recording form used in the study see Appendix 1.

RESULTS

Each subject's scores were matched for their performance on each instrument. A correlation matrix was used, comparing an individual subject's performance on the Eyespan versus the Accuvision, the Wayne Saccadic Fixator versus the Accuvision, and the Reaction Plus versus the Eyespan, Accuvision, and Wayne Saccadic Fixator. A t-value was computed for each correlation (r) value and statistical significance determined ($p < 0.05$).

The data shows that the highest levels of correlation (the lowest {r} value) exist between performance on the Accuvision and reaction and response times. The lowest level is between the Wayne and the Accuvision.

Table 1 illustrates the correlation (r) values for the comparisons described above as well as the t-values calculated from the correlation coefficients. A statistically significant relationship ($p < 0.05$) exists for performance on the Accuvision and Eyespan with reaction and response

times. The Wayne Saccadic Fixator and reaction time were also found to be significantly correlated.

Performance on the Accuvision was shown to be independent of performance on either the Eyespan or Wayne Saccadic Fixator. Response time as measured on the Reaction Plus was not found to be related to performance on the Wayne Saccadic Fixator.

DISCUSSION

The purpose of this study was to determine what, if any, relationship exists between performance on the Accuvision 1000 and the Eyespan 2064 or the Wayne Saccadic Fixator. In addition, the study also assessed whether reaction or response times, as measured with the Reaction Plus, is related to performance on the Accuvision, Eyespan, or Wayne Saccadic Fixator.

The data revealed that performance on the Accuvision is not related to performance on either the Eyespan or Wayne Saccadic Fixator.

The lack of any statistically significant relationship may be due to inherent differences between the three instruments. First, the Accuvision lights a predetermined number of stimulus lights (60 for this

study) and thus the time to take the test will vary based upon the individual subject's responsiveness. There is a ceiling maximum score possible. Both the Eyespan and Wayne run for a preset specific length of time (30 seconds for this study). In our experimental design, the number of stimuli presented was completely dependent on the self-paced speed of the subject. There was no ceiling with either of these instruments.

Second, the Accuvision's stimulus lights are flush with the surface of the instrument whereas both the Eyespan and Wayne's stimulus lights protrude out approximately 0.5 mm. The Accuvision requires more accurate tactile response to depress the stimuli versus the other two instruments.

Reaction time was shown to be significantly related to performance on all three instruments. Response time, which includes both the visual-reaction and visual-motor components, was also highly correlated with performance on the Accuvision and Eyespan. Since all three instruments require the subject to quickly recognize and respond to a lighted stimulus it is unclear why response time was not significantly related to performance on the Wayne Saccadic Fixator. A follow up study is recommended to further investigate this result. Also, it would be of interest to compare performances utilizing the instrument-paced modes of the Eyespan and Wayne. This study did not investigate possible relationships between these

instruments in consideration of gender, age, past or present sports, and recreational participation.^{6,8,11,12}

CONCLUSION

Based on the experimental design of this project an individual's performance on the Accuvision 1000 cannot be reliably compared to the data base previously collected for the PSVPP with the Eyespan 2064 and Wayne Saccadic Fixator. However, both reaction and response times, as measured by the Reaction Plus, were found to be related to eye-hand performance on the Accuvision and Eyespan. Reaction time was found to be related to Wayne Saccadic Fixator performance.

REFERENCES

1. Trachtman J. The relationship between visual and athletic performance. National Academy of Sports Vision Highlights 1988; 4(1):2-4.
2. McLeod P. Visual reaction time and high speed ball games: Perception; 1987;16(1):49-59.
3. Christenson GN, Windelstein AM. Visual skills of athletes versus nonathletes: Development of a sports vision battery. J Am Optom Assoc 1988; 59(9):666-675.
4. Coffey B, Reichow AW. Optometric evaluation of the elite athlete: Problems in optometry; 1990; 2(1):33-59.
5. Pierson JM, Bradshaw JL, Meyer TF, Howard MJ. Direction of gaze during vibrotactile choice reaction time tasks: Neuropsychologia; 1991; 29(9):925-928.
6. Ironius M, Sireteanu R. Pointing errors in strabismics: Complex patterns of distorted visuomotor coordination: Vision-Research; 1994; 34(5):689-707.
7. Vogel GL, Hale RE. Using the Wayne Saccadic Fixator to evaluate aspects of laterality skills in children: J Am Optom Assoc 1992; 63(10):714-722.
8. Enright JT. The non-visual impact of eye orientation on eye-hand coordination: Vision-Research; 1995; 35(11):1611-1618.
9. Furst DM, Tenenbaum G. Influence of attentional focus on reaction time: Psychological-Reports; 1985; 56(1):299-302.
10. Campbell FW, Rothwell SE, Perry MJ. Bad light stops play: Ophthalmic and Physiological Optics; 1987; 7(2):165-167.
11. Era P, Jokela J, Heikkinen E. Reaction and movement times in men of different ages: A population study: Perceptual and Motor Skills; 1986;63(1):111-130.
12. Ruff RM, Parker SB. Gender and age specific changes in motor speed and eye-hand coordination in adults: Percept Mot Skills; 1993 76(3):1219-30

APPENDIX 1

TESTING PROTOCOLS

- INSTRUMENTATION:** Wayne Saccadic Fixator, Eyespan 2064, Accuvision 1000
- VISUAL ABILITY EVALUATED:** Visual Motor response time to visual stimuli based upon a precise, visually guided motor response (finger press of lighted target button).
- ILLUMINATION:** 6-7 footcandles incident upon instrument. Calibrate with photometer.
- TESTING DISTANCE:** Dependent upon subject.
- SUBJECT POSITION:** Standing relaxed with center of instrument at eye level. Distance from instrument should be such that while the subject stands relaxed with arms extended directly in front, the fingertips of both hands touch the face of the instrument.
- CRITICAL FACTORS:** Check instrument timing calibration and note any errors. Illumination level and test distance are critical. Subjects may either move their eyes to the stimuli, or may gaze to any other desired position at personal discretion. The Wayne Saccadic Fixator and Eyespan are run for 30 second trials. The Accuvision runs until 60 stimuli are presented. For the Accuvision, the subject must respond to the stimulus light within 1.33 seconds or it will automatically to a new random position and will not register a "hit".
- INSTRUCTIONS:** With the Eyespan or Wayne Saccadic Fixator, the subject is to depress the lighted stimulus buttons as rapidly as possible. With the Accuvision, the subjects task is the same, but if the the stimulus button is not depressed within 1.33 seconds, the stimulus light automatically will shift to its next random location. For the Eyespan and Wayne: "When you see one of the lights turn on, press it quickly using the tips of your fingers. Another light will come on automatically and again, turn it off by pressing it as quickly as you can. Your task is to turn off as many lights as you can in 30 seconds. Ready? Go." For the Accuvision "When you see one of the lights turn on, press it quickly using the tips of your fingers. You must press the lighted button before it goes out automatically. Ready? Go?." One trial for each instrument preceded by a practice trial are given.
- RECORDING:** Record the value displayed on the digital readout of each instrument at the conclusion of each testing mode.

- INSTRUMENTATION:** Reaction Plus dual chronometer reaction / response timer.
- VISUAL ABILITY EVALUATED:** Visual motor reaction and response time to central visual stimuli based upon visually guided eye-hand motor response (via hand button release and press lit target button). Reaction time is measured as the elapsed time between onset of stimulus light and release of depressed "reaction" button. Response time is measured as total elapsed time between onset of stimulus light and press of stimulus ("response") light by subject.
- TESTING DISTANCE:** Top of instrument 86.4 cm above floor.
- ILLUMINATION:** Dim room (6-7 footcandles)
- SUBJECT POSITION:** Standing relaxed with dominant hand depressing reaction button. Dominant hand must be lined up tangent to boundary line with reaction button under flat of hand at base of fingers. Subject's head aligned vertically over target button.
- CRITICAL FACTORS:** Body, head, hand alignment. Control panel and examiner positioned behind and to the side of subject so control panel is not visible to subject.
- INSTRUCTIONS:** "Which hand is your dominant hand?" Adjust instrument to measure performance using dominant hand. "Place your right (or left depending on dominance) hand on this button so that your hand lies up against the line without crossing it. The ready light will come on when you have place your hand on the reaction button. Position yourself with your head directly over the response button. I will say 'Ready,' and within one to five seconds the response button will light up. Move your hand over and depress the button as quickly as possible. The reaction button should lie under the base of your hand as I will demonstrate." Examiner will initiate stimulus between two and four seconds after "Ready" command. Subject will be given one practice trial followed by six timed trials. Subject will not be told his/her times during the testing sequence.
- RECORDING:** Record both the reaction and response times for each of the six trials and calculate the means.

Table 1

	ACCUVISION - EYESPAN	ACCUVISION - WAYNE	REACTION- EYESPAN	RESPONSE- EYESPAN	REACTION- WAYNE	RESPONSE- WAYNE	REACTION- ACCUVISION	RESPONSE- ACCUVISION
Correlation (r)	0.322	0.404	0.15	0.244	0.286	0.427	0.105	0.107
(t) Value	2.2	2.86	0.983	1.63	1.36	3.06	0.689	0.697
(p) Value	>0.05	>0.05	<0.05	<0.05	<0.05	>0.05	<0.05	<0.05