

Visual Attention Span and Optometric Conditions: Is there a connection between a poor VAS and an optometric diagnosis?

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This paper investigates whether there is a correlation between a poor Visual Attention Span (VAS) and the child's optometric status. Convergence excess impacts most upon a male achieving a VAS-3 more than 75 per cent of the time. Fifty per cent of females with eye-teaming problems are unlikely to achieve a VAS-3 more than 25 per cent of the time. Overall children with an optometric diagnosis were unlikely to achieve a VAS-3 more than 75 per cent of the time. This indicates that children with optometric conditions are more likely to have a poor VAS ability.

Visual Attention Span, convergence excess, children, eye-teaming, optometric conditions

INTRODUCTION

Harrison and Zollner (1993) suggested that a child's Visual Attention Span (VAS) is primarily developmental. Observations by staff at a paediatric behavioural optometry clinic, however, suggest that children with convergence excess also have a reduced VAS. This study investigates whether there is a correlation between eye-teaming problems, both convergence excess and other eye-teaming problems, and a reduced VAS. To do this comparisons are made between the optometric assessment of children in a clinic population and the number of letters they can recall immediately after seeing them.

VAS is the number of high visibility letters that a child can process and recall in one glance (Harrison et al., 1996; Harrison and Zollner 1993). A VAS of three letters is considered necessary for a child to word guess one or two syllable words. The average child will develop this ability by the age of 7 years 8 months (Harrison et al., 1996). A great deal of research has been conducted into children's visual attention (Pearson and Lane 1990; Yussen 1974), and its impact on reading (Brannan and Williams, 1987; Cornelissen et al., 1991) however, very little research has been done into the impact of VAS other than that by its pioneer Harrison (Harrison et al., 1996; Harrison and Zollner 1993).

The VAS ability of each of the children included in this survey was tested using the Reading Diagnostic Program, developed by Liubinas¹. Initially one letter is flashed on to a blank screen. The child is then asked to say what letter they saw. This process is repeated until two correct answers in a row have been achieved. Another letter then appears so that two letters are shown simultaneously. The process is repeated until the maximum number of letters that the child can recall is obtained. If a child answers incorrectly they progress back a level. Another letter is then not added until they have successfully identified the letters shown twice. The use of a blank screen

¹ See Rite Pty Ltd, 133 Puckle Street, Moonee Ponds, VIC 3039

ensures that the child's visual attention is not compromised by other surrounding objects (Casco et al., 1998). Therefore the test will measure the number of letters the child can recall after visually seeing them rather than their ability to 'discover' the letter (Casco et al., 1998).

The use of a clinic population means that there will be a higher incidence of optometric problems (Schieman et al., 1996). Schieman et al., (1996) suggest that in the age range of 6 to 18 years this is in the vicinity of 8.5 times greater than for the normal population. This, however, will allow any connection to be made as a higher frequency of optometric conditions will provide more children than can be included in the survey.

In accordance with Cornelissen et al., (1991) suggestion of a connection between binocular fixation and a greater tendency for reading problems it is suggested that the children involved in this study are more likely to have learning difficulties than the general population. Solan (1981) also indicated that the optometrist is most likely to be the first practitioner to evaluate children with a learning disability. This corresponds with the anecdotal belief of staff at the practice that most children attending the practice had some kind of learning difficulty or delay. Harrison et al., (1996) also found that the performance of children who visit optometric practices is inferior to those in state and Catholic schools. This was attributed to a higher incidence of reading disabilities than the state average. This study is collecting preliminary data to establish whether there is a correlation between a poor VAS and an optometric problem, which can be assisted.

The aim in each test conducted was to optimise the child's performance. Clear instructions were given to the child prior to the VAS test indicating what they would see and should try to remember. This is in accordance with research which indicated that prior instruction to a child telling them to remember what they saw increased their visual attention to such a level that neither the belief of reward or punishment could increase it further (Yussen 1974). The VAS results are therefore likely to be a good indicator of the child's maximum Visual Attention Span.

METHOD

Data were retrospectively collated for children (younger than 18 years), who had visited the practice in late 2002 and early 2003. All of the children's ages were recorded in years and months at the time of their appointment. For analysis the months were then converted to decimals.

The same behavioural optometrist, who has been working primarily with children for the past 13 years, examined all the children. The results from the optometric assessment were used to classify each child's vision into one or more of the following criteria; no problems, longsighted, focussing, tracking, eye co-ordination problems or convergence excess (see Appendix 1). Most children are longsighted, however, children have only been classified here as longsighted if they are more long-sighted than a child of that age and it is affecting their ocular-motor skills. Although convergence excess is a type of binocular anomaly (Schieman and Wick 1994), that is, an eye co-ordination problem, children were classified, if appropriate, as either having convergence excess or eye co-ordination problems, but not both. This was done to allow the number of patients with an eye co-ordination problem that was not convergence excess to be determined. The difference, if any, on their VAS scores could then be considered.

The results from the computer assessment were collated similarly. That is patients were either classified as having a competent VAS or not. As a VAS of three letters is considered the minimum level for a child to read adequately and copy in the classroom (Harrison et al., 1996; Harrison and Zollner 1993) the children were graded according to their VAS of three. That is they were graded according to whether they could recall three letters more than 75 per cent or less than 25 per cent of the time.

The Reading Diagnostic Program was administered by a Vision Therapy assistant who had completed the Australasian College of Behavioural Optometrists Vision Therapists module related to computer programs. Children who had a computer assessment but were younger than eight years were excluded from the data because a VAS of three is not developed until the child is 7 years 8 months (Harrison et al., 1996).

RESULTS

Thirteen females and 17 males completed the VAS component of the computer assessment. As can be seen from Table 1 and Figure 1 females were more than two times as likely as males to score a VAS-3, 75 per cent of the time. However, they were also more likely than males to not be able to achieve a VAS-3 less than 25 per cent of the time.

Table 1. Percentage of each gender in that range of VAS-3 Score

Range of VAS-3 Score (V)	Males	Females
V<25%	17.7	30.8
25%<V<75%	70.6	30.8
V>75%	15.3	38.5

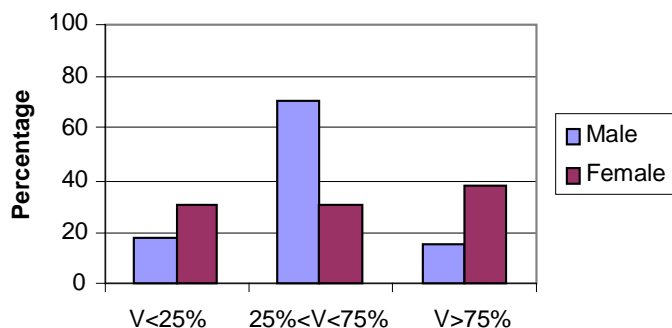


Figure 1. VAS-3 Score according to the percentage of gender in each range

Figure 2 outlines the age and gender of the participants in this study as well as those who scored a VAS-3 less than 25 per cent of the time. The children with a poor VAS were mainly aged between 8 and 9 years and therefore may be developmentally delayed in general. Some older children, however, were also unable to score a VAS-3 more than 25 per cent of the time.

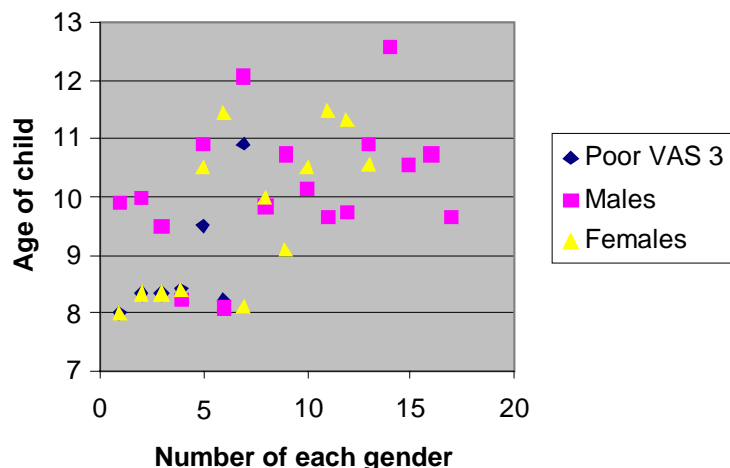


Figure 2. Age of participants in study and those with a poor VAS-3

Twelve males and eight females in the study were diagnosed with convergence excess. All except one female were also longsighted and had focusing and tracking difficulties. The female was just longsighted in addition to convergence excess. Fifty per cent of females with convergence excess

were likely to achieve a VAS-3 score 75 per cent or more of the time. This is more than five times greater than males who predominantly scored a VAS-3 between 25 and 75 per cent of the time.

Table 2. Patients with convergence excess who completed the VAS section of the computer assessment

Range of VAS-3 Score	Males	Females
V<25%	3 (25%)	1 (13%)
25%<V<75%	8 (67%)	3 (38%)
V>75%	1 (8%)	4 (50%)

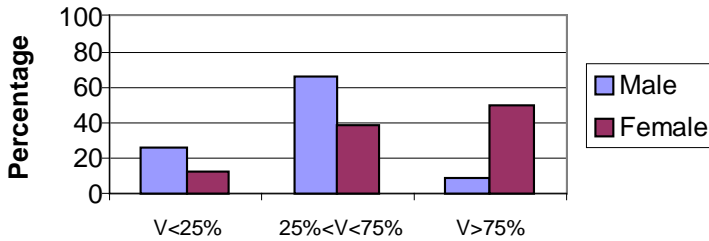


Figure 3. Subjects with convergence excess and their respective VAS-3 scores as a percentage of gender

Four males and four females were diagnosed as having eye-teaming problems that were not convergence excess. They were all considered to be longsighted and some also had tracking and focusing difficulties. As can be seen from Table 3 and Figure 3, 50 per cent of females with eye-teaming difficulties were unlikely to achieve a VAS-3, 25 per cent of the time. No males were in this situation. Twenty-five per cent of both males and females were likely to achieve a VAS-3, more than 75 per cent of the time.

Table 3. Patients with eye-teaming problems who completed the VAS section of the computer assessment

VAS-3 Score	Males	Females
V<25%	0 (0%)	2 (50%)
25%<V<75%	1 (75%)	1 (25%)
V>75%	3 (25%)	1 (25%)

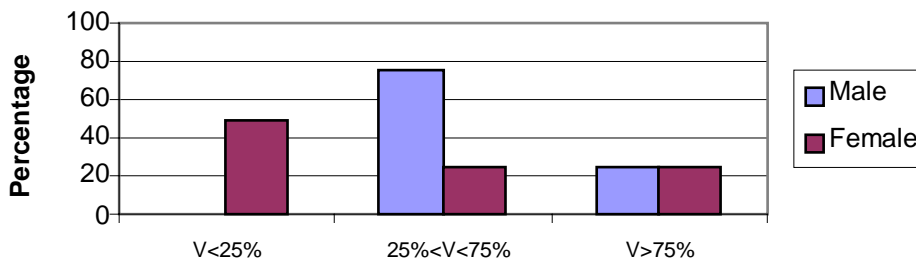


Figure 4. Patients with eye-teaming problems and their respective VAS-3 scores

One male and one female who completed the computer assessment did not have eye-teaming or convergence excess problems. They were both longsighted and had focusing and tracking difficulties. The female could not achieve a VAS-3 more than 25 per cent of the time whereas the male achieved a VAS-3 between 25 and 75 per cent of the time. Both children were in the age range of 8 to 10 years.

DISCUSSION

Cornelissen et al., (1991) suggested that children with reading difficulties also have binocular fixation problems which might cause their eyes to aim either in front or past the page they were

trying to read. It was also indicated that the children involved in that study described what was occurring on the page in terms of the letters moving and blurring together. Both of these factors correspond with the symptoms of convergence excess (Scheiman and Wick 1994). Convergence excess is a condition where the eyes focus in front of the plane. These and other symptoms of convergence excess such as burning and tearing, difficulty concentrating and sustaining reading, decreased reading comprehension over time and sleepiness when reading (Scheiman and Wick 1994) all impact upon a child's reading ability.

This study was interested in whether these factors detrimentally affected a child's VAS. A good VAS was considered important for both reading and copying work in the classroom (Harrison et al., 1996) and it was presumed that convergence excess would impact upon the VAS because the child took longer to co-ordinate their eyes to look at the letters.

The VAS-3 of males with convergence excess appeared to be affected much more than females. However, because males were most likely to achieve a VAS-3 in the range of 25 to 75 per cent of the time this might be because males tended to be at least six months behind females developmentally. Interestingly, the results of this study tended to indicate that females with eye-teaming problems had difficulty achieving a VAS-3 of more than 25 per cent of the time. This indicated that females with eye-teaming problems might have a poorer VAS than initially thought.

Overall, this study indicated some correlation between an optometric condition and a poor VAS because regardless of gender almost 75 per cent of children tested were unlikely to achieve a VAS-3 more than 75 per cent of the time. Convergence excess impacted more upon males than it did females, however, females with eye-teaming difficulties had substantial difficulty with their VAS. This indicated that children with optometric diagnosis, particularly eye-teaming and convergence excess were going to have difficulty accurately guessing words particularly in situations where speed was required. These children were also going to require more time to copy work from the board as they would only be able to see, process and recall one or two letters most of the time.

Special educators need to be aware of the correlation between optometric diagnosis and VAS as they are more likely to encounter children who are struggling with reading because of a poor VAS and optometric conditions. Harrison and Winter (1987) suggest this is in the range of 10 to 20 per cent of schoolchildren. Children with a reduced VAS score was more likely to guess words when reading because they were unable to see enough letters to decipher accurately the words.

Although this study does not indicate whether a poor VAS is the result of or exacerbated by an optometric condition, it does illustrate that few children with an optometric condition consistently achieve a VAS-3 score more than 75 per cent of the time. This study is limited by the small sample included and that the results are based on correlations. Further research is required to examine whether assistance for an optometric problem reduces the time required for a child to develop a VAS-3, or whether the development of VAS is unrelated to optometric difficulties. Anecdotal evidence suggests that a child's VAS can be improved through Vision Therapy. This, however, contradicts the theory that VAS cannot be externally stimulated or influenced (Harrison et al., 1996; Harrison and Zollner, 1993).

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APPENDIX 1

- Longsighted:** This means the child has to strain their eyes harder when looking at close work, however, they do not have any difficulty seeing distance.
- Tracking:** This is the child's ability to follow a line of text and then move to the beginning of the next line of text without missing letters or lines.
- Focussing:** This is the child's ability to look at an object near them then far away, or *vice versa*, and make it into one clear image within three seconds.
- Eye-teaming:** This is the child's ability to move both eyes together to look at an object.
- Convergence excess:** This is when the child's eyes turn (converge) in too far when trying to look at an object. They are therefore looking above the plane of the object and have to work their eyes much harder to force their eyes to diverge so that they can look at the object.

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