Vision and Learning

There are claims made by various professionals and support groups that there is no need for optometry intervention in the management of children with reading disorders.

There is now clear evidence that dyslexia and other learning disabilities are common in the paediatric population, and that there is an increased incidence of vision dysfunction occurring in the presence of problems like dyslexia.

Are Vision and Learning Linked?

There are studies that evidence the theory that vision and learning are strongly linked.

Professor Robert Barton of Durham University presented a study at the American Academy of Science in 2004[i], which looked at stereoscopic vision and brain development. He says that "The results support the hypothesis that brain size evolution in primates was associated with visual specialization." If he is correct, there is a link between vision and neural development.

Zhang et al (2005)[ii] investigated how periods of misalignment such as strabismus alter the cortical circuits that support binocular vision. After only 3 days of imposed strabismus they demonstrated a "striking" increase in binocular suppression. The sensitivity of the relationship was not affected. One could reasonably conclude that removal of the strabismus would improve binocular vision. The relationship between brain and visual function is likely to be quite responsive.

There is also evidence to suggest a link between colour perception and eye movement. Bompas and O'Reagan (2006)[iii] demonstrated "clear evidence for a role of eye movements in perceived colour and argues for the involvement in colour perception of neural mechanisms continuously tuned to sensorimotor contingencies."

P Bonifacci (2004)[iv] examined perceptual, visual-motor abilities and intellectual skills in 144 children (aged 6-10 years) attending elementary school children with low, average and above average motor abilities. The results highlight a significant difference in visual-motor integration between children with high and low gross-motor abilities, in the absence of significant differences in perceptual skills or intellectual ability.

A 1994 paper by Eden et al.[v] found that Dyslexic children had significantly worse eye movement stability during fixation of small targets than normal children, and that the presence of oculomotor abnormalities in a nonreading task strongly suggest that the underlying deficit in the control of eye movements seen in dyslexics is not caused by language problems alone.

A follow up study by Eden in 1995[vi] using a larger group of subjects showed that in addition to performing poorly on verbal tests, the children with reading disability were significantly worse than nondisabled children at many visual and eye movement tasks. Professor Eden says that "These results provide further support for the hypothesis that reading disability may, to some extent, result from dysfunction of the visual and oculomotor systems."

The work done by Eden supports a 1993 paper by Grisham and colleagues[vii] that concluded "that visual symptoms are a factor in reducing reading performance, particularly in very symptomatic individuals."

Prior to this in 1987[viii] Grisham and his colleague H Simons produced a paper that reviewed and evaluated the research literature on the relationship of binocular anomalies to reading problems. The concluded that "The weight of the evidence supports a positive relationship between certain binocular anomalies and reading problems."

M Taylor Kulp et al (1996) clearly demonstrated that visual performance was "significantly related to reading performance even in children of average intelligence when IQ was partially controlled."

A review of literature also in 1996[ix] by Professor Kulp revealed that "Many visual difficulties have been shown to be related to reading ability. Efficient reading requires accurate eye movements and continuous integration of the information obtained from each fixation by the brain. A relation between oculomotor efficiency and reading skill has been shown in the literature. Frequently, these visual difficulties can be treated successfully with vision therapy."

Austrian ophthalmologists (Dusek et al, 2000)[x] reviewed over 800 children with learning and reading problems and found that the referred group were statistically more likely to have poorer distance visual acuity, an exophoric deviation at near, a lower amplitude of accommodation, reduced accommodative facility, reduced vergence facility, a reduced near point of convergence, a lower AC/A ratio and a slower reading speed than those in the clinical control group. They confirm the importance of a full assessment and treatment of binocular vision in order to prevent the visual problems continuing to impact upon educational development.

In 2014 Germano[xi] et al studied the phonological and visual capability of sixty-six children with developmental dyslexia and a cohort of normal children. Results show that children with developmental dyslexia are impaired not only in phonological processing but further in visual processing. The phonological and visual processing abilities significantly and independently contribute to reading fluency in the whole population

A large 2015 study[xii] of children in the UK showed that that dyslexic kids have vision problems that occur 50% more frequently than in the general population. The study notes that 2 of every ten dyslexic children had abnormal fusion of information from each eye. Around double the incidence of their unaffected peers. Twenty percent (20%) of dyslexic children also had 3-D vision problems.

An ophthalmology study in 2018[xiii] showed a significantly reduced monocular and binocular near point accommodation in dyslexic children. They recommended that this function should be assessed by an optometric clinician in children with dyslexia.

Raghuram et al (2018)[xiv] note that "Developmental dyslexia (DD) is a specific learning disability of neurobiological origin whose core cognitive deficit is widely believed to involve language (phonological) processing. Although reading is also a visual task, the potential role of vision

in DD has been controversial, and little is known about the integrity of visual function in individuals with DD."

In their 2018 paper they show that accommodation issues were significantly more prevalent in DD children than their unaffected peers. They report that "The prevalence of visual deficits was high among children with DD; 23 (79%) met the criteria for a diagnosis of deficit in 1 or more domains of vergence, accommodation, and/or tracking compared with only 11 children in the TD group (33%)."

Logically it is appropriate to detect and treat these issues to remove any physical visual impediment to function in daily life of reading and computer use, as well as to potential remediation approaches. It does not prove or suggest that vision dysfunction is a cause of dyslexia, nor do optometrists hold that it is. Our approach is to make people as visually efficient as possible.

Vision Therapy & Learning Ability

In 2000 Fischer, Hartnegg & Klaus[xv] studied the effects of daily practice of three visual tasks on the saccadic performance of 85 dyslexic children, and found that daily practice improved not only the perceptual capacity, but also the voluntary saccade control, within 3 to 8 weeks. After the training, the group of dyslexics was no longer statistically different from the control group.

A paper in 2002[xvi] by Dr Paul Harris presented a longitudinal, single-masked, random sample study of children at a Baltimore City Public Elementary school documents the prevalence of learning-related visual problems in the inner city of Baltimore and tests the effectiveness of vision therapy. Vision therapy was provided to one of the randomly selected groups and data were collected on optometric tests, visual performance tests, and standardized achievement tests before and after treatment was provided. Data presented show that the vision therapy program has made a significant difference in the demand level of reading that could be read for understanding, in math achievement on standardized testing, and in reading scores on standardized testing, as well as on infrared eye-movement Visagraph recordings, which show significant changes on nearly all mechanical aspects of the reading process.

Ramsey et al. (2014)[xvii] looked at the effect of computerised vergence training for twelve dyslexic children and found that there was a statistically significant improvement in the study group for words per minute. They suggested that larger groups were required to confirm the results.

Motsch & Mühlendyck (2001)[xviii] studied 33 children disgnosed with dyslexia and found ocular disturbances in 28 (84.8%) out of 33 children. 26 (78.8%) children showed improved reading after therapy. They had mostly accommodative problems: uncorrected hyperopia, hypo accommodation and/or exophoria compensated by accommodative convergence (pathophoria).

Badami and colleagues (2016)[xix] looked at a group of children who participated in sports vision exercise courses for 12 weeks (3 one hr sessions per week) and the latter (control group)

continued their routine daily activities during the exercise. The results showed that the sports vision exercises increase motor skills, visual perceptual skills and reading skills in developmental dyslexic children. Based on the results of the presented study it was concluded that sports vision exercises can be used for fundamental and cognitive skills of developmental dyslexic children.

In 73 children with reading difficulty, ophthalmological evaluation (Haddad H, 1984)[xx] showed that 18 had overt refractive errors, 18 had dyslexia and no ocular anomalies, and 37 had impaired fusional amplitudes, 24 of whom were dyslexic. In all patients with poor fusional amplitudes the reading mechanism could be improved with orthoptic exercises designed to augment the fusional amplitudes. The treatment did not affect the perceptual defect associated with dyslexia.

Conclusion

There is ample evidence that behavioural optometry treatment methods can and do improve the visual performance of children with specific learning problems. It is clear that these vision problems can occur more frequently in children with learning and reading problems. Improving their vision will improve their learning and reading.

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