

## THE ROLE OF THE OPTOMETRIST IN MANAGING CHILDREN WITH LEARNING PROBLEMS

*The relation between vision and learning, and hence the role of the optometrist in managing children with learning problems, has been the subject of considerable research, speculation and controversy. In this issue I argue that vision disorders frequently interfere with reading and learning and that the optometrist must identify existing vision disorders, determine whether visual dysfunctions appear to correlate with the particular learning difficulties experienced by the patient, and then initiate appropriate intervention. Dr. Jerome Rosner, Professor of Pediatric Optometry at the University of Houston College of Optometry, similarly emphasizes that the optometrist not only must identify vision deficits but must know which visual functions, if deficient, are likely to cause adverse classroom behaviors. He suggests that causative relationships have been established for but a few vision disorders, notably hyperopia and visual perception deficit, and implies that vision disorders are not a frequent cause of learning problems.*

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### Vision disorders frequently interfere with reading and learning: They should be diagnosed and treated

■ Martin H. Birnbaum, O.D.

#### ABSTRACT

*The optometrist is frequently called upon to evaluate children with learning problems. Considerable evidence suggests that hyperopia, non-strabismic binocular vision disorders, and deficits in eye movement, visual perception and transient visual system processing contribute to reading and other academic difficulties. Children with learning disorders should be thoroughly evaluated and deficiencies in visual function should be remediated in order to eliminate vision as a potential etiologic factor.*

*The visual functions involved in learning to read in the early primary grades differ considerably from those required for efficient reading in the later grades. Knowledge of the manner in which specific visual deficits may contribute to reading difficulty permits the optometrist to more*

*effectively counsel patients and recommend care. Deficits in visual form perception, visual memory, visual appreciation of direction, and auditory-visual integration are most significant in the early grades and should be thoroughly evaluated in the child who experiences difficulty in learning how to read. Subtle disorders of vergence and accommodation are unlikely to interfere with learning to read, but interfere with reading efficiency, especially in the later grades, as print becomes smaller and demands increase for sustained reading with comprehension.*

#### KEY WORDS

*vision-related learning disorders, reading disorders, dyslexia, reading and vision disorder, learning disorder*

**T**he optometrist does not treat reading or other learning disorders. However, he or she is frequently called upon to evaluate children with such problems to determine whether vision disorders exist that may cause or contribute to academic difficulty. The role of the optometrist is to identify existing vision disorders, to determine whether visual dysfunction appears to correlate with the particular learning difficulties experienced by the patient, to counsel the patient and parents, and to initiate the most appropriate interventions.

#### Research relating to reading and vision disorder

Considerable research indicates that vision disorders may cause or contribute to academic problems. Individuals with reading and learning problems demonstrate

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# Vision disorders do not cause learning problems as often as you might think

■ Jerome Rosner, O.D.

## ABSTRACT

*The optometrist's examination is designed to obtain information that is inherently relevant to the health and proper functioning of the visual system. It is important, however, that she also know what subset of that information is needed to address specific clinical problems. For example, when a child with an enigmatic school learning problem presents, which visual functions, if impaired, will generate learning problems and, if remedied or not effectively accommodated, will enable the child to progress satisfactorily in the classroom. This paper argues that the list is short and identifies those functions.*

## KEY WORDS

*learning problems, perceptual skills, visual functions*

Children with enigmatic school learning problems (i.e., children who do not make satisfactory school progress despite adequate IQ; children who are often called *dyslexic* or *learning-disabled*) frequently exhibit behaviors/symptoms that imply a vision disorder; e.g., letter reversals, frequent loss of place on page when reading, trouble completing paper work, etc. Hence, they often seek our services.

Certainly, the optometrist is always obliged to conduct a comprehensive examination. But we are also obliged to know which vision functions, if deficient, are likely to generate those worrisome classroom behaviors. Further, we should not simply conclude, by virtue of "logic" or because of statistical correlations, that all vision functions fall into this category.

In other words, the optometrist must not only measure vision functions and treat those that do not meet standard criteria, he/she must also know how those behaviors affect classroom performance. For example:

### Visual acuity

Obviously, the child in a standard classroom must be able to see his school materials, but that does not necessarily require 20/20 acuity. There is much empirical evidence that illustrates this.

### Ocular motilities

Although there are many who support the proposition that poor readers ARE poor readers because of faulty eye movements (some stress versions; others emphasize saccades),<sup>1-3</sup> their respective cases are based on statistical correlations rather than on valid evidence. Indeed, there are compelling data to support the opposite proposition: that poor readers have poor eye movements while reading simply because they are poor readers; their eye movements are not impaired when engaged in other visual tasks.<sup>4,5</sup>

### Refraction

The data are convincing: myopes tend to be good school achievers; hyperopes

are more prone to school difficulties; and astigmats are difficult to categorize.<sup>6,7</sup> The unanswered question in this regard: How much hyperopia justifies compensatory lenses? Few would argue against prescribing compensatory lenses for the school child with significant hyperopia, but not enough is known about the degree of hyperopia required to earn the designation of "significant."

### Phoria

Although there is reason to believe that heterophoria may hamper school performance (depending on the magnitude of the heterophoria, the patient's relative fusional vergence capacities, and the extent to which the patient adapts to vergence stress by suppressing versus manifesting diplopia), there is no evidence to show that it CAUSES a learning disability.

### Binocular status

Strabismus has not been found to be a significant factor in a child's school achievement except in those cases where the strabismus is caused by a CNS disorder that also produced the learning problem.<sup>8</sup> This shows what, in my opinion, many experienced O.D.s know: Satisfactory school achievement does not always REQUIRE the participation of two eyes.

### Accommodative/vergence facility

These functions are frequently implicated in discussions regarding learning disabilities--and, again, it is more on the basis of reasoning than on hard data.<sup>9</sup> As of this date, there are no data showing that accommodative and/or vergence infacility produces school failure. Indeed, it appears to be exceptionally difficult even to collect valid data regarding these functions because of the unreliability of the tests that are used to measure them.<sup>10</sup>

### Ocular health

Obviously this is an important concern, but not one directly related to school performance except in those situations where the pathology impairs visual acuity

or any of the other visual functions that have a negative effect on classroom performance.

### Perceptual skills

For our purposes, the term *perceptual skills* refers to the basic analytic aptitudes that normal children are expected to develop on a predictable schedule during the first decade of life. These aptitudes enable children to analyze what they see and hear on the basis of concrete (sensory) as well as abstract (semantic) features.<sup>11</sup> These skills are critical to learning to read, write, spell and do arithmetic because it is the concrete features of information that the symbols of the classroom (letters and numerals) code. Once the child identifies these features, reading, writing, spelling and arithmetic make sense. If they are not identified, then the child's only alternative is to attempt to memorize what he is to learn--an impossible task.

### Visual perceptual skills

Visual perceptual skills, in behavioral terms, refers to the ability to identify the concrete features of spatially-organized patterns. The optometrist usually assesses this with standardized geometric design copying tests that reveal how effectively the child can identify the (concrete) features of quantity, magnitude and spatial relationships. The link between being able to identify these features and the classroom is obvious. These concrete features provide a basis for classifying information which is a must with respect to memory and reading comprehension. In arithmetic, they represent precisely those spatial features that numerals symbolize.<sup>12</sup>

### Auditory perceptual skills

Auditory perceptual skills refers to the ability to recognize the concrete features of acoustical patterns. In discussing school performance, the acoustical patterns of interest are spoken words, and the concrete features are the separate sounds--the phonemes--and their temporal sequences. Once again, the link between these skills and the classroom is apparent. Phonemic analysis provides the basis for learning to read and spell in that it enables the child to identify those features in spoken information that letters symbolize.<sup>13</sup>

### Conclusion

The optometrist examines all patients as thoroughly as the situation requires, employing those tests that provide the in-

formation needed to address the patient's spoken (and unspoken) concerns. When serving children with puzzling learning problems, we should pay particular attention to those vision functions that, if successfully remediated (before the child gets too far behind in school) and/or accommodated (if remediation provides an unfavorable prognosis), will improve school achievement. These visual functions are, specifically, visual acuity, ametropia (especially hyperopia), and (visual and auditory) perceptual skills.<sup>14</sup>

Obviously the other vision functions should also be assessed and treated if found to be deficient. However, treatment should not be initiated to eliminate a possible learning disability, but rather because these functions are important for clear, single, simultaneous binocular vision, independent of school performance concerns.

Treatment recommendations should be formulated in accord with existing knowledge rather than on the basis of well-intentioned wishful thinking. To prescribe a treatment based on correlational evidence rather than cause-effect evidence, on the strength of "it can do no harm and it might even help" reasoning, represents a disservice to the patient. IT DOES DO HARM. It wastes resources and serves to discredit the profession.

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a higher incidence of hyperopia<sup>1-3</sup> and non-strabismic binocular vision disorders, particularly exophoria at near, convergence insufficiency, and low fusional vergence ranges.<sup>3,4</sup> Pursuit and/or saccadic eye movements are more frequently impaired in reading-disabled children than in normal readers.<sup>5,16</sup> Reports document improvement in reading ability following correction of hyperopia,<sup>17,18</sup> anisometropia,<sup>19</sup> eye movement disorder,<sup>20-28</sup> and deficits of binocular and accommodative function.<sup>29-32</sup>

Certain visual-perceptual-motor abilities are predictive of reading readiness in kindergarten and of reading achievement in the early primary school grades.<sup>33-40</sup> A meta-analysis of 161 studies concludes that visual perceptual skills are important correlates of reading achievement, especially at the preschool and primary levels.<sup>41</sup> In the later primary grades a reduced but still statistically significant relationship between visual perceptual function and reading achievement has been reported.<sup>42,43</sup>

Abnormal spatio-temporal processing, attributable to transient visual system dysfunction, has been demonstrated in over 75% of individuals with specific reading disability.<sup>44,45</sup> In the presence of a transient system deficit, activity in the sustained channel from the previous fixation may persist and interfere with input during the current fixation, resulting in garbled input and confused reading.<sup>44-48</sup> An alternative mechanism suggests that transient system dysfunction may interfere with the peripheral visual mechanisms that select appropriate locations for fixation as one reads along a line of print.<sup>44,49</sup>

### Visual factors in dyslexia

Learning to read involves both phonetic and eidetic processes.<sup>50</sup> Phonetic analysis involves sounding out, grapheme-by-grapheme. Eidetic, whole-word decoding, is a more global process in which words are recognized based upon their shape and configuration. Visual perceptual deficits which interfere with the consistent recognition of graphemes may impede each of these processes.

Research suggests the existence of several sub-types of dyslexia. Among the most common are those in which auditory-language disorders are primary and those characterized chiefly by the

presence of visual-spatial perceptual disorders.<sup>51-57</sup>

Visual-spatial dyslexics typically demonstrate excessive reversals, transposition of letters and syllables, spatial difficulty, and faulty eye movements during reading. These individuals have poor sight recognition ability and consequently confuse letter shapes and have difficulty perceiving whole words and building a sight vocabulary. They often guess at words from their shapes so that similar looking words are confused and miscalled. They frequently read and spell phonetically so that reading is slow and labored.<sup>53</sup>

Although auditory-linguistic dyslexia outnumbers the visual-perceptual type by at least four or five to one,<sup>50,53,58-60</sup> optometrists typically see a much greater proportion of those who show signs of vision disorders. This may explain why educators and optometrists have substantially differing perceptions of the frequency with which reading disorders are caused by inadequate visual perception.

### Clinical considerations

The optometrist may obtain useful information by listening to the child read. I administer a shortened version of the Gates-McKillop Oral Reading Test.<sup>61</sup> The child with poor sight recognition often has difficulty recognizing familiar words and confuses words that look alike. Reading may be slow and laborious as the child phonetically decodes each word. Poor sight recognition often results from inadequate visual form perception. When testing indicates that visual form perception is inadequate, appropriate vision therapy should be initiated.

The child with impaired phonic ability, in contrast, may recognize familiar words but is unable to decode unfamiliar and multisyllabic words. Poor phonetic decoding may result from auditory and language deficits or from inadequate instruction. Inadequate phonics ability most frequently requires educational rather than optometric remediation.

The child who demonstrates both language and visual perceptual deficits has no mechanism available for effective decoding, and typically suffers with severe reading disability. Although visual perceptual training is not sufficient to resolve such a disability, remediation of the visual perception deficits may permit more adequate sight recognition and be of value.

Flax<sup>62-64</sup> points out that the visual functions involved in learning to read differ considerably from those required to read long passages with efficiency and comprehension at the high school and college levels. When learning to read, the child must differentiate the shape and orientation of visual symbols and transform them into verbal symbols. Deficiencies in visual form perception, visual memory, visual appreciation of directional differences, and auditory-visual integration may cause confusion of similar looking letters and words and interfere with the acquisition of sight recognition skills. These perceptual skills should therefore be carefully evaluated in the child who has difficulty learning to read.

By 3rd or 4th grade there is a transition from "learning to read" to "reading to learn." Efficient eye movements, accommodative and binocular function become increasingly important as reading assignments become lengthier, demands for speed and comprehension become greater, print size becomes smaller, and spacing decreases between letters, words and lines.<sup>63,64</sup> Therefore, when examining a child who has learned adequate decoding skills but begins to experience difficulty in 3rd or 4th grade; who is unable to sustain single binocular vision comfortably at near work tasks; or who demonstrates impaired comprehension despite normal intelligence and adequate oral reading ability, the clinician should suspect and test for subtle disorders of vergence and accommodation that may interfere with visual efficiency.

Some children make frequent small word errors, miscalling simple words like "the," "a" and "and." These errors are commonly encountered in patients with vergence and accommodative disorders, who may scan globally as a result of a less than optimal relationship between accommodation and convergence. I have found that vision therapy is often effective in improving reading accuracy in such cases. Since these small words are connectors that significantly influence meaning, reading comprehension frequently improves when these errors drop out. Small word errors may also result from visual form perception and ocular motility deficits.

By 3rd or 4th grade the good reader not only reads fluently and efficiently, but reads for meaning as well. Skeffington<sup>65</sup>

indicates that, in the presence of nearpoint stress-induced interference with vergence and accommodation, increased effort required for visual function detracts from the automaticity of the visual process and consequently interferes with information processing and reading comprehension. Forrest<sup>66</sup> points out that reading comprehension may be impaired if visual imagery and visualization abilities are inadequate or underutilized. Thus, when reading comprehension is poor in a fluid reader with no language, intellectual, emotional, or attentional problems, the optometrist should determine whether inefficient vergence and accommodative function or inadequate or underutilized visualization ability may be contributing factors.

### Vision and other aspects of classroom performance

Visual function plays a significant role not only in reading but in other aspects of classroom performance as well. In written arithmetic, children with visual-perceptual, spatial, and eye movement deficits often copy inaccurately, space numbers improperly, and fail to properly align columns of numbers. Spatial and visual-perceptual deficits interfere with mental arithmetic and with higher mathematical functions that require visualization of geometric and conceptual relationships.<sup>67,68</sup>

The child must be able to neatly and accurately organize letters, words and numbers on the page when copying from the chalkboard and when taking notes. Efficient performance requires adequate eye movement, vergence, accommodative, visual-spatial, visual-motor and eye-hand coordination skills. Visual-motor skills also play an important role in handwriting and in drawing ability.

Spelling involves a combination of visual and verbal processing. Visual imagery or visualization permits proper spelling despite the phonetic irregularities frequently encountered in the English language. The speller with inadequate visualization skill is excessively dependent upon phonologic analysis and spells words exactly as they sound, misspelling irregular words with great frequency. Inadequate visualization skills should be suspected in the child who is a good reader, indicating that phonetic decoding skills are adequate, but who persistently spells poorly.<sup>66</sup>

### Conclusion

Deficits in visual function may cause or contribute to difficulty learning to read in the early primary grades and may interfere with visual efficiency in the later grades as demands increase for sustained reading and comprehension. Different visual abilities are of primary importance at different stages of the reading process. Consequently, the optometrist called upon to examine a child with reading difficulty must evaluate a broad range of visual functions. The key clinical decision is to determine the degree to which existing deficits in visual function contribute to the specific reading difficulties experienced by the child. In cases in which deficient visual abilities appear consistent with deficits in reading, considerable gains in reading ability or in ability to benefit from appropriate reading instruction may be achieved following remediation of vision disorder. Vision disorders may interfere not only with reading but with copying, spelling and arithmetic as well.

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