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Joint Statement—Learning Disabilities, Dyslexia, and Vision

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AMERICAN ACADEMY OF OPHTHALMOLOGY
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abstract

Learning disabilities, including reading disabilities, are commonly diagnosed in children. Their etiologies are multifactorial, reflecting genetic influences and dysfunction of brain systems. Learning disabilities are complex problems that require complex solutions. Early recognition and referral to qualified educational professionals for evidence-based evaluations and treatments seem necessary to achieve the best possible outcome. Most experts believe that dyslexia is a language-based disorder. Vision problems can interfere with the process of learning; however, vision problems are not the cause of primary dyslexia or learning disabilities. Scientific evidence does not support the efficacy of eye exercises, behavioral vision therapy, or special tinted filters or lenses for improving the long-term educational performance in these complex pediatric neurocognitive conditions. Diagnostic and treatment approaches that lack scientific evidence of efficacy, including eye exercises, behavioral vision therapy, or special tinted filters or lenses, are not endorsed and should not be recommended. *Pediatrics* 2009;124:837–844

BACKGROUND

Reading is the process of extracting meaning from written symbolic characters. In elementary school, a large amount of time and effort is devoted to the complicated task of learning to read. Because of the difficulties that some children experience with learning to read, Congress mandated that the Eunice Kennedy Shriver National Institute of Child Health and Human Development assemble a national panel of educators and scientists to review the literature to research the optimal methods of teaching children to read. The 2000 report of the National Reading Panel titled "Teaching Children to Read: An Evidence-Based Assessment of the Scientific Research Literature on Reading and Its Implications for Reading Instruction"[1] linked research findings with recommendations for specific approaches to teaching reading to all children.

Learning disabilities remain a concern for the children and families involved and for the public. The inability to read and comprehend is a major obstacle to learning, which may have long-term educational, social, and economic consequences. Depending on the definition chosen, 5% to 17.5% of people in the United States have a learning disability, with an estimated 2.6 million children aged 6 to 11 years affected.[2] Learning disabilities often prevent children from reaching their full potential. They may cause children to have difficulty learning to listen,

speak, read, spell, write, reason, concentrate, solve mathematical problems, and organize information. These children may also have difficulty mastering social skills or motor coordination. Learning difficulties are frequently associated with and complicated by attention-deficit/hyperactivity disorder.[2] Left untreated, learning difficulties may lead to frustration, low self-confidence, and poor self-esteem and substantially increase the risk of developing psychological and emotional problems.[3]

Approximately 80% of people with learning disabilities have dyslexia.[2,4–7] The terms "reading disability" and "dyslexia" are often used interchangeably in the literature.[8] Dyslexia is a primary reading disorder and results from a written word processing abnormality in the brain.[2,4] It is characterized by difficulties with accurate and/or fluent sight word recognition and by poor spelling and decoding abilities. These difficulties are unexpected in relation to the child's other cognitive skills. Dyslexia has been identified as having a strong genetic basis.[2,8,9] Recent genetic-linkage studies have identified many loci at which dyslexia-related genes are encoded. Approximately 40% of siblings, children, or parents of an affected individual will have dyslexia. Although dyslexia is often inherited, it may exist in the absence of a family history. Dyslexia can be mild or severe, occurs throughout the world, seems to affect boys more than girls,[10] involves children with all levels of intelligence, and can persist for a lifetime.[2,4,5,8,11,12] Dyslexia is identified in some people early in their lives but in others is not diagnosed until much later, when more complex reading and writing skills are required. People with dyslexia can be very bright and may be gifted in math, science, the arts, or even in unexpected areas such as writing.[12] Dyslexia should be separated from other secondary forms of reading difficulties caused by visual or hearing disorders, mental retardation, and experiential or instructional deficits.[2,8] Early reading difficulties may be caused by experiential and instructional deficits.[8] It is important to identify and address such causes of secondary reading difficulties.[5,8]

Oral language development has been found to play a critical role in learning to read.[1] Unlike speaking, reading and writing do not develop naturally and require active learning. Reading is more difficult than speaking, because children must be aware of the sound structure in spoken language and then break the alphabetic code to acquire the sound/symbol connection.

English is a phonemically complex language in which the 26 letters of the alphabet create 44 sounds, or phonemes, in approximately 70 letter combinations.[6,7,13] The phonemic complexity of an alphabet-based language corresponds to the prevalence of dyslexia, pointing to the linguistic origin of dyslexia.[8,14] Reading involves the integration of multiple factors related to a person's experience, ability, and neurologic functioning. Most people with dyslexia have a neurobiological deficit in the processing of the sound structure of language, called a phonemic deficit,[1,2,4–8,11,13,15] which exists despite relatively intact overall language abilities.[2,4–7] Children with more severe forms of dyslexia may have a second deficit in naming letters, numbers, and pictures, creating a double deficit,[8,16] or they may have problems with their attention or working memory.[8] Other children may have trouble orienting, recognizing, and remembering letter combinations.[8,17] This difficulty may be a neuromaturational delay that improves with development. Importantly, the definition of dyslexia does not include reversal of letters or words or mirror reading or writing, which are commonly held misconceptions.[8,12,14]

Research has shown that most children and adults with reading disabilities experience a variety of problems with language[1,2,4–8,11,13] that stem from altered brain function.[2,4,8,18–29] There is solid scientific evidence that supports the neurologic basis for the phonological coding deficit theory of reading disabilities.[2,4–8,18–29] Scientific research using functional MRI studies and positron emission tomography scans has shown that reading takes place predominantly in left-hemisphere sites including the inferior frontal, superior temporal, parietotemporal, and middle temporal-middle occipital gyri in typical readers. Children with dyslexia, on the other hand, use different areas of the brain when reading.[2,4,18–29] People with dyslexia demonstrate a dysfunction in the left-hemisphere posterior reading systems and show compensatory use of the inferior frontal gyri of both hemispheres and the right occipitotemporal area.[2,4,18–29] People with dyslexia have an abnormality in the word-analysis pathways that interferes with their ability to convert written words into spoken words. These dyslexia-specific brain abnormalities have been shown to improve after successful phonologically based intervention.[19,28,29]

THE ROLE OF THE VISUAL SYSTEM AND THE EYES

Visual processing is a higher cortical function.[8,30] Decoding and interpretation of retinal images occur in the brain after visual signals are transmitted from the eyes. Reading print involves adequate vision and the neurologic ability to identify what is seen. Although vision is fundamental for reading, the brain must interpret the incoming visual images. Historically, many theories have implicated defects in the visual system as a cause of dys-

lexia. We now know these theories to be untrue. Improved understanding began with a series of related studies that systematically demonstrated that deficits in visual processes, such as visualization, visual sequencing, visual memory, visual perception, and perceptual-motor abilities, were not basic causes of reading difficulties.[8] Difficulties in maintaining proper directionality have been demonstrated to be a symptom, not a cause, of reading disorders.[8,30,31] Word reversals and skipping words, which are seen in readers with dyslexia, have been shown to result from linguistic deficiencies rather than visual or perceptual disorders.[8]

Specific reading disability in a small subset of patients with dyslexia has been attributed by some researchers to a deficit in the magnocellular visual system.[32–35] The visual system comprises 2 parallel systems: the magnocellular system and the parvocellular system.[32] The magnocellular system responds to high temporal frequency and object movement, and the parvocellular system is sensitive to low-frequency and fine spatial details.[32] It has been proposed that a magnocellular system deficit produces a visual trace of abnormal longevity that creates a masking effect and causes visual acuity blurring when reading connected text in some children with dyslexia.[35] There are study results that support this theory[32–35] and others that refute it.[36–44] Many researchers have concluded that magnocellular system deficits and associated visual trace persistence are not a significant cause of specific reading disability.[8,36–43] At the present, there is insufficient evidence to base any treatment on this possible deficit.

Short-duration, high-velocity, small jumping eye movements called saccades are used for reading. Readers with dyslexia characteristically have saccadic eye movements and fixations similar to the beginning reader but show normal saccadic eye movements when content is corrected for ability.[30,31] The saccadic patterns seen in readers with dyslexia seem to be the result, not the cause, of their reading disability.[30,31,45,46] Decoding and comprehension failure, rather than a primary abnormality of the oculomotor control systems, is responsible for slow reading, increased duration of fixations, and increased backward saccades.[46] Children with dyslexia often lose their place while reading because they struggle to decode a letter or word combination and/or because of lack of comprehension, not because of a "tracking abnormality." Improving reading has been shown to change saccadic patterns, but there has been no evidence to suggest that saccadic training results in better reading. Finally, children with saccadic disorders do not show an increased likelihood of dyslexia.[47] As indicated above, dyslexia is not correlated with eye or eye-movement abnormalities.[8,30,31,45–59]

Other conditions may affect reading. Convergence insufficiency and poor accommodation, both of which are uncommon in children, can interfere with the physical act of reading but not with decoding.[14] Thus, treatment of these disorders can make reading more comfortable and may allow reading for longer periods of time but does not directly improve decoding or comprehension.[14]

Numerous studies have shown that children with dyslexia or related learning disabilities have the same visual function and ocular health as children without such conditions.[8,30,31,45,46,48–59] Specifically, subtle eye or visual problems, including visual perceptual disorders, refractive error, abnormal focusing, jerky eye movements, binocular dysfunction, and misaligned or crossed eyes, do not cause dyslexia.[8,30,31,45,46,48–59] In summary, research has shown that most reading disabilities are not caused by altered visual function.[8,30,31,45,46,48–59]

Many children with reading disabilities enjoy playing video games, including handheld games, for prolonged periods. Playing video games requires concentration, visual perception, visual processing, eye movements, and eye-hand coordination. Convergence and accommodation are also required for handheld games. Thus, if visual deficits were a major cause of reading disabilities, children with such disabilities would reject this vision-intensive activity.

EARLY DETECTION

A family history of learning disabilities should keep parents, teachers, and physicians alert to this possibility. A history of delay or difficulty in developing speech and language, learning rhymes, or recognizing letters and sound/symbol connections may be an early indication of dyslexia.[2,4,5,8] Parents or teachers may detect early signs of learning difficulties in preschool-aged children; however, in most cases, learning disabilities are not discovered until children experience academic difficulties in elementary school.[2,4] The child may have difficulty with reading, spelling, handwriting, remembering words, or performing mathematical computation. Because remediation is more effective during the early years, prompt diagnosis is important.[1,2,4–8,13,15,60] The effect that dyslexia has may be different for each person and depends on the severity of the condition and the effectiveness and timeliness of instruction or remediation.

THE ROLE OF EDUCATION

The educational system has the triple responsibility of early detection, evaluation, and treatment of chil-

dren with learning disabilities. Elementary school teachers are often the first to detect learning difficulties. Assessments for difficulties with alphabet recognition in kindergarten and difficulties with phonemic awareness and rapid naming in kindergarten and first grade can predict many of those who will have difficulty learning to read.[1,2,5–8,13,15] Because early reading difficulties may be caused primarily by experiential and instructional deficits, there are 2 approaches that can be used in the young underachieving child.[8] In the traditional approach, the child would need to show significant underachievement before referral, assessment, and remediation. In the response-to-intervention method, the child will be placed directly in an educational intervention program when he or she first experiences academic difficulties. Only the children who do not show significant improvement with both the group-intervention first-tier program and second-tier targeted intensive individual intervention will undergo a full educational assessment.[8,61,62] Ideally, the response-to intervention approach will allow earlier identification of learning disabilities than the "wait-to-fail" situation that occurs when an ability achievement discrepancy formula is used to determine if a student qualifies for an evaluation of a learning disability.[62]

Because dyslexia is a language-based disorder, treatment should be directed at this etiology.[1,2,4–8,13,15,60] Most students with dyslexia require highly structured, intensive, individualized instruction by a teacher or educational therapist who was specially trained explicitly in teaching the application of phonics.[1,2,4–8,13,15] Longitudinal data indicate that systematic phonics instruction results in more favorable outcomes for readers with disabilities than does a context-emphasis (whole-language) approach.[1,4,8,13,15,60] The critical elements of effective intervention include individualization, feedback and guidance, ongoing assessment, and regular ongoing practice.[4]

Remediation programs should include specific instruction in decoding, fluency training, vocabulary, and comprehension.[1,4–8,13,15] The approach to learning decoding skills begins with explicit instruction in recognizing spoken sounds (phonemic awareness), becoming aware of rhyme, learning the alphabetic code, memorizing sight words, and studying phonics and spelling.[6–8] A child must first accurately decode a word before it can be read fluently.[4,6–8] The home is the ideal setting for practice and reinforcement. Just as an athlete must practice to optimize his or her skills, the child should read aloud to a parent or tutor each day to practice decoding, memorize new sight words, and develop greater fluency by rereading of previously decoded and memorized words.[4] Fluency forms the bridge between decoding and comprehension.[4,6–8] Comprehension is gained through fluency training, vocabulary instruction, and active reading comprehension.[4] Techniques that enhance active reading comprehension include prediction, summarization, visualization, clarification, critical thinking, making inferences, and drawing conclusions.[2,4,6–8,13] Because people with dyslexia have a persistent problem and continue to have slower reading throughout their lives, accommodations and modifications may be necessary in addition to remediation.[2,4] Examples of accommodations include extra time, shortened assignments, a separate quiet room for taking tests, testing alternatives, computers, spell checkers, tape recorders, lecture notes, recorded books, and tutors.[2,4,11]

A MULTIDISCIPLINARY APPROACH

The diagnosis and treatment of learning disabilities depend on the collaboration of a team that may include educators; educational remediation specialists; audiologists; speech, physical, and occupational therapists; teachers for the visually impaired; psychologists; and physicians. Children with learning disabilities should undergo assessments of their health, development, hearing, and vision and, when appropriate, medical and psychological interventions for associated and related treatable conditions.[63]

A formal evidence-based evaluation is needed to discover whether a child has a learning disability. Educational psychologists and neuropsychologists diagnose learning disabilities by performing appropriate testing as part of an educational assessment of the child's abilities and disabilities. A formal assessment for learning disabilities should include evaluation of cognition, memory functions, attention, intellectual ability, information processing, psycholinguistic processing, expressive and receptive language function, academic skills, social-emotional development, and adaptive behavioral functioning. These results are used to develop an individualized education plan (IEP), which includes evidence-based educational remediations, accommodations, and modifications.[2,4,7,13] Educational therapists or educators with specialized training in learning disabilities play a key role by designing and implementing remedial programs and monitoring the student's progress.

Audiologists can identify hearing problems. Speech therapists can evaluate and treat underlying oral language difficulties often associated with dyslexia and help students learn phonological awareness. Physical and occupational therapists do not treat dyslexia but do treat fine and gross motor difficulties or sensory problems that may be associated with learning disabilities. Children with low vision and learning disabilities may benefit from having a

teacher of the visually impaired. Psychiatrists, psychologists, neurologists, and specialty-trained pediatricians can diagnose associated comorbid conditions. Psychiatrists, clinical psychologists, licensed clinical social workers, or licensed mental health counselors can provide strategies to help children adapt to their disabilities and provide therapy to address concurrent psychological disorders. Psychiatrists, neurologists, or specialty-trained pediatricians may prescribe medications. The role of other physicians will be elaborated in a later section of this statement.

THE ROLE OF PARENTS

Parental participation in a child's education is of utmost importance. Families with a history of dyslexia should observe their children for early language difficulties. Reading to their preschool-aged child and having their child read to them as soon as he or she is able allows parents to detect early signs of learning difficulties. Parents should collaborate with early elementary school teachers to monitor their child for academic struggles. Parents need to serve as the child's advocate, speaking with the child's teacher, pediatrician, and other professionals; requesting an educational evaluation; and coordinating remediation and other treatment. By educating themselves in the areas of learning disabilities, available services, and state education rules and regulations, parents will increase their effectiveness as the child's advocate. After a child has been diagnosed with a learning disability, an individualized educational plan or a Section 504 plan may be created. Parents should work with educators to ensure that the school provides the proper remediation and accommodations. Children with dyslexia should read aloud to their parents frequently. Parents should help with practice and reinforcement at home in a supportive and nurturing environment with adequate opportunity for their child to participate in activities in which he or she excels. As the child gets older, parents should help their child use recommended alternative learning strategies such as books on tape or computers. Parents should continue to monitor their child's progress and advocate for their child when necessary.

Because of the complex nature of learning disabilities, including dyslexia, there are no simple remedies. Teaching children with dyslexia and learning disabilities can be a challenge for educators and parents. With proper remediation, accommodations, and support, children with dyslexia and learning disabilities can succeed.

THE ROLE OF THE PHYSICIAN

Physicians, including pediatricians, family physicians, otolaryngologists, neurologists, ophthalmologists, mental health professionals, and other relevant medical specialists, may participate in the comprehensive care of children with learning disabilities including dyslexia. Pediatricians should not diagnose learning disabilities[63] but should inquire about the child's educational progress and be vigilant in looking for early signs of evolving learning disabilities.[63] When a child has suspected learning difficulties, the pediatrician or family physician should first assess the child for medical problems that could affect the child's ability to learn and refer him or her for further evaluation if deemed appropriate.[63,64]

Pediatricians and family physicians have an extremely important function in acting as a medical home by helping parents decide whether further evaluations are needed and in coordinating care for the child after a diagnosis has been made.[63,64] Primary care physicians who have a strong role in assisting school districts should only recommend evidence-based treatments and accommodations. Pediatricians and family physicians should provide information and support to parents on learning disabilities and their treatment and should dispel the myths surrounding these disorders.[30] This should include discussion regarding the lack of efficacy of vision therapy and other "alternative treatments" with the parents.[30] Parents need to be informed that dyslexia is a complex disorder and that there are no quick cures. The American Academy of Pediatrics has information for families on what parents need to know about learning disabilities.[65] The primary care physician should compile and provide a resource list of local specialists from whom the child can obtain proper help and from whom the family members can learn to become advocates for the child.[63]

The Individuals With Disabilities Education Act, Section 504 of the Rehabilitation Act, and the Americans With Disabilities Act define the rights of students with dyslexia and other specific learning disabilities.[66,67] These acts allow parents to request a formal educational evaluation by the school district to determine eligibility for special education and related services. Information for pediatricians on this legislation and its associated rights and procedures is available from the American Academy of Pediatrics.[63,64] Physicians can refer parents of children with learning disabilities to their state's parent training and information center. These parent-directed centers provide information and technical assistance to parents and professionals regarding family and student rights and responsibilities in special education.

For all children, primary care physicians should perform hearing and vision screenings according to national standards[68] so that hearing, ocular, and visual disorders are identified as early as possible. Periodic eye and vi-

sion screenings can identify children who have reduced visual acuity or other visual disorders. Vision screening with nonletter symbols may be necessary for testing children with dyslexia or other learning disabilities.

Children who do not pass vision screening should be referred to an ophthalmologist with experience in the care of children.[68] In addition, the recommended routine pediatric vision screenings are unlikely to disclose near-vision problems such as convergence insufficiency, accommodative insufficiency, and significant hyperopia. Children with suspected learning disabilities in whom a vision problem is suspected by the child, parents, physicians, or educators should be seen by an ophthalmologist with experience in the assessment and treatment of children, because some of these children may also have a treatable visual problem that accompanies or contributes to their primary reading or learning dysfunction.[30,45,58] Treatable ocular conditions can include strabismus, amblyopia, convergence and/or focusing deficiencies, and refractive errors. Missing these problems could cause long-term consequences from assigning these patients to incorrect treatment categories.

The ophthalmologist should identify and treat any significant visual defect according to standard principles of treatment.[69,70] Strabismus, amblyopia, and refractive errors may require glasses, eye patching, eye drops, or eye-muscle surgery. Symptomatic convergence insufficiency can be treated with near-point exercises, prism-convergence exercises, or computer-based convergence exercises. Most of these exercises can be performed at home, and extensive in-office vision therapy is usually not required.[71–73] Alternatively, for other patients, reading glasses with base-in prism[73] or minus-lenses can be used as treatment. Treating convergence insufficiency can make reading more comfortable but does not improve the decoding or understanding of reading.[14] If no ocular or visual disorder is found, the child needs no further vision assessment or management. The ophthalmologist should not diagnose learning disabilities but should provide information on learning disabilities and reinforce the need for additional medical, psychological, educational, or other appropriate evaluation or services. In addition, the ophthalmologist should discuss the lack of efficacy of vision therapy and other "alternative treatments" with the parents. The American Academy of Ophthalmology has a patient-education brochure for families titled "Learning Disabilities."[74] The ophthalmologist, when necessary, should compile and provide a resource list of local specialists who can help obtain proper help for the child.[69]

CONTROVERSIES

Because they are difficult for the public to understand and for educators to treat, learning disabilities have spawned a wide variety of controversial and scientifically unsupported alternative treatments, including vision therapy.* Scientific evidence of effectiveness should be the basis for treatment recommendations.[4,45,60] Treatments that have inadequate scientific proof of efficacy should be discouraged. Ineffective, controversial methods of treatment such as vision therapy may give parents and teachers a false sense of security that a child's learning difficulties are being addressed, may waste family and/or school resources, and may delay proper instruction or remediation.[45]

Currently, there is inadequate scientific evidence to support the view that subtle eye or visual problems, including abnormal focusing, jerky eye movements, misaligned or crossed eyes, binocular dysfunction, visual-motor dysfunction, visual perceptual difficulties, or hypothetical difficulties with laterality or "trouble crossing the midline" of the visual field, cause learning disabilities.[8,30,31,45,46,48–59] Statistically, children with dyslexia or related learning disabilities have the same visual function and ocular health as children without such conditions.[8,30,31,45,46,48–59] Because visual problems do not underlie dyslexia, approaches designed to improve visual function by training are misdirected.[31,47,56,57,69,78] Other than convergence-insufficiency treatment,[70–73,79,81,95,96] scientific evidence does not support the assumption that vision therapy is capable of correcting subtle visual defects,† nor does it prove eye exercises or behavioral vision therapy to be effective direct or indirect treatments for learning disabilities.‡ Detailed review of the literature supporting vision therapy reveals that most of the information is poorly validated, because it relies on anecdotes, poorly designed studies, and poorly controlled or uncontrolled studies.§ Their reported benefits can often be explained by the placebo effect or by the traditional educational remedial techniques with which they are usually combined.[30,45,46,55,57,58,78,79] There is currently no evidence that children who participate in vision therapy are more responsive to educational instruction than are children who do not participate.‖ Thus, current evidence is of poor scientific quality and does not provide adequate scientific evidence that vision training is a necessary primary or adjunctive therapy.¶

*Refs 2, 8, 30, 31, 45, 46, 55–58, 69, 70, and 75–94.

†Refs 14, 30, 31, 45, 46, 55, 57, 58, 69, 70, 77, and 79–81.

‡Refs 2, 4, 8, 14, 30, 31, 45, 46, 55–58, 69, 70, and 76–82.

§Refs 30, 31, 45, 46, 55–58, 69, 70, and 76–81.

‖Refs 2, 4, 8, 14, 30, 31, 45, 46, 55–58, 69, 70, and 76–82.

¶Refs 2, 4, 8, 14, 30, 31, 45, 46, 55–58, 69, 70, and 76–82.

Tinted lenses and filters have been suggested to treat visual perceptual dysfunctions that lead to visual distortion caused by sensitivities to particular wavelengths of light but not to treat language-based dyslexia.[97] Scrutiny of published study results that advocated the use of these therapies to treat dyslexia have shown serious flaws in their methods and have not been sufficiently well controlled to support this assertion.[30,70,84,85,88] There have also been many inconsistencies in the results,[89,98,99] with some studies showing some partial positive results[100–106] and others showing negative results.[84,86,90–94] The method used to select the lens or filter color has been highly variable,[89,104,106] the color selection has also shown considerable variability,[104] and the test-retest consistency has been poor.[107] Many of the studies that have been cited as proof of Irlen-lens efficiency have actually been inconclusive after deeper analysis. The evidence does not support the effectiveness of tinted lenses and tinted filters in these patients because of the weaknesses in methodology and statistics, variability in techniques in the trials, and the largely negative results.[8,30,45,70,76,83–94,107]

RECOMMENDATIONS

1. Children who exhibit signs of learning disabilities should be referred as early in the process as possible for educational, psychological, neuropsychological, and/or medical diagnostic assessments.
2. Children with learning disabilities should receive appropriate support and individualized evidence-based educational interventions combined with psychological and medical treatments as needed.
3. Families of children with suspected learning disabilities should receive information about state and local parent support programs.
4. Pediatricians and family physicians should perform periodic eye and vision screening for all children according to national standards and refer those who do not pass screening to ophthalmologists who are experienced in the care of children.
5. Children with a suspected or diagnosed learning disability in which vision is felt to play a role by parents, the child, educators, or physicians should be referred to an ophthalmologist with experience in the care of children, because routine pediatric vision screening is not designed to detect near-vision problems.
6. Ophthalmologists should identify and treat any significant ocular or visual disorder found to be present.
7. Primary care physicians should only recommend evidence-based treatments and accommodations to school districts.
8. Diagnostic and treatment approaches for dyslexia that lack scientific evidence of efficacy such as behavioral vision therapy, eye-muscle exercises, or colored filters and lenses are not endorsed or recommended.

SUMMARY

Dyslexia and learning disabilities are complex problems that have no simple solutions. The most widely accepted view is that dyslexia is a language-based disorder. The American Academy of Pediatrics, the American Academy of Ophthalmology, the American Association for Pediatric Ophthalmology and Strabismus, and the American Association of Certified Orthoptists strongly support the need for early diagnosis and educational intervention.

Recommendations for multidisciplinary evaluation and management must be based on evidence of proven effectiveness that is demonstrated by objective scientific methodology.[4,45,60] It is important that any therapy for learning disabilities be scientifically established to be valid before it can be recommended for treatment.[60]

Currently, there is no adequate scientific evidence to support the view that subtle eye or visual problems cause learning disabilities.[8,30,31,45,46,48–59] Furthermore, the evidence does not support the concept that vision therapy or tinted lenses or filters are effective, directly or indirectly, in the treatment of learning disabilities.# Thus, the claim that vision therapy improves visual efficiency cannot be substantiated. Diagnostic and treatment approaches that lack scientific evidence of efficacy are not endorsed or recommended.

With early recognition and individualized, interdisciplinary management strategies, children with learning disabilities can enjoy successful academic experiences.

#Refs 2, 4, 8, 14, 30, 31, 45, 46, 55–58, 69, 70, 76–88, and 90–94.

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REFERENCES are available online at www.pediatrics.org

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OTHER RESOURCES

International Dyslexia Association: www.interdys.org

National Center for Learning Disabilities: www.ncld.org

Learning Disabilities OnLine: www.ldonline.org

Interdisciplinary Council on Developmental and Learning Disorders: www.icdl.com

Great Schools Inc/Schwab Learning: www.schwablearning.org

All Kinds of Minds: www.allkindsofminds.org

Children and Adults With Attention Deficit/Hyperactivity Disorder: www.chadd.org

National Center for the Study of Adult Learning and Literacy: www.ncsall.net

Parent Advocacy Coalition for Educational Rights Center: www.pacer.org

Parental Information and Resource Centers: www.ed.gov/programs/pirc/index.html

Family Voices: www.familyvoices.org