Learning disabilities, dyslexia, and vision: a subject review

A rebuttal, literature review, and commentary

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Background: In 1998, the American Academy of Pediatrics, the American Academy of Ophthalmology, and the American Association of Pediatric Ophthalmology and Strabismus (AAP/AAO/AAPOS) published a position paper entitled "Learning Disabilities, Dyslexia And Vision: A Subject Review," intended to support their assertion that there is no relationship between learning disabilities, dyslexia, and vision. The paper presents an unsupported opinion that optometrists (by implication) have said that vision problems cause learning disabilities and/or dyslexia and that visual therapy cures the conditions. The 1998 position paper follows two very similar and discredited papers published in 1972 and 1981.

Method: This article critically reviews and comments on the many problems of scholarship, the inconsistencies, and the false allegations the position paper presents. Perhaps the foremost problem is that the authoring committee has ignored a veritable mountain of relevant literature that strongly argues against their assertion that vision does not relate to academic performance. It is for this reason that an overview, drawn from more than 1,400 identified references from Medline and other database sources and pertinent texts that were reviewed, is incorporated into this current article. The AAP/AAO/AAPOS paper is also examined for the Levels of Evidence that their references offer in support of their position.

Conclusion: The AAP/AAO/AAPOS paper contains errors and internal inconsistencies. Through highly selective reference choices, it misrepresents the great body of evidence from the literature that supports a relationship between visual and perceptual problems as they contribute to classroom difficulties. The 1998 paper should be retracted because of the errors, bias, and disinformation it presents. The public assigns great trust to authorities for accurate, intellectually honest guidance, which is lacking in this AAP/AAO/AAPOS position paper.

Key Words: AAO, AAP, AAPOS, dyslexia, learning disabilities, perceptual therapy, reading, vision, visual therapy.

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I. Introduction

In 1998, the American Academy of Pediatrics, the American Academy of Ophthalmology, and the American Association of Pediatric Ophthalmology and Strabismus (AAP/AAO/AAPOS) jointly published a position paper titled "Learning Disabilities, Dyslexia And Vision: A Subject Review."[1] This was an updated statement of their understanding of the role of vision in learning disabilities and dyslexia (*see* Appendix). The new position paper followed two comparable published papers—"The Eye and Learning Disabilities"[2] (1972) and "Learning Disabilities, Dyslexia And Vision"[3] (1981)—that drew the same conclusions: that visual therapy, lenses, prisms, and filters do not treat specific learning disabilities. [*Author's note*: it should be noted that the American Academy of Pediatrics was not a signator to the 1981 paper, but has rejoined to sign the 1998 paper.]

Unfortunately, the 1972 and 1981 position papers suffered from a lack of integrity in their scholarship. Each was studied and thoroughly discredited in papers published in a peer-reviewed journal[4,5] for their corrupted use of references. Neither of these critical reviews was rebutted. The 1972 and 1981 position papers ignored the role of collateral visual and visual processing difficulties that the 1998 paper now acknowledges. However, the authors of the 1998 paper have failed to use this information in any constructive way for public and professional guidance. The literature review provided in this critical review and commentary refutes their unfounded charge that the literature fails to support a relationship between the visual process and learning.

The 1972, 1981, and 1998 position papers appear to represent a high degree of subjectivity more than any objec-

tive consideration of the huge body of evidence. It is dismaying that the organizations offered no formal response nor any other answer to the charges of scientific abuse made in the two previous critiques by Flax and by Flax et al; e.g.:

> *"The dissemination of this statement* [the 1972 position paper]*...does a disservice to the public and represents an affront to the academic community"*; "...[the paper shows] *gross distortion and inaccuracies in the use of the reference material"*; *"The distorted utilization of reference material is monumental"*; "[The paper]*...offers absolutely no supporting material for (its) conclusion"*; and *"This policy statement* [the 1981 paper]*...does the public a disservice... The references offered are misconstrued, non-applicable, and grossly distorted."*[4,5]

All of the references used negatively in the earlier position papers actually support a vision-learning link, according to the critics.

The 1998 AAP/AAO/AAPOS position paper has the same pivotal problem as its two predecessors: the assumption that optometrists* believe that visual problems are in some way responsible for dyslexia. This is not—and has never been—the position of any responsible organization within optometry.[6-10] Optometrists, as a profession, have never held that learning disabilities or dyslexia are caused solely by vision or visual functioning difficulties. Quite to the contrary, and consistent with the literature, optometrists recognize that reading and learning problems are multifactoral in origin.[8-17] Experts from other disciplines also agree that reading problems in the classroom are diverse in etiology[18-30] and follow two broad types: visual-spatial and phonologically-related problems. Visual functioning and visual processing difficulties often co-exist with and contribute to learning problems, but they are probably not causative.

II. Examination of the 1998 AAP/AAO/AAPOS text

The 1998 AAP/AAO/AAPOS position paper (*see* Appendix) appears to be essentially a rehash of the earlier papers. However, in this new publication, there are only eight references from the 1990's: two of which are policy statements on visual screening,[Appendix refs. 8,9] one concerns a neurological basis for dyslexia,[Appendix ref. 6] another is a poorly referenced opinion piece with no data,[Appendix ref. 24] and the other four are on Irlen lenses.[Appendix refs. 18-20,23] One of the newer references (Solan, 1990) is used to support a negative position on "neurologic organizational training" [sic] when it addresses only Irlen lenses. In fact, the 1998 paper contains no actual research to support the allegation that there is no relationship between vision and learning. The vast majority of the body of literature *does* support a relationship; while it is relatively uncommon to find negative references, they *do* exist.

In considering academic performance and any relationship with vision, it is helpful to understand the emerging practice of ranking the validity of medical evidence via systematic assessment. The Levels of Evidence method is meant to assist practitioners in making recommendations on the basis of evaluation of the studies available. The Levels of Evidence system is quite often organized into five levels. One model, in declining strength, is as follows:

- ***Level I Evidence***—randomized, double-blinded, controlled studies of adequate size;
- ***Level II Evidence***—smaller, randomized, double-blinded, controlled studies with positive trends that may not be statistically significant;
- ***Level III Evidence***—either non-randomized controlled studies or cohort or case series studies; and
- ***Level IV Evidence***—expert opinions from acknowledged authorities.

The weakest of all is ***Level V Evidence***—opinions from those who have merely studied and dis-

* The 1972, 1981, and 1998 position papers on vision therapy and learning have carefully left out the terms "optometry" or "optometrists." However, for all practical purposes, nobody but optometrists perform visual therapy in nonstrabismic cases.[84 (p.199)] This is supported by the observation that the vast majority, if not all, literature on visual therapy and its application is found in optometric sources or is authored by optometrists. An Internet search with three large metasearch engines (*www.Dogpile.com*, *www.Ixquick.com*, and *www.Google.com*) revealed only one ophthalmological practice that notes doing orthoptic visual therapy in the scope of their multidisciplinary practice. For these reasons, there is little cause to doubt that when the AAP/AAO/AAPOS position papers indict the use of visual therapy in learning applications, that the subject methods they censure are used only by optometry and optometrists.

cussed the literature. This is the model used in this critique for examination of the data.†

Background

Starting with the *Background* statement, let us examine the AAP/AAO/AAPOS position paper: *"Many educators, psychologists, and medical specialists concur that individuals who have learning disabilities should...avoid remedies involving eye exercises, filters, tinted lenses, or other optical devices that have no known scientific proof of efficacy."* This statement is actually scientifically vague, lacking citations to support it. Because of the way it is worded, it implies that no eye exercises, filters, tinted lenses, and optical devices have any efficacy and that vision does not relate to learning, the historic position in all three papers.[1-3] This does not represent what the literature reports. Since it is unattributed, it may not even represent any knowledgeable opinion (*Level V Evidence*, the weakest level). Respected authorities in education have long found that efficient visual functioning and visual perception are a necessary component of satisfactory learning and have been addressed in research.[31-67] Other research that existed at the time of this paper's publication also contradicts the statement.[12, 68-100]

Evaluation and Management

The authors make a statement that is inconsistent with the premise of the 1998 AAP/AAO/AAPOS paper: *"Sometimes children also may have treatable visual difficulties along with their primary reading or learning dysfunction."* It is important to point out that those treatable problems, in fact, may indeed require eye exercises, lenses, prisms, and filters, which were dismissed in the *Background* statement. This inconsistency escapes the authors. Their explanation goes on to state that visual acuity needs to be ruled in or out as a factor. However, this is generally a fruitless gesture in relation to reading retardation, since researchers and clinicians have long known that studies show an inverse relationship between visual acuity and academic performance. That is to say, reduced sight is often due to myopia, and myopia is frequently associated with above-average academic achievement and educational level.[76,101-105] On the other hand, low-to-moderate farsightedness rarely causes visual acuity problems, yet has been associated with visual perception and vision function anomalies. These children will pass vision screenings and yet may have academic difficulty.[74,76,106-108]

Role of the Eyes

The authors assert in an undocumented statement that: *"some vision care practitioners incorrectly attribute reading difficulties to one or more subtle ocular or visual abnormalities."* Besides the lack of supporting citations from expert sources which might raise this statement to Level V evidence, problems of definition arise. Who do the authors mean by "some vision care practitioners"? What do the authors mean by the nebulous term "subtle ocular or visual abnormalities"? Do they mean suppression? Suppression can be a co-existent visual abnormality in retarded readers, according to Benton (a pediatric ophthalmologist)[109] and Safra.[110]

† The *Levels of Evidence* method for systematic evaluation of the validity and strength of the sources of data being reported in medical studies was generated by researchers for the Canadian Task Force on the Periodic Health Examination.[327] The concept has been promoted by the Cochrane Centre and Library, who inaugurated the Cochrane Collaboration with its Cochrane Database of Systematic Reviews, an electronic publication, as a means of publishing the results of reviewing groups. Depending on the field of study and its inherent clinical characteristics, there can be modifications of the Levels as agreed upon by each field's review groups, depending on their assessment of the field's data and practices, but the randomized, controlled (and double-blind) trial (RCT) is always the gold standard for Level I evidence. There is acknowledgment among the review groups that RCT's cannot always be designed, and some areas may resist any form of quantitative study at all. A balance must be exercised between practical and ethical issues in deciding the quality of the evidence. Customarily, there are from three to five levels (included in one example was the "Somebody once told me," level VI). Other variations occur: the separate review groups studying cancer and cardiovascular disease have agreed in their Levels, but differ from groups studying other conditions in their Level IV and Level V definitions. Some of those groups relegate case studies to Level IV and all opinion is considered Level V. The design may also include sublevels within each major level. For instance, the guidelines for the breast cancer review group out of Canada allow that when enough case studies are conducted at different times, in different sites and are consistent in their results, their credibility within that level is increased.[328] The review group studying osteoporosis has adopted the same Level descriptions as the breast cancer review group.[329] The objectives of these latter groups' model were unilaterally judged by this author as being the best fit to the nature of the literature on these vision/learning topics and why their guidelines' structure is used here.

Do they mean eye movement (saccadic) abnormalities? Deficient oculomotor abilities have been associated with reading disabled/dyslexic students.[15,68,70,111-120] Do they mean accommodative difficulties? These, too, have been shown by researchers to be associated problems in some deficient readers.[75,91,97,99,111,121-124] The omission of definitions and references is a significant difficulty.

The last sentence of this subtopic in the 1998 AAP/AAO/AAPOS paper states that children with learning problems have the same ocular health as children without such conditions. Granted, ocular health has little (if any) relationship to learning. This non-issue appears to be introduced to impress the reader with a "piling-on effect" of negative statements. It is a moot point, however, since there is very little basis for assertion that ocular health is related to learning problems.

This does offer the opportunity to examine a most-curious reference [Helveston et al., "Visual Function and Academic Performance" (Appendix ref. 11)] that the authors use in support of the non-issue of ocular health. Because of its poor scholarship and questionable methods, this paper has been thoroughly dissected in another critique.[126] Of all the 1998 AAP/AAO/AAPOS position paper's references, the Helveston et al. paper arguably offers the most-fitting opportunity to prove the thesis that vision and learning are not related, as it could present Level I evidence of their position. It is not used for that purpose, even though the authors state in their abstract: *"Evaluation of 1,910 first-, second-, and third-grade students indicated that visual function and academic performance as measured by reading were not positively related,"* (Appendix ref. 11 (p. 346)) The reason it is not used almost certainly has to be that the paper's statistics omit the most salient of all data tests: the researchers completely leave out testing of the central question about the relationship between vision and learning and spuriously accept the null hypothesis. Nothing in the Helveston et al. paper supports the claim in their abstract.[126]

Paradoxically, in the very midst of that potentially critical vision and learning study, and in an earlier paper based on a copying test of Helveston's creation (the "Draw a bicycle test"), the authors support educators' and optometrists' assertion that a strong relationship exists between visual-motor copying skills and academic performance.[127] Helveston et al.'s data show a highly significant relationship between the two ($p < 0.0001$). It would appear that the unstated answer to their initial question of whether visual skills and learning are related is "Yes".

Controversies

In this section the authors assert there is no scientific support for muscle exercises and *"'training' glasses (with or without bifocals or prisms)"* improving academic abilities. The lack of appropriate scholarship is reflected here, since one of the three references used to support this statement refers only to Doman-Delecato cross-patterning training.[Appendix ref. 15] Their statement is in direct contradiction to reports in the literature that support the observation that convergence insufficiency and suppression are associated with learning inefficiency and can be improved with orthoptic therapy and prism glasses.[94,96,98,99,109,128-134] Most of these studies existed at the time of the publication of the 1998 AAP/AAO/AAPOS paper.

Perceptual therapy has been associated with improving academic abilities, in direct contradiction to the 1998 paper's assertion that it has not. Rosner conducted several years of basic research in this area and found a high correlation of visual and auditory analytical skills to math and reading achievement. He developed a perceptual curriculum that remediated these skills and demonstrated a transfer of the improvement into academic performance.[135-141] Most of this research was completed before the publication of the 1972 position paper.

Research supports at least some role of blue filters in assisting certain children with inefficient reading and attentional difficulties.[142-144] However, the use of Irlen lenses (based on the Scotopic Sensitivity Syndrome) has never been a general optometric intervention, and is still a matter of great controversy. The American Optometric Association has appropriately taken a cautionary position in that respect.[145] Even though the Scotopic Sensitivity Syndrome has yet to be demonstrated as a real phenomenon, the filter question is being examined, with at least some support for the validity of filters' effect on the brain—probably in the magnocellular strata of the lateral geniculate nucleus. Ongoing research may lead to clinical guidelines for the use of filters as the relationships are clarified.

The topic of expense of treatment is discussed, with the authors stating that the expense is unwarranted. This assumes that visual therapies or visual perceptual therapies are never effective. The very concept of this negative hypothesis is illogical. If parents pay tutors, psychologists, and educational specialists for assistance with their child's learning problems, there will be less than effective results when there are visual barriers to learning that contribute in significant ways.[96,99,103,108,109,117,130-132,134] Proper visual analysis and intervention need to be considered in all children with reading dysfunctions.

We often clinically see children with visual performance-related headaches subjected to extensive medical and neurological tests of great sophistication to reveal only normal results. A proper diagnostic protocol could potentially save parents and insurance companies great amounts of unneeded expense. (Atzmon et al. found that, while both experimental groups improved in reading ability in their study, reading-disabled children who received visual therapy had a decrease in headache symptoms, but children who were only tutored actually had an increase of headache symptoms. Their impression was that the tutored-only children were reading more, and this resulted in greater visual distress.[128])

Further, taxpayers support special education programs that are populated by children with clinically significant visual function and visual processing problems.[17,24,43,94,97,98] Learning support programs cannot effectively address children with the types of problems we are discussing here. The cost to society is additionally increased not only by these ineffectual attempts at rehabilitation, but—over time—by lost lifetime income,[146] a greater incidence of crime in learning dysfunctional students (studies of juvenile delinquents and adult prisoners have shown that many are 'retarded' in reading[146-150]), and therapy for emotional sequellae.[146] We would expect that any moneys productively spent in rehabilitating retarded readers by valid methods will potentially have great economic effect on any society.

Appropriate Educational Measures

The suggestion that "appropriate educational measures" be used in lieu of visual interventions is not as helpful as it might seem in the management of most of these cases. Children who are referred for visual and perceptual remediation (whether by psychologists, educators, or merely family friends) have often had years of public school and private tutoring for their problems. Clinical experience reveals that these children are often hardcore dysfunctional readers of many years' standing, whose parents and schools have invested enormously in educational and medical interventions to little avail. They have been referred for visual evaluation only as a last resort, not as a first option. As an example of this, Solan et al. reported on therapies that were directed at remediating 31 deficient readers with long-standing reading problems. These students had been addressed by traditional means for five years, but at the end of the trial, had improved their learning rate (achievement divided by time on task) from a previous annual rate of 60% to 400% in 24 weeks—in spite of the many years of previous remedial interventions.[151]

Educational measures—intelligence, achievement, and related tests—fail to indicate what the teacher should do to assist children with learning skills problems: they merely reveal that a problem exists. Rosner demonstrated that if children have a visual-motor skills problem, they will often have math, spelling (sight-words), and writing difficulties. Children with auditory-motor skills problems often will have reading, language arts, and phonetic spelling difficulties.[135] As mentioned previously, Rosner also proved that the perceptual skills deficiencies were remediable and transferred into classroom skills. "Teaching kids harder" without addressing learning skills barriers is an inefficient use of the teacher's time and resources when a child is experiencing visual-motor or auditory-motor skills problems. This frequently will increase the chances that children with learning problems will develop anxieties and depression over the learning experience,[152-156] which further frustrates the child, the teacher, and the parents. Unfortunately, the most common ways educators apply psychometric information is to adapt lessons, or to water down the content, or teach to the strengths. In a metastudy of this last method, not one of the 15 papers that were considered provided a positive outcome.[157] So, the AAP/AAO/AAPOS position paper's recommendation to consult educators is less than useful, for all practical purposes. For pragmatic reasons, application of what is currently known from the body of neurobiological and neuropsychological

research is not on the near horizon in the classrooms of America, unfortunately. Teachers are not yet trained as diagnosticians and clinicians, which presents a significant problem, since diagnostic skills are needed to address the differing learning styles and sensorimotor problems children bring into classrooms.[64]

At present, education has little to offer therapeutically to a student with perceptual and motor deficiencies, although individual teachers may take the remediation of students' specific problems upon themselves. The Bradley reference[Appendix ref. 21] has no data to support the assertion that the *"reported benefits can be explained by the traditional educational remedial techniques with which [training techniques and interventions] are usually combined."* This is one educator's opinion and—at very best—is no more than Level IV evidence. The Solan et al. study is primary evidence—of at least Level III quality—that nontraditional therapy can bring success to students when traditional educational remedial methods had failed (for five previous years).[151]

By inference, the 1998 AAP/AAO/AAPOS policy statement allows that even when physicians have no concrete suggestions, evaluation on a case-by-case basis for visual processing problems is a waste of time. Proper visual analysis needs to be considered in all children with reading dysfunctions.

Early detection

This section raises a significant problem of definition. In the past, the word *"dyslexia"* referred to the inability to read due to known pathological or traumatic insult of the brain.[77 (p. 2)] That is no longer the case, as dyslexia has now become a layman's catchword for "learning disability." The authors have separated the two concepts in the very title of the paper ("Learning Disabilities, Dyslexia, and Vision"), yet now blend the two into one, and combine both with a third—Attention Deficit Disorder (ADD). Dyslexia, attention deficit disorder, and the most common learning disabilities are three separate entities of symptoms with some crossover areas and need to be addressed as such. The authors seem to wish to merge them in an apparent attempt to gain synergy for their efforts to ignore and discredit optometric therapeutic interventions. The literature shows that ADD is only modestly related to academic difficulties.[64 (pp. 151-192), 67, 158-160] However, Attention-Deficit Hyperactivity Disorder (ADHD) may have a vision connection in at least some cases: convergence insufficiency has been related to ADHD in one study.[161]

Role of the physician

The recommendations here are largely ineffective, since the direct instruction is for pediatricians to refer refractive errors, focusing deficiencies, eye muscle imbalance, and motor-fusion deficiencies to ophthalmologists. At face value, this is not a bad recommendation, if we ignore the obvious inconsistency of this recommendation with their *Background Statement*, because the problems mentioned generally require the use of lenses, prisms, and training they had recommended to be avoided. However that may be, few pediatricians are in a position to detect these problems in a routine evaluation, and few parents will seek out the pediatrician for a medical opinion when a child is referred from the school for a learning disability.[162]

It may be that the authors of the 1998 AAP/AAO/AAPOS paper intend something other than the most common understanding of "ocular defects" when they use that term. The authors, in this 'Role of the Physician' section, assure the reader there really are visual problems that need to be addressed. However, all vision care specialists will appreciate that focusing deficiencies, eye muscle imbalance, and motor-fusion deficiencies are not "ocular defects," *ipso facto*. Therefore, the statement, *"If no ocular defect is found, the child needs no further vision care or treatment..."*—taken literally—is remiss, based on the findings of Helveston et al.,[127] Atzmon et al.,[128] Rosner,[135-141] many others previously cited, and the very recommendations in the opening of the 'Role of the Physician' section. The authors of this 1998 AAP/AAO/AAPOS text almost seem to wish to rush to close the door on any consideration of their admission that there are functional factors in the relationships of vision, visual processing, perception, and learning problems.

Multidisciplinary approach

All optometric practitioners who deal with learning disabled children would agree with the observation in the sections 'Multidisciplinary Approach' and 'The Role of Education' that a mul-

tidisciplinary interventional strategy is needed for dealing with learning disabilities. To that end, many optometrists work closely with reading specialists, speech therapists, and occupational therapists. Psychologists are important at the outset, to determine the presence of adequate intelligence and the level of achievement. They also can provide reassurance and counsel to the anxious, depressed child who has lost confidence and views the classroom as an unfriendly, embarrassing, even hostile environment.

The 1998 AAP/AAO/AAPOS position paper points to the neurobiological research that has found some correlates of learning problems to brain function and brain structure, but does not take into consideration that there may very well be an essential error: there is an assumption that these are the *causes* of the academic problems and not just the *result* of physiological and emotional disorders. Brain changes from environmental etiologies may be a significant source of factors altering the brain performance and structure in learning problems. Research has demonstrated that experience and stress affect brain structure and function.[163-170] We will not be certain for some time which comes first—the learning problems or the brain changes.[171] This question certainly needs to be studied. However, it is premature to conclude that the etiological road only goes one way—as the 1998 AAP/AAO/AAPOS paper appears to assume.

Recommendations

The visual screenings that the 1998 AAP/AAO/AAPOS paper recommends do not take into account a child's ability to *sustain* single, clear, comfortable, and efficient binocular vision on desktop tasks, like reading and writing. Indeed, there are very few adequate nonprofessional screening techniques that accurately reveal learning-related vision problems.[172] Rosner and Rosner[74,103] demonstrated that far-sighted children are more likely to have visual perceptual problems and it is well known that these children will pass most visual screenings. The 'Recommendations' go on to say that when the child with a vision problem is referred, the screener is directed to refer the child to an *ophthalmologist*, which presents a problem of ethics because of the suggested constraint of free choice. In light of the evidence presented here, it would be more appropriate to use the term "a functional vision specialist"—or perhaps just "eye care practitioner."

Summary

The authors assert once again in the 'Summary' that there is no known visual cause for these learning difficulties and no known effective visual treatment. In support of this statement, they cite a non-issue—Irlen lenses, a controversial and seldom used optometric method of treatment. They also cite an opinion piece by Silver,[Appendix ref. 24] a child psychiatrist who has historically maintained a consistent attitude of negativity against visual and perceptual therapy in his books and papers.[173-176] He has done this, though, without data-related support for his position that is representative of the body of literature. However, Silver (with Keys) published at least one opinion piece[84] that does support the type of interventions that optometrists and the 1998 AAP/AAO/AAPOS position paper obliquely recommends. They affirm that eye muscle functioning must be assessed because, *"Vision problems can interfere with the process of learning."*[84 (p.194)] It may be that an overdue change in awareness is looming on the ophthalmological horizon, but the 1998 AAP/AAO/AAPOS position paper remains essentially a barrier to scientific and clinical progress.

III. Summary of the Position Papers

1. In the first position paper, *The Eye and Learning Disabilities*,[2] the references that were used actually upheld a vision-learning link, but appear to have been deliberately cited to support a negative argument. Flax dissected the paper's use of references to show the poor scholarship and gross errors in their application.[4] The committee members who wrote that position statement also tried to assert that optometric therapies depended on Doman-Delecato cross-crawling and cross-creeping. This was a major error based in ignorance of actual optometric thinking, practice, and methodology.
2. In the second paper,[3] the new committee repeated much from the first paper, including most of the optometric references, but—perhaps aware of the first critique's charges about Doman-Delecato patterning—changed emphasis from cross-patterning training to the use of Irlen lenses, a non-optometric method not currently supported by the American Optometric Association.[145] Flax et al. detailed the errors in the paper, repeating once again that many of the citations that were based in actual research *supported* a

role for the relationship of vision to reading and of the effectiveness of therapy in aiding children with vision-related learning problems.[5]

3. In the current position paper,[1] the imagined relationship of Irlen lenses and Doman-Delecato methods to optometric visual and developmental training is maintained. The immense body of supportive literature is ignored and, once again, literature that contains no measures of vision (other than eye dominance) is used to support the non-argument about eye defects and learning.[Appendix ref. 10] The following review of the literature shows there is voluminous support for a vision-learning link, in direct contradiction to the position paper's assertion that, *"Currently, no scientific evidence supports the view that correction of subtle visual defects can alter the brain's processing of visual stimuli..."*

IV. Support from the Literature

There is a constellation of visual functioning and visual processing problems that relate to academic performance difficulties and learning problems, mostly as co-existent, contributing factors. The literature available at the time of the writing of the 1998 paper and that has been published since affirms a positive relationship between the following:

1. Saccadic skills and learning.[15,68,70,111-120]
2. Convergence insufficiency and learning.[80,96,98,128,132,134,177-193]
3. Use of prisms and spectacle lenses and learning.[98,130,191,193,194]
4. Suppression and learning.[109,110,195,196]
5. Binocular vision and learning.[20,80,86,93,97,99, 109-111,123,197-212]
6. Visual motor skills and learning.[68-70,81,84, 86,111-113,116,124,144,204,213-222]
7. Auditory perception and learning.[76,77,82,212, 223-228]
8. Hyperopia and learning.[74,96,102,103,106,229,230]
9. Amblyopia and learning.[105,196,211]
10. Visual processing and learning.[6,24,27,29,68, 88,95,118,144,154,224,231-271]

A great deal of this has been reviewed before in at least one literature search and was in existence at the time of the 1998 AAP/AAO/AAPOS publication.[272] Much of the body of literature suggests that a significant portion of learning dysfunctional/dyslexic individuals have a low-threshold neurophysiology that is intolerant of what would ordinarily be considered subclinical vision problems (by most practices). The literature shows that visual therapy techniques, lenses, prisms, and some filters have positive effects on the following conditions that the above citations support as being co-existent problems to reading dysfunctions:

1. Accommodative disorders.[273-283]
2. Amblyopia.[284-293]
3. Convergence insufficiency.[132,180,183,187,294-300]
4. Intermittent exotropia.[188,301-317]

The literature also reflects nonsupportive references, a few of which were found to refer to: saccadic abilities,[318, 319] convergence insufficiency,[320] prism spectacles,[321] binocular vision,[320, 322; 323] visual-motor skills,[324] auditory perception,[325] and visual processing.[326]

V. Conclusion

Over the past 30 years, the three AAP/AAO/AAPOS policy papers[1-3] concerning vision and learning have been widely disseminated. None of the papers properly represented what was known from the body of literature at the time. The impact of the three papers' publication does a disservice to physicians, educators, psychologists, and the public.

As evidenced by the types of changes that were made in each subsequent policy paper following the 1972 statement, the committees that authored them demonstrated their awareness of the existing critiques. The only substantive change made in the 1998 paper was to omit all the optometric references that were so poorly used in both of the first two position papers. There are absolutely no optometric references to the methods these papers condemn, which makes this 1998 paper an even more-questionable review. If the intent was to actually present a subject review in a scholarly way, one would expect that the paper would incorporate the addressing of actual optometric methods and management of learning-related vision problems.

The most-central problem with the arguments of this current paper is the same as that of its two predecessors: there is an assumption that optometrists believe vision is in some way solely responsible for dyslexia and learning disabilities. This is not—and has never been—the position of

any responsible organization within optometry.[6-10] Repeating the assertion does not make it any more true.

VI. Commentary

In light of the apparently known existence of critiques of the original papers, it is a puzzle why the parent agencies did not provide more oversight in the drafting of this 1998 position paper before they approved it. Disturbingly, in light of the paper's serious academic shortcomings, it appears that the peer-review process has been compromised. This point also extends to the Helveston et al. paper[Appendix ref. 11], which either proved nothing or proved that vision and learning are indeed related. Both of these papers set out to argue that there is no relationship between visual function and learning, but no actual research data are presented to that effect. In the 1998 paper, much of the evidence presented is either unattributed, or of the weak, Level V Evidence variety. None of their evidence rises above Level IV (at the very best). The 1998 paper perpetuates the spurious allegation of the original position papers[2,3] that, *"No known scientific evidence [exists] supporting claims for improving the academic abilities of dyslexic or learning disabled children...with treatment based on [visual interventions]."* As this critique has demonstrated—and by their paper's own advice—this statement is patently false whenever co-existing visual, perceptual, and visual processing problems are providing barriers to learning.

Ophthalmological critics of the vision-learning link have often used the argument that since there are superior students with visual dysfunctioning, that those problems (strabismus, suppressions, saccadic clumsiness, and so on) *never* correlate with reading or learning difficulties. The literature cited above (Benton,[109] Lennerstrand and Ygge,[125] and Silver[84]) illustrates the fallacy of such thinking [that because there are patients with strabismus (et al., per above) who do read well, that strabismus (et al.) does not associate with learning difficulties. Benton actually found that strabismus surgery *increased* the incidence of reading retardation in his 7-year study[109 (p. 150)]].

Because individuals can discover and master reading skills and mathematics abilities by several cognitive strategies, designing a proper research question to study vision and the visual process as they relate to learning in a general population may be difficult, but not impossible. Researchers may only rarely be able to rise above cohort or case series (Level III evidence) designs, and we may have to be satisfied knowing that the possibility of designing a properly randomized, controlled, double-blind large study (Level I evidence) will be elusive.†

It should be noted that—in the same manner that the citations in the original position papers were appropriately dissected—reviewers might take exception to a few of the multitude of references cited in this current critique. This is a fact of research life: no pick-proof research model was ever devised. Once that possibility is acknowledged, it must then be noted that the sheer vol-

† The *Levels of Evidence* method for systematic evaluation of the validity and strength of the sources of data being reported in medical studies was generated by researchers for the Canadian Task Force on the Periodic Health Examination.[327] The concept has been promoted by the Cochrane Centre and Library, who inaugurated the Cochrane Collaboration with its Cochrane Database of Systematic Reviews, an electronic publication, as a means of publishing the results of reviewing groups. Depending on the field of study and its inherent clinical characteristics, there can be modifications of the Levels as agreed upon by each field's review groups, depending on their assessment of the field's data and practices, but the randomized, controlled (and double-blind) trial (RCT) is always the gold standard for Level I evidence. There is acknowledgment among the review groups that RCT's cannot always be designed, and some areas may resist any form of quantitative study at all. A balance must be exercised between practical and ethical issues in deciding the quality of the evidence. Customarily, there are from three to five levels (included in one example was the "Somebody once told me," level VI). Other variations occur: the separate review groups studying cancer and cardiovascular disease have agreed in their Levels, but differ from groups studying other conditions in their Level IV and Level V definitions. Some of those groups relegate case studies to Level IV and all opinion is considered Level V. The design may also include sublevels within each major level. For instance, the guidelines for the breast cancer review group out of Canada allow that when enough case studies are conducted at different times, in different sites and are consistent in their results, their credibility within that level is increased.[328] The review group studying osteoporosis has adopted the same Level descriptions as the breast cancer review group.[329] The objectives of these latter groups' model were unilaterally judged by this author as being the best fit to the nature of the literature on these vision/learning topics and why their guidelines' structure is used here.

ume of supportive papers and paucity of truly nonsupportive papers overwhelms any critic's attempt to continue the assertion that there is no evidence of a relationship between vision and learning, or that visual therapy is not effective in addressing the vision problems known to contribute to reading and learning dysfunctions.

If the professional organizations who co-signed the monograph are to act in the public welfare, a formal retraction of the position paper is necessary. School administrators, teachers, medical, and allied professional personnel have trusted these recommendations in error and may have counseled parents against availing themselves of possible assistance from vision professionals because of AAP/AAO/AAPOS recommendations. Insurance companies must be informed of the appropriate uses and medical necessity of visual and perceptual therapy.

Productive and collegial, open-minded inquiry needs to move forward, based on what is already known and demonstrated: that vision and learning are undeniably related.

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Appendix

Position Statement:

AMERICAN ACADEMY OF PEDIATRICS

Committee on Children With Disabilities, American Academy of Pediatrics (AAP) and American Academy of Ophthalmology (AAO), American Association for Pediatric Ophthalmology and Strabismus (AAPOS)

Learning Disabilities, Dyslexia, and Vision: A Subject Review

ABSTRACT. Learning disabilities are common conditions in pediatric patients. The etiology of these difficulties is multifactorial, reflecting genetic influences and abnormalities of brain structure and function. Early recognition and referral to qualified educational professionals is critical for the best possible outcome. Visual problems are rarely responsible for learning difficulties. No scientific evidence exists for the efficacy of eye exercises ("vision therapy") or the use of special tinted lenses in the remediation of these complex pediatric developmental and neurologic conditions.

BACKGROUND

Learning disabilities have become an increasing personal and public concern. Among the spectrum of issues of concern in learning disabilities, the inability to read and comprehend is a major obstacle to learning and may have long-term educational, social, and economic implications. Family concern for the welfare of children with dyslexia and learning disabilities has led to a proliferation of diagnostic and remedial treatment procedures, many of which are controversial or without clear scientific evidence of efficacy. Many educators, psychologists, and medical specialists concur that individuals who have learning disabilities should: (1) receive early comprehensive educational, psychological, and medical assessment; (2) receive educational remediation combined with appropriate psychological and medical treatment; and (3) avoid remedies involving eye exercises, filters, tinted lenses, or other optical devices that have no known scientific proof of efficacy.

EVALUATION AND MANAGEMENT

Reading involves the integration of multiple factors related to an individual's experience, ability, and neurologic functioning. Research has shown that the majority of children and adults with reading difficulties experience a variety of problems with language[1-3] that stem from altered brain function and that such difficulties are not caused by altered visual function.[4-7] In addition, a variety of secondary emotional and environmental factors may have a detrimental effect on the learning process in such children.

Sometimes children may also have treatable visual difficulty along with their primary reading or learning dysfunction. Routine vision screening examinations can identify most of those who have reduced visual acuity. Pediatricians and other primary care physicians whose pediatric patients cannot pass vision screening according to national standards[8,9] should refer these patients to an ophthalmologist who has experience in the care of children.

Role of the Eyes

Decoding of retinal images occurs in the brain after visual signals are transmitted from the eye via the visual pathways. Some vision care practitioners incorrectly attribute reading difficulties to one or more subtle ocular or visual abnormalities. Although the eyes are obviously necessary for vision, the brain performs the complex function of interpreting visual images. Currently, no scientific evidence supports the view that correction of subtle visual defects can alter the brain's processing of visual stimuli. Statistically, children with dyslexia or related learning disabilities have the same ocular health as children without such conditions.[10-12]

Controversies

Eye defects, subtle or severe, do not cause the patient to experience reversal of letters, words, or numbers. No scientific evidence supports claims that the academic abilities of children with learning disabilities can be improved with treatments that are based on (1) visual training, including muscle exercises, ocular pursuit, tracking exercises, or "training" glasses (with or without bifocals or prisms);[13-15] (2) neurologic organizational training (laterality training, crawling, balance board, perceptual training);[16-18] or (3) colored lenses.[18-20] These more controversial methods of treatment may give parents and teachers a false sense of security that a child's reading difficulties are being addressed, which may delay proper instruction or remediation. The expense of these methods is unwarranted, and they cannot be substituted for appropriate educational measures. Claims of improved reading and learning after visual training, neurologic organization training, or use of colored lenses are almost always based on poorly controlled studies that typically rely on anecdotal information. These methods are without scientific validation.[21] Their reported benefits can be explained by the traditional educational remedial techniques with which they are usually combined.

Early Detection

Pediatricians, other primary care physicians, and educational specialists may use screening techniques to detect learning disabilities in preschool-aged children, but in many cases, the learning disability is discovered after the child experiences academic difficulties. Learning disabilities can include dyslexia, problems with memory and language, and difficulty with mathematic computation. These difficulties are often complicated by attention deficit disorders. A family history of learning disabilities is common in such conditions. Children who are considered to be at risk for or suspected of having these conditions by their physician should be evaluated for more detailed study by educational and/or psychological specialists.

Role of the Physician

Ocular defects in young children should be identified as early as possible, and when they are correctable, they should be managed by an ophthalmologist who is experienced in the care of children.[22] Treatable ocular conditions among others include refractive errors, focusing deficiencies, eye muscle imbalances, and motor fusion deficiencies. When children have learning problems that are suspected to be associated with visual defects, the ophthalmologist may be consulted by the primary care pediatrician. If no ocular defect is found, the child needs no further vision care or treatment and should be referred for medical and appropriate special educational evaluation and services. Pediatricians have an important role in coordination of care between the family and other health care services provided by ophthalmologists, optometrists, and other health care professionals who may become involved in the treatment plan.

Multidisciplinary Approach

The management of a child who has learning disabilities requires a multidisciplinary approach for diagnosis and treatment that involves educators, psychologists, and physicians. Basic scientific and clinical research into the role of the brain's structure and function in learning disabilities has demonstrated a neural basis of dyslexia and other specific learning disabilities and not the result of an ocular disorder alone.[4-6]

The Role of Education

The teaching of children, adolescents, and adults with dyslexia and learning disabilities is a challenge for educators. Skilled educators use standardized educational diagnostic evaluations and professional judgment to design and monitor individualized remedial programs. Psychologists may help with educational diagnosis and classification. Physicians, including pediatricians, otolaryngologists, neurologists, ophthalmologists, mental health professionals, and other appropriate medical specialists, may assist in treating the health problems of these patients. Because remediation may be more effective during the early years, prompt diagnosis is paramount.[20,21] Educators with specialty training in learning disabilities play a key role in providing help for the learning disabled or dyslexic child or adult.

RECOMMENDATIONS

1. For all children, clinicians should perform vision screening according to national standards.[8,9]
2. Any child who cannot pass the recommended vision screening test should be referred to an ophthalmologist who has experience in the care of children.
3. Children with educational problems and normal vision screening should be referred for educational diagnostic evaluation and appropriate special educational evaluation and services.
4. Diagnostic and treatment approaches that lack objective, scientifically established efficacy should not be used.

SUMMARY

Reading difficulties and learning disabilities are complex problems that have no simple solutions. The American Academy of Pediatrics and the American Academy of Ophthalmology, American Association for Pediatric Ophthalmology and Strabismus strongly support the need for early diagnosis and educational remediation. There is no known visual cause for these learning disabilities and no known effective visual treatment.[23,24] Recommendations for multidisciplinary evaluation and management must be based on evidence of proven effectiveness demonstrated by objective scientific methodology.[23-24] It is important that any therapy for learning disabilities be scientifically established to be valid before it can be recommended for treatment.

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The Eye and Learning Disabilities*

Nathan Flax, O.D.

The American Academy of Pediatrics, the American Academy of Ophthalmology and Otolaryngology, and the American Association of Ophthalmology have recently issued a joint organizational statement titled "The Eye and Learning Disabilities".** This paper, prepared by an ad hoc committee of the three organizations with the assistance of the president and the past president of the Division for Children With Learning Disabilities, states that the eye and visual training in the treatment of dyslexia and associated learning disabilities have been reviewed, and cites fifteen references and one bibliographic item.

Among the conclusions offered is that vision training and glasses are ineffective and, "Furthermore, such training has frequently resulted in unwarranted expense and has delayed proper instruction for the child." This statement would seem to be directed at a licensed profession, optometry, which is the only profession specifically licensed to practice visual training. In view of the seriousness of this allegation and since it is directly endorsed by three prestigious organizations which clothe it with an aura of respectability and implied scholarship, it necessary that the position statement and its supporting documentation be subjected to scrutiny.

It is the intent of this paper to challenge the conclusions of "The Eye and Learning Disabilities" as they relate to vision. It is not the purpose of this paper to defend the practice of vision training by those unlicensed to perform this service, nor is it the purpose of this paper to defend the neurological organization approach espoused by Doman and Delacato. The refutation of this joint organizational statement will be made without resorting to any supporting documentation other than the references cited. This can be done because of gross distortions and inaccuracies in the use of the reference material.

The position statement does not make any particular attempt to define the terms "dyslexia" or "learning disability." The cited references utilize operational definitions which vary considerably from reading retardation of any etiology to a more narrowly defined concept of dyslexia as a specific, incurable entity due to a specific brain lesion. This often contradictory use of terminology demonstrates, at the very least, naivete on the part of the ad hoc committee and, at the worst, an intentional unscholarly and dishonest presentation.

*Reprinted from the Journal of the American Optometric Association, June 1972, 43 (6).

**Pediatric News, February, 1972, Page 1, 63-66. Sight Saving Review, Vol. 41, #4, Winter 1971-1972, Page 183. This Joint Organizational Statement with references is included as an Appendix, exactly as it appeared without editing.

Flax[2], Bettman et al.[3], and Norn et al.[4] are cited to document the statement that children with learning disabilities have the same incidence of ocular abnormalities as children who are normal achievers and read at grade level. Flax[2] states that visual acuity and refractive errors do not particularly relate to scholastic success, but he lists a number of other visual factors which do correlate with reading achievement. He differentiates between visual factors which render reading inefficient (and therefore contribute to the more general problem of reading retardation) and other visual factors which interfere with the acquisition of word recognition skills. The thrust of the article is quite different from that implied by the use of the citation. Flax states "the role of visual function in learning disability may run the gamut from interferences in the more mechanical aspects of vision (such as binocular fusion, accommodation, and eye aiming), which will limit efficiency at the reading activity, to a failure of development of adequate visual perception abilities which will make it impossible to develop fundamental word recognition skills."

The paper by Bettman, Stern, Whitsell, and Gofman[3] is also used to support the statement that children with learning disabilities have the same incidence of ocular abnormalities as children who are normal achievers. This article is worthy of much closer consideration. The study reports on 47 dyslexic children, defined as reading on an average 2.2 grades below their grade level and as having been diagnosed by the Pediatric Child Study of the University of California as having specific learning disorders. The ophthalmological examinations support the notion that there are no differences between this population and a control population in terms of visual acuity, amblyopia and strabismus, but they state: "Yet, 42% of dyslexic children had foveal suppression detected by the four diopter prism test at distance or near, compared with 9% of the controls. The difference is highly significant statistically (chi square greater than 14) and may indicate another neuro-muscular abnormality frequently present in dyslexia." "Fifty-two percent of dyslexic children showed gross jerkiness of their eyes in attempting to follow a pencil tip moved along a diagonal line. Only 11% of the controls had such jerkiness. The difference between the two groups was readily apparent to the observer and is highly significant statistically (X^2 =6.9). This may be another manifestation of defective fine motor coordination." They also indicate differences in retinal rivalry between dyslexics and a control population. The contention that there are no differences in ocular function between dyslexics and normals is certainly not supported by this reference.

The article by Norn, Rindziunsky and Skydsgaard[4] is also cited to support the notion that there are no differences in ocular characteristics between normal children and those not reading at grade level. These authors carefully distinguish between primary reading retardation, which they call specific dyslexia, and secondary reading difficulties, which they feel constitute by far the largest group of reading disabled persons. They consider specific dyslexia to be a hereditary disorder, probably due to a lesion in the parietal-occipital lobe. So fixed are they in their opinion of specific dyslexia being due to an organic defect that they state: "if a cure is obtained, this must be due to a mistaken diagnosis." They further state: "visual anomalies may, of course, render reading extremely difficult but it is not the cause of specific dyslexia." They cite the role of visual anomalies in the general problem of reading disability, while denying visual influence in that type of reading disability which they feel is due to brain lesion and incurable. Incurable reading disorders represent a very small portion of all reading or learning problems encountered. Interestingly, their data indicate that dyslexic children show a much higher incidence of subjective ocular complaints during near work than their controls, and they also state that there is a preponderance of latent strabismus in the wordblind group as compared to the controls. The utilization of this reference to support the notion that children with learning disabilities have the same incidence of ocular abnormalities as children who are normal achievers represents a gross misinterpretation of the article. Norn et al. carefully point out the differences between

what they consider to be an incurable form of *specific dyslexia* of very low incidence and the more general problem of reading retardation and they conclude: "The results of this study thus afford evidence to suggest that visual defects bear no causal relation to specific dyslexia. However, this primary handicap may, of course, be intensified when visual anomalies playing a relevant part in near work, including reading, are present at the same time. It rests with the ophthalmologist to take care that such are not overlooked."

Papers by Goldberg and Drash[5] and Goldberg[6] are used to document the statement "studies have shown there is no peripheral eye defect which produces dyslexia and associated learning disabilities." Neither paper contains any data on visual measures other than a report of eye dominance of 72 children in the first paper. The second paper is based on the study of 100 children with reading difficulties. No data whatever pertaining to eyes or vision is presented. The literature concerning the relationship of eyes, vision, and reading is hardly sampled in either article and when it is, it is done confusingly. In the first paper, Park is cited as reporting no differences in visual function between normal and retarded readers. In the second article, Park is cited quite differently: "Muscle imbalance and strabismus do not affect the interpretation of symbols but the effort to overcome such a weakness and to see binocularly may cause fatigue and discourage reading. There may be alternate fusion and suppression. Convergence insufficiency and other muscle anomalies have been found in a large percentage of cases (Park)."

Goldberg and Drash[6] write of "the optometric point of view" and yet, among 47 citations, only refer to one article in the optometric literature, that one written by an educator. They attribute statistics to optometric sources without citation and demonstrate a somewhat naive concept of current optometric practice since they indicate that, among other things, the metronoscope is of importance in visual training. This instrument has not been manufactured for more than 25 years and is currently largely a museum item.

Six references are cited to discredit the role of visual training and glasses in improving academic abilities of learning disabled children. These references must be evaluated in terms of honesty of scholarship, since none of the references are in fact concerned with vision training or with glasses. All are papers about the neurological organization or patterning procedures of Doman-Delacato. Not one discusses glasses or vision training prescribed by licensed practitioners. Let us look at them closely.

The article by Robbins[7] about the Doman-Delacato Theory, doesn't discuss vision training, and the only eye procedure mentioned is the utilization of a red lens to change dominance. Red lens techniques do not represent a significant aspect of optometric vision training and are generally utilized only in treatment of a certain type of amblyopia.

The Cohen, Birch and Taft paper[8] also concerns itself with the Doman-Delacato patterning techniques and does not discuss eye exercises or vision training. There is only one mention of the eye and that has to do with occlusion techniques to change dominance. There is no mention of vision training or glasses.

The article by Freeman[9] discusses patterning as a treatment for brain-damaged children. There is a single mention of visual training having to do with some of the procedures done at the Institute for Human Potential. This article does not concern itself with visual training done by optometrists or ophthalmologists, nor with glasses.

The two other articles[10 11] used to "document" the statement that visual training and glasses are of no value in cases of academic disabilities are likewise not pertinent to the argument. "The Role of Patching in Learning" by Goldberg[11] is concerned with eye patching to shift dominance, another aspect of Doman-Delacato treatment. Again, glasses and/or visual training are not discussed.

The next article, also by Goldberg[12], concerns itself with ocular motility in learning disabilities. Goldberg contends that reading facility itself influences the recording of eye movements as made with the ophthalmograph, but fails to realize that there is also the possibility of poor oculomotor control influ-

encing reading. He utilizes a technique for measuring eye movements which records the movement of one eye only, thereby making impossible identification of binocular problems during reading. This article does not deal with vision training. It does not concern itself with fusion problems, accommodative inefficiency, or a number of other aspects of vision which are normally treated through visual training techniques, and it hardly represents the basis upon which to state that visual training has nothing to do with learning disability. As a matter of fact, Goldberg states: "The relative importance of good ocular movement to good reading becomes apparent when one considers that the smoother and more accurate binocular activity, the faster and more efficient is reading."

The strong, inflammatory statement in the position paper that vision training has frequently resulted in unwarranted expense and has delayed proper instruction for the child remains totally unsubstantiated. No documentation of any sort (not even of the very weak scientific caliber of the previously cited references) is offered.

Rosen[13] is cited to disprove the efficiency of perceptual training in the classroom. The study disclosed that low perceiving boys in the experimental group showed higher reading achievement than low perceiving boys in the control group. Far from being documentation to refute perceptual training, the Rosen article actually offers support for this type of treatment when offered to appropriately selected children.

Smith[14] also is used to refute the role of perceptual training. Rather than refutation, the author states: "Many elements of current theories concerning the interrelationships of perceptual development and sensory motor activity are not new but have their roots in psychological theories of perception constructed in the past. Suggested perceptual-motor training may provide important implications for elementary school physical education programs for all children, not just those who have learning disabilities."

It has been the purpose of this article to systematically review the position statement offered by the ad hoc committee and approved by the American Academy of Pediatrics, the American Academy of Ophthalmology, and the American Association of Ophthalmology as it pertains to the eye and learning disabilities. The distorted utilization of reference materials is monumental. Perhaps the final nonsequitur is the single bibliographic item by Keeney and Keeney. It has absolutely nothing to do with anything referred to in the position paper, but rather concerns itself with the successful life adjustments made by nineteen blind physicians. What it has to do with the position statement is beyond the understanding of this writer other than the possibility that the pseudo-scientific format of the position paper required a bibliographic reference and it was assumed that no one would bother to check it.

The dissemination of this statement as a conclusion of the American Academy of Pediatrics, the American Academy of Ophthalmology and Otolaryngology, and the American Association of Ophthalmology does a disservice to the public and represents an affront to the academic community. The posi-

tion paper attempts to discredit visual training and the use of glasses in cases of dyslexia and learning disability. It offers absolutely no supporting material for this conclusion. Almost all of the references offered have nothing to do with the topic. The few which are germane actually support a *positive* relationship between vision and learning disabilites. At the very least, better scholarship and intellectual honesty is to be expected of these organizations. — *Optometric Center of New York, 122 East 25th Street, New York, New York 10010.*

*The following joint organizational statement on the eye and learning disabilities has been approved by the American Academy of Pediatrics, the American Academy of Ophthalmology and Otolaryngology, and the American Association of Ophthalmology.**

The problem of learning disability has become a matter of increasing public concern, which has led to exploitation by some practitioners of the normal concern of parents for the welfare of their children. A child's inability to read with understanding as a result of defects in processing visual symbols, a condition which has been called dyslexia, is a major obstacle to school learning and has far-reaching social and economic implications. The significance and magnitude of the problem have generated a proliferation of diagnostic and remedial procedures, many of which imply a relationship between visual function and learning.[1]

The eye and visual training in the treatment of dyslexia and associated learning disabilities have recently been reviewed with the following conclusions by the American Academy of Ophthalmology and Otolaryngology, and the American Association of Ophthalmology:

1. Learning disability and dyslexia, as well as other forms of school underachievement, require a multi-disciplinary approach from medicine, education and psychology in diagnosis and treatment. *Eye care should never be instituted in isolation when a patient has a reading problem.* Children with learning disabilities have the same incidence of ocular abnormalties, e.g., refractive errors and muscle imbalance, as children who are normal achievers and reading at grade level.[2 3 4] These abnormalities should be corrected.

2. Since clues in word recognition are transmitted through the eyes to the brain, it has become practice to attribute reading difficulties to subtle ocular abnormalities presumed to cause faulty visual perception. Studies have shown that *there is no peripheral eye defect which produces dyslexia and associated learning disabilities.*[5 6] Eye defects do not cause reversals of letters, words, or numbers.

3. No known scientific evidence supports claims for improving the academic abilities of learning-disabled or dyslexic children with treatment based solely on:

a) visual training (muscle exercises, ocular pursuit, glasses).[7 8 9 10 11 12]

b) neurologic organizational training (laterality training, balance board, perceptual training).[2-14]

Furthermore, such training has frequently resulted in unwarranted expense and has delayed proper instruction for the child.

4. Excluding correctable ocular defects, glasses have no value in the specific treatment of dyslexia or other learning problems. In fact, unnecessarily prescribed glasses may create a false sense of security that may delay needed treatment.

5. The teaching of learning-disabled and dyslexic children is a problem of educational science. No one approach is applicable to all children. A change in any variable may result in increased motivation of the child and reduced frustration. Parents should be made aware that mental level and psychological implications are contributing factors to a child's success or failure. Ophthalmologists and other medical specialists should offer their knowledge. This may consist of the identification of specific defects, or simply early recognition.

The precursors of learning disabilities can often be detected by three years of age. Since remediation may be more effective during the

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**This statement was prepared by an ad hoc committee of the American Academy of Pediatrics, the American Academy of Ophthalmology and Otolaryngology, and the American Association of Ophthalmology. Reprinted by permission of the American Academy of Pediatrics.*

early years,[15] it is important for the physician to recognize the child with this problem and refer him to the appropriate service, if available, before he is of school age. Medical specialists may assist in bringing the child's potential to the best level, but the actual remedial educational procedures remain the responsibility of educators.

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Dyslexia wrongly blamed on vision problems, doctors say.

By LIDIA WASOWICZ
UPI Science Writer

SAN FRANCISCO (UPI) – Three major medical groups Friday denounced the widely held but harmful belief that dyslexia, an otherwise normal person's inability to read, is caused by eyesight problems.

''Although poor vision, jerky eye movements, misaligned or crossed eyes and hand-eye coordination problems have been blamed for letter reversals or reading disabilities, there is no scientific evidence to support this belief,'' they said.

The statement was issued by the American Academy of Ophthalmology, the American Academy of Pediatrics and the American Association for Pediatric Ophthalmology and Strabismus.

Dyslexia affects the brain's ability to translate correctly the written images the eye receives. The disorder may be inherited or caused by illness, damage to certain parts of the brain or such environmental factors as a family that shuns reading, doctors said.

The groups warned visual training, muscle exercises, perceptual training or hand-eye coordination exercises will not improve a dyslexic child's reading abilities and may even ''result in a false sense of security which may delay or prevent proper remedial educational measures.''

The statement was backed by a three-year study of 1,910 first-, second- and third-graders in Indianapolis that showed children with learning disabilities had no more eye problems than the best of the students.

''We have just finished this big study which tends for the first time to provide scientific credibility to our statement that visual functions and academic performance are not related,'' said Dr. Eugene Helveston, director of Pediatric Ophthalmology Service at Indiana University.

Helveston, a professor of ophthalmology who has been studying dyslexia for 17 years, has submitted his findings for publication in the New England Journal of Medicine. He plans to study the children for another nine years.

''One problem with the misconception that visual problems cause dyslexia lies with a group of health care providers who seem to be at best overzealous and at worst opportunist,'' he said.

''Parents frantic about their child's problem are often willing to pay $2,000 for a useless program of eye exercises. We had a fellow in town who prescribed empty glass frames—with surprising financial success.''

Parents who note improvements in their child's academic abilities following visual training and similar exercises are usually seeing the results ''from those remedial educational techniques with which they are combined,'' the physicians' statement said.

''When the problem is inherited – some 2 percent of Americans have hereditary primary dyslexia – or when the brain has been damaged, there is no treatment,'' Helveston said in a telephone interview.

''With lots of individual training in reading and writing, the child can make progress, however. At times a change in environment or proper motivation can produce great results.''

A child suspected of having a learning disability should be given a full physical and mental examination to determine the origin of the problem, the physicians recommended.

Is Vision Therapy Quackery?

How to separate fact from fiction and get pediatric patients the care they need.

BY HAROLD KOLLER, MD *Philadelphia*

Many general ophthalmologists who examine children, and nearly all pediatric ophthalmologists, have at one time or another been asked by parents whether it's a good idea for their child to undergo "vision therapy," the treatment some optometrists promote as an elixir for everything from reading problems to poor athletic performance. How should we respond? And how can we make certain these patients get the care they need?

In this article, I'll briefly explain what we know and don't know about vision therapy. I'll then explain how to work up children who are having difficulty with learning.

What We Know

One thing is certain: the conditions or problems that bring children to vision therapy in the first place can be very real. Children may present with systemic or ocular disorders, reading difficulties, learning disorders or attention deficit disorders. I'll discuss these shortly. Parents of these children are understandably anxious to solve the problem.

Another thing we know about vision therapy is that some of its practitioners are extraordinarily enthusiastic about its capabilities. Some may have truly seen what they believe to be benefits of vision therapy and are trying to do their very best for patients. Others may have additional motives. An advertisement which ran here in Philadelphia claimed that vision therapy could "remedy" myopia, hyperopia, astigmatism when "usually combined with appropriate lenses" by eliminating the underlying causes of these problems, which the ad claimed are "inadequate visual skills and visual stress," whatever that means. The ad continued: "Visual training also has proven to be a remarkably effective tool in helping people with learning related visual problems. Many problems in learning to read and write are made worse by poorly developed visual skills." The ad went on to promote "behavioral optometrists" who can treat problems "beyond visual performance" and practice "developmental and functional optometry." The ad cited no studies to back up these claims.

We also know that in their enthusiasm, some vision therapists overlook alternative explanations for the patients' problems. In my office, I'm always surprised by the variety of problems for which vision therapy is proposed as a cure. I've seen therapy recommended for:

- Children with obvious ophthalmic conditions, with or without vision loss;
- Children with a completely healthy visual system who were having trouble in school; and
- Even children with two healthy eyes and no obvious visual or scholastic complaints.

What We Don't Know

What we don't know is whether vision therapy works.

It's difficult to believe that there is no basis at all for a discipline that has attracted many intelligent and dedicated professionals. However, when evaluated by the standards of modern scientific study, vision therapy fares very poorly. The literature that exists in support of the therapy is ambiguous and vague; published accounts fail to reveal the rationale for the various therapies, and there's not even general agreement on what vision therapy is. There are numerous claims of anecdotal success, but not one well-controlled multi-subject study on vision therapy. Undoubtedly, vision therapy is sometimes successful, but as there is no control for the placebo effect, one could very logically assume that the positive results are secondary to the development of a one-on-one relationship between therapist and patient. That is, there may be a level of Pavlovian conditioning, or positive psychological reinforcement for a task well-performed. One perhaps could accomplish the same by asking the child to keep his bedroom clean and then rewarding him with a gift each time he succeeds.

The studies used to support "vision training" (i.e. muscle exercises, ocular pursuit, tracking exercises, or training glasses) as a means of treating learning disabilities have come under a lot of fire. The criticisms of the studies are spelled out succinctly in a commentary on why vision training can't help reading impaired students, which was published in *Pediatrics* by Melvin D. Levine, MD, and from which I'll paraphrase:

- The studies rely too much on anecdotal evidence;

WHOM TO CALL

In preparation for encounters with parents whose children have learning problems, I suggest you keep numbers for two or more of each of these professionals handy:

- A pediatric developmental specialist;
- A pediatric geneticist;
- A pediatric metabolic and nutritional specialist;
- A pediatric psychiatrist;
- A pediatric neurodevelopmental psychologist;
- An educational psychologist;
- An auditory processing specialist;
- A reading teacher or tutor;
- A pediatric social worker;
- A school child study team;
- An orthoptist; and
- An attorney specializing in obtaining appropriate financial and educational aid.

Vision Therapy

• They lack carefully matched comparison groups from normal and dysfunctional children;

• They are designed with the preconception that reading problems are caused by only one factor and fail to consider the possibility that a number of factors may be to blame.

• They tend to view results narrowly. For example, inattention to visual detail might be narrowly viewed as a visual problem, while ignoring the possibility that it might be caused by an attention deficit;

• Research tends to be conducted by practitioners with a vested interest in positive outcomes.[1]

The studies utterly fail to prove a link between visual perception and reading disability. In fact, the problems faced by the reading disabled clearly appear to originate in the brain (the domain of psychiatrists and psychologists, not eye doctors) rather than in the eyes. Two studies illustrate this point.

In the first, children were asked to view a target stimulus for one second and then draw the item they had just seen. Researchers showed the children figures, letters and words. Disabled readers did not differ from average readers in their ability to reproduce words, suggesting that poor readers do not "see" letters reversed any more frequently than normal readers do. Then, the children were shown the same set of target stimuli but were asked to name the items rather than draw them. Disabled readers were significantly worse at pronouncing and orally spelling the words they used to describe the stimuli. These results suggest that disabled readers see in the exact same manner as normal readers. They differ in their ability to verbally describe what they've seen. Researchers concluded that disabled readers have a visual-to-verbal recoding deficit, a process that is thought to be a function of memory, not sight.[2-4] A genetic phonics disability is frequently responsible.[5]

A second study supports this conclusion. Average and disabled readers (average age: seven years old) underwent tests to determine their ability to differentiate between similar abstract figures, consonant strings and pseudowords (pronounceable but nonsensical words). The study found the two groups performed the same on the abstract figures. However, the learning disabled children performed significantly worse when words were involved. In fact, the more the pseudoword resembled an English word, the greater the numbers of errors made on it by disabled readers. Again, these results suggest that perception is not the problem with disabled children. Rather, visual to verbal recoding is.[6]

Vision therapists like to promote "neurological organizational training" (laterality training, crawling, use of balance boards and perceptual training) as a therapy for reading problems. This therapy has shown very little efficacy. Writing in *Pediatrics*, ophthalmologist George R. Beauchamp, MD, concludes that evidence in favor of perceptual training "would appear to be particularly weak."[7] A meta-analysis of perceptual training studies concludes its effects "present an unbroken vista of disappointment."[8]

The Medical Approach

When confronted with parents requesting information about vision therapy, I recommend the following strategy.

First, acknowledge and empathize with the concern. Parents whose child has received the broad, vague label of "learning disabled" are understandably anxious and upset. It's also important to acknowledge that we don't yet know all the reasons some children have difficulties in school.

However, say that your recommendation is to rule out all the problems that we do know about and make certain the diagnosis is sound before proceeding to a treatment.

The first thing to do is make sure that a ocular medical problem has not been missed. Here are some conditions to check for:

• Strabismus. Look for intermittent diplopia, abnormal head tilt, face turns, head positions or chin positions.

• Developmental cataracts;

- Juvenile glaucoma;
- Congenital corneal dystrophies;
- Mesodermal dygeneses;
- Large corneal dermotoid cysts;
- Colobomas of the retina or optic nerves;
- Familial exudative vitreo-retinopathy;
- Optic nerve hypoplasia; and
- Central nervous system anomalies or tumors affecting the visual system.

After ruling out ocular problems, look for systemic conditions which may cause secondary problems with sight, such as:

- Uveitis syndromes (i.e. JRA)
- Pediatric migraines. In my experience this is the most common systemic disorder presented by children recommended for vision therapy.[9]

The diagnosis is often one of exclusion, for these children sometimes don't have symptoms of severe headache or typical nausea. They typically have a family history of a parent, grandparent, uncle, or cousin who has migraine. Infantile colic, lactose intolerance or milk allergy, motion sickness, unexplained abdominal discomfort, history of febrile seizure, sleep disturbances including night terrors and nightmares, unusual sensitivity to noise, photophobia, or an acute sense of smell are all paramigranine symptoms. These children tend to have a Type A fastidious personality with some degree of obsessive-compulsive disorder, and an intermittent blurring of vision while in school, which is the pediatric version of the scintillating scotoma that older individuals and adults experience. They may also see various visual phenomena, such as silver foil, sparkling lights and various colored objects. Diplopia without strabismus is another common finding in children with migraines. I have found a number of children who have small near esophoria with full-blown pedi-

atric migraine. This is temporarily treatable with bifocal glasses. The reason for this accommodative paresis is unclear, but bifocals seem to alleviate the symptoms in school that might cause these children scholastic problems.

• Brain tumors. Almost every pediatric ophthalmologist has seen a case in which the first sign of a brain tumor is a sudden change in personality or regression into a more infantile behavior pattern. Order an MRI scan.

• Juvenile diabetes

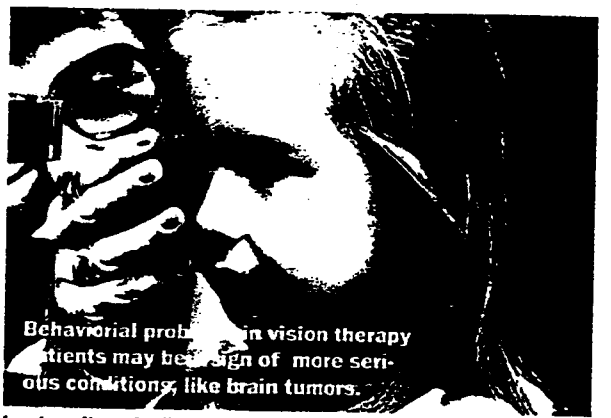
• Diabetes insipidus. This may be accompanied by conditions such as septum-pellucidum dysplasia, which may manifest as congenital optic nerve hypoplasia. Mid-line cranial defects, such as absence of the septopolucidim and agenesis of the corpus collasum are common.

• Mitochondrial cytopathies. This is a very hot topic in genetics right now. More and more diseases, especially of neurologic nature, have been found to be inherited from genetic material derived from the mitochondria and not the nucleus. Children with learning disabilities, liver dysfunction, unexplained fatigue, digestive problems, changes in personality as well as those with multisystem disorders, including variable strabismus and opticatrophy, should have a work up done for mitochondrial problems. A child's pediatrician should know where to get this done.

If there are no ocular or general health problems, evaluate the child for neuro-psychological problems.

The three major categories of neuropsychological problems you will see in children recommended for vision therapy are learning disabilities including dyslexia, attention deficit disorders and social reading difficulties. It's important to understand these conditions so that you can refer these children to the appropriate specialists.

• Learning disabilities. This is a general term used to describe a group of disorders involving an as yet unspecified central nervous system dysfunction. In the past, terms such as "minimal brain dysfunction" or "minimal brain disorder" have been used to describe it. Sufferers may have problems with listening, speaking, reading, writing, reasoning and mathematical skills, with consequent loss of confidence and self-esteem. These problems typically arise in early childhood, but often are not recognized until the child is seven to 10. Patterns of learning disabilities vary in type and severity. IQ is frequently normal or above average. Males are more often affected than females. The condition is life-long, but remediation can improve some skills.


Behavioral prob[illegible]n vision therapy [illegible]tients may be [illegible]sign of more serious conditions, like brain tumors.

Dyslexia is a common and well-known learning disability. True dyslexia—the inability to understand the written word—is rare. More often, patients simply have deficiencies in reading, writing and spelling. Commonly, one of the problems is letter and word reversal. It is thought that visual memory impairment results in reversing letters like "d" for "b" or "saw" for "was." These children often have poor or illegible handwriting. Children who at pre-school age were late in developing language and who have auditory, memory and word naming problems may be at greater risk for dyslexia. Difficulty with spelling is often common, as these children are often unable to associate letters with the sounds they represent. As I mentioned before, this does not mean that the child has visual or hearing problems; the trouble is in the brain. Developmental dyslexia is characterized by an unexplained reading difficulty in people who otherwise possess the talent and schooling for fluid reading. Dyslexia is both familial and inheritable. Family history is one of the most important risk factors. Linkage studies implicate loci on chromosome 6 and 15. Additional studies show a strong inheritability of phonological awareness. Teaching phonics is one of the most effective methods of overcoming dyslexia in children and adults.[10]

Attention deficit disorders (ADD). This pattern of behavior, which affects an estimated 5 to 10 percent of school-age children, is characterized by short attention spans and impulsivity with or without hyperactivity. Boys appear 10 times more likely to be affected than girls. Symptoms usually appear at ages 4 to 7 and peak between the ages of 8 and 10.

To accurately diagnose this problem, you must first exclude health problems such as hearing deficiencies, visual defects, seizure disorders, sleep disorders, chronic illnesses and even drug abuse.

Continued on page 49

Vision Therapy (Continued from page 43)

Also, mental disorders such as bipolar and/or depressive mood disorders, obsessive-compulsive disorders and anxiety attacks, Asberger Syndrome, mental retardation (an IQ of less than 70) and Tourette's Syndrome need to be ruled out.

Patients with ADD frequently have learning problems, possibly caused or at least exacerbated by ADD. Signs of this include;

- Subject is easily distracted by irrelevant sights and sounds
- Fails to pay attention to details and makes careless mistakes;
- Rarely follows instruction carefully and completely; and
- Loses and forgets things like toys, pencils, books, or items required for a given task.

ADD is often accompanied by hyperactivity. This is something fairly easy to spot in the exam room. Signs include:

- Squirming or fidgeting with hands or feet;
- Running, climbing or leaving a seat when sitting or quiet behavior is expected;
- Blurting out spontaneous answers before hearing the entire question; and
- Having difficulty waiting in line for any length of time.

The causes of ADHD are unknown. We know it is not caused by "too much TV," food allergies, excess sugar, a poor home life, or poor educational environments. Positron emission tomography scans reveal a lower level of glucose uptake in some parts of the brain in patients with attention deficit disorders when compared to normal controls.

Currently, only psychiatrists and psychologists provide counseling and training for these patients. Usually pediatricians and neurologists don't provide therapy, although they frequently diagnose the disease.

Unlike the other two conditions mentioned in this section, non-dyslexic reading difficulties are most often a result of environment. Most students with learning disorders have trouble with reading. However, the inverse is not true. In fact, as many as 80 percent of all patients who've been diagnosed as learning disabled due to a reading disorder are misdiagnosed. Instead, experts believe that most reading difficulties stem from factors such as poor instruction, lack of reading readiness, and/or cultural differences.[11]

Disposition

If after all this the parent still desires my opinion on vision therapy, I simply explain that there is as yet no published accurate controlled and scientifically derived data to prove that eye exercises or vision therapy are effective treatments for vision problems or learning disabilities. I also provide the parents with an application for Bridges to Reading from PERC, as well as an AAO pamphlet on learning disabilities. If the patient wishes to pursue this therapy anyway, I neither encourage or discourage them. After all, we do not know for sure that vision therapy does not work. We only know that there is no proof that it does, and that the evidence suggests it won't.

More often, though, by offering parents insight into their child's specific and often complex learning and behavioral problems, I find they are less likely to proceed with unproven vision therapy. This saves them time, money, false hope and additional anxiety.

Dr Koller is a pediatric ophthalmologist in private practice. He is a clinical professor of ophthalmology at Thomas Jefferson University, attending surgeon at Wills Eye Hospital and chairman of the section on ophthalmology of the American Academy of Pediatrics.

SUPPORT GROUPS

Here are some organizations that can be very helpful to parents:

- P.E.R.C. (The Parents Educational Resource Counsel), San Mateo, Calif. (650) 665-2410.
- C.H.A.D.D. Children and adults with ADD. (954) 587-3700 fax (954)-587-4599 website http//www.chadd.org.
- CEC (Children's Educational Counsel), Reston, Va., (888) 232-7733.
- The American Speech, Language and Hearing Association, Rockville, MD (800) 638-8255.
- Learning Disabilities Association of America, Pittsburgh, Pa. (412) 341-1515.
- The Orton Dyslexia Society, Baltimore, (800) 222-3123.

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In Support of Vision Therapy

● BY HAROLD A. SOLAN, OD, MA *New York City*

A number of different professionals are involved in treating children who have been identified as having learning and reading disabilities. This is truly an interdisciplinary problem that not only depends upon vision care but also contributions from pediatricians, pediatric neurologists, psychiatrists, and psychologists.

Abundant, scientifically sound research from these fields support the efficacy of visual therapy for the treatment of binocular insufficiencies, strabismus and developmental disabilities.

• Recently, one investigator[1] summarized 15 studies involving 1,931 patients diagnosed with convergence insufficiency. The cure rate showed that 72 percent of the patients found complete relief from their symptoms for at least two years. An additional 8 percent received some improvement. Other studies show similar results[2,3] as well as the enduring effects.[4]

• A well-controlled 40-subject study found that the correction of convergence insufficiency led to a significant improvement in reading performance ($p<.05$).[5]

• Another reported significant improvement after treatment of accommodative insufficiency,[6] a focusing disorder sometimes associated with convergence insufficiency and convergence excess. In a cohort of 96 patients, 53 percent were seen as totally cured based on vision therapy results and symptom relief, and an additional 37 percent showed improvement.

• In a controlled study[7] of 48 children with primary accommodative disorders, all the children in the experimental group reached acceptable levels of accommodative functioning with the elimination of major symptoms. Children in the 5-to 8-year old experimental group also showed more than 60 percent improvement in several measurements of visual perception.

• Three studies show that vision therapy can correct strabismus not only cosmetically but functionally. In one 149-patient study, therapy produced a 73 percent success rate from a binocular vision standpoint and a 96 percent success rate from a cosmetic standpoint.[8] A long-term follow-up study showed that 89 percent of the 81 patients who returned for care retained their binocular vision.[9] In another 439-patient study,[10] 76 percent of the patients met very rigorous criteria for success after therapy. Eighty-six percent achieved a cosmetic cure.

There is also a body of scientific evidence to support the notion that vision therapy has a salutary effect on developmental difficulties in children.

First, I want to make it abundantly clear that vision specialists do not treat reading and learning disabilities directly. What optometrists do is render care to children and adolescents who have been identified as reading- and learning-disabled and who manifest learning related visual dystfunctions.[11]

In some cases, the vision problem may be primary in the development of the learning disability, but in many cases it is contributory. For example, an eight or nine-year-old child may have a visual integrative disorder, which could manifest in poor visually guided motor skills such as being unable to copy a vertical diamond. Although he is able to draw the oblique lines, the child is not able to integrate the subskills, because he lacks the developmental framework. Others with intersensory integration deficits have difficulty equating auditory with visual stimuli, the basis of phonetic analysis[12]. These perceptual delays are often symptomatic of a neuromaturational lag as seen in children identified as reading disabled. Correcting visual integrative disorders and improving rate of visual processing have a beneficial effect on reading readiness.

Studies support the notion that during early childhood, children shift from one dominant sensory modality to the next: from tactile to auditory to visual. Some may be delayed or impaired in their ability to make the final hierarchical shift to visual dominance[13]. This lag has a significant impact on their ability to process visual information, and ultimately affects classroom learning. These children often have perceptual and visual motor integration deficits and slow visual processing. Frequently associated with these disorders are histories of pre-peri- and post-natal episodes[14], low birth weight, and malnutrition during the first two years of life, which are thought to subsequently influence a child's neurointegrative development and functioning. These lags are present

very early in life, but often remain undetected until the child's first few months in school. We know our treatments— lens correction, binocular and focusing therapy, and perceptual and developmental therapy– have a salutary effect in developing visual systems as the dominant sensory modality.

By applying the basic tenets of physiological optics and visual psychology, doctors can provide many patients with significant relief from visual discomfort and stress; and this can have a beneficiary effect on visual attention, reading and learning. We have a professional obligation to treat patients who would benefit from this care. ■

Dr. Solan is a Distinguished Service Professor at the State College of Optometry/SUNY, where he served as director of the Learning Disabilities Unit from 1981 to 1991. He is currently researching the effect transient visual processing deficits have on reading comprehension and eye movement efficiency in reading.

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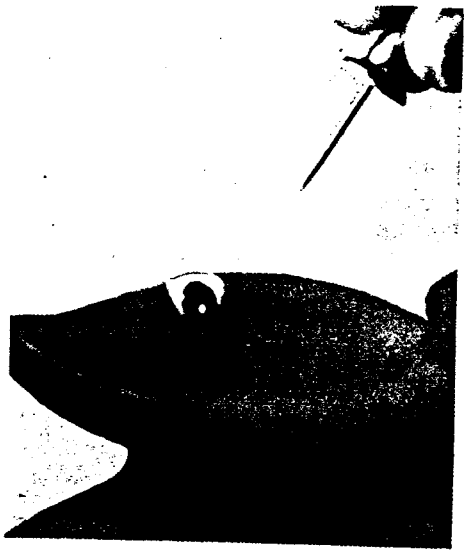
Deflating the Rubber Duck



■ JEFFREY COOPER, M.S., O.D.

Editor's note.

In the editorial of the last issue of this Journal (Vol. 9, No. 4, 1998) I commented on an article that was an unsubstantiated attack on vision therapy. It appeared in the March, 1998 issue of the Review of Ophthalmology, and was written by ophthalmologist H. Koller. The title, "Is Vision Therapy Quackery?" says it all.

The article quickly made its way through optometric circles, and angered many of us. However, Dr. Jeffrey Cooper saw fit to write a scholarly response. He sent it as a Letter to the Editor of the Review of Ophthalmology, but that periodical did not see fit to publish Dr. Cooper's response in its entirety. The officers and staff of the Optometric Extension Program Foundation are pleased that Dr. Cooper gave his permission to present his thoughtful, scholarly and instructive original letter in its entirety. However, I must claim credit for the title.

Mr. Stan Herrin, Editor
Review of Ophthalmology
Chilton Way
Radnor, PA 19089

Dear Mr. Herrin:

I have just read, "Is Vision Therapy Quackery? How to Separate Fact from Fiction and Get Pediatric Patients the Care they Need," by Harold Koller, M.D. I am shocked that *Review of Ophthalmology* printed such a poorly documented, politically biased, intellectually dishonest paper with an equally inflammatory editorial and picture on the cover. The article is an affront to the optometric profession and deserves a response. I will begin with a review of the inaccurate statements reported in this paper by using peer reviewed, scientific evidence to the contrary. I will also correct misconceptions about what vision therapy is and what it purports to do. Finally I will ask this pediatric ophthalmologist to evaluate his specialty at the same level that he does optometry (no more or less).

Vision therapy, like any area in a health profession, is practiced differently by various clinicians. I will restrict this discussion to the most commonly practiced and largest portion of the area of vision therapy: treatment of accommodative and vergence anomalies, including strabismus. These categories include the majority of patients treated by optometrists providing vision therapy services. In addition, all schools of optometry include diagnosis and treatment of anomalies of accommodation and vergence in their curriculum.

Dr. Koller states that the "literature in (which) exists support of the (vision) therapy is ambiguous and vague; published accounts fail to reveal the rationale for various therapies. There are numerous claims of anecdotal success, but not one well-controlled multi-subject study on vision therapy." *These statements suggest that Dr. Koller did not perform a comprehensive literature search which should be required by any journal before publication.*

Negative feedback control theory analysis of the accommodative and vergence systems provides the basis of today's optometric vision therapy. These models have a strong physiological and anatomical basis, and have been described in numerous articles[1-4] and textbooks.[5-7] Computer simulations using control theory demonstrates the predictability of both the accommodative and vergence systems.[1,2,5] Defects in any component of the system may result in asthenopia, diplopia, and/or strabismus.[8] The most common cause of asthenopia is related to inadequate slow vergence.[4,9] Vision therapy differs from orthoptic models in that control theory analysis acknowledges the dynamic interaction of accommodation and vergence, and its respective feedback mechanisms.

Numerous studies have evaluated the effectiveness of vision therapy in eliminating symptoms and abnormal objective

findings associated with binocular anomalies. One study used random dot stereograms (RDSs) in a carefully controlled double blind, cross over experimental design to determine if vergence training improved vergence ability.[10] The results of the experiment definitively demonstrate that those subjects who received vergence treatment improved their vergence amplitudes while the control group did not. In addition, improvement on one vergence task generalized to other related vergence tasks such as vectographs, Risley prism, and stereoscopes. These findings have been replicated by other studies using different instrumentation.[11-15] These studies, also, clearly demonstrate that vergence therapy improves vergence ability and that the effects persist over time.

The largest group of patients treated with vision therapy are patients manifesting symptomatic convergence insufficiency. These patients account for up to 15% of the population depending upon the definition and criteria used.[16] Numerous optometric and ophthalmological studies have shown that vision therapy is the treatment of choice for CI.[17-28] Orthoptics or vision therapy is cost effective and has a high success rate. Even ophthalmological textbooks including the standards such as von Noorden's *Binocular Vision and Ocular Motility: Theory and Management of Strabismus*[29] and Leigh and Zee's *The Neurology of Eye Movements*,[30] dogmatically state the most clinically accepted treatment for convergence insufficiency is orthoptics/vision therapy. Pooled data from 18 studies accounting for 2149 patients is impressive, with 73% reported as cured, 15% reported as significantly improved, and only 5% reported as failed.[16,31] Pantano[32] demonstrated that orthoptic treatment lasts for at least two years following the termination of treatment, when a complete cure is achieved. Similar findings were reported by Grisham, et al.,[11] in a group of patients. Age is not a deterrent to the successful treatment of binocular anomalies.[33] Wick[33] treated 191 patients who ranged from 45-89 years of age. Immediately after therapy, 93% were reported as cured. Cohen and Soden[34] confirmed Wick's results. They treated 28 CI patients over 60 years of age. They reported an immediate cure rate of 96%. The cure rate was 83% 9-12 months later.

All of the above are large sample, retrospective studies. Their sheer numbers provide compelling evidence of the effectiveness of vision therapy. Case studies, when properly documented, can provide important clinical information as to the nature of the treatment. An excellent example of such a case was published in *Neuro-Opthalmology* describing the findings and treatment of a patient with Guillain-Baire syndrome. This single subject study documents the effectiveness of vision therapy in treating a patient with organic disease.[35]

Cooper, et al.,[36] published in a peer reviewed journal a controlled, prospective, double blind, A-B reversal study that evaluated experimental vergence treatment vs. placebo treatment for a group of patients diagnosed with a pure convergence insufficiency. Prior to treatment, all the patients had clinical vergence amplitudes measured and completed a numerically scaled asthenopia questionnaire to quantify their degree of asthenopia. The experimental group had specific, automated vergence therapy using RDSs to improve convergence amplitudes. The automated design eliminated the possibility of experimental bias. Correct responses to the position of a RDS resulted in an increase in the vergence demand and a concurrent delivery of a reinforcement while incorrect responses resulted in a decrease in vergence demand and no reinforcement. Thus, the vergence demand and therapy was controlled by the patient's responses using an operant conditioning paradigm. The experimental group showed a dramatic improvement in vergence amplitude, a change in a forced fixation disparity curve and a decrease in asthenopic symptoms on the scaled questionnaire. The control group was treated with the same stimuli in an identical therapy paradigm except that there was no alteration vergence demand during trials. The control group did not show an improvement in either vergence amplitudes nor a decrease in symptoms. When the control group, crossed over to become the experimental group, similar findings were found (i.e., an increase in vergence amplitudes with a concurrent reduction in symptoms). *This study also clearly meets the definition of well-controlled, multi subject study.*

Atzmon, et al.,[37] addressed the effectiveness of orthoptics/vision therapy in the area of reading disabilities in an article, which appeared in *Binocular Vision and Eye Muscle Surgery Quarterly*, an ophthalmological journal. This double blind prospective study compared the effectiveness of orthoptics to other treatment modalities in the remediation of reading disorders. These investigators matched three groups of children with reading disabilities. One group received orthoptic treatment to improve fusional amplitudes to at least 60Δ. Group two received conventional reading tutoring. Group three received no treatment and served as the control. Each child had 40 20-minute sessions of therapy. Prior to therapy 100% had poor fusional convergence by the authors' criteria, 60% had a receded nearpoint of convergence, and many had asthenopic symptoms. After treatment asthenopic symptoms were eliminated in the orthoptic group. Reading had improved significantly in both the orthoptic/vision therapy group and reading group, but not in the control group. Atzmon, et.al.,[37] concluded that orthoptics/vison therapy was as effective as reading tutoring but had an additional benefit of eliminating asthenopia. This study also meets the criteria of multi-subject, controlled study.

Pooled success rates of different treatment regimens for the divergence excess type of intermittent exotropia have been reported as follows: 59% for orthoptics/vision therapy, 43% for surgery, and 30% for passive therapy (minus lenses, patching, and/or prisms).[38] These data suggest that *vision therapy/orthoptics is more effective* than surgery in patients with smaller angle intermittent exotropia and should be considered part of the treatment regimen for patients who receive surgery.[39] Sanfilippo and Clahane[40] reported on the success of orthoptic treatment with 31 intermittent exotropia patients. They reported that 64.5% were cured, 9.7% were classified as improved, and 9% were classified as fair. In a subsequent study, they reported after five years that 52% remained cured while 32% were in the improved group.[41] Similar findings have been reported by other studies.[42-47] Another study reported that the highest success rate occurred when office therapy was supplemented with home vision therapy.[48]

Several studies have reported that accommodation can be modified with therapy.[49-53] Studies have also shown that voluntary accommodation can be taught[52] and that accommodation developed by biofeedback could transfer from one task to another.[53] Accommodative therapy has been shown to be effective in eliminating subnormal accommodation.[54,55] One study reported that 87% of their patients with accommodative anomalies eliminated their asthenopia and normalized their accommodative findings with approximately 26 sessions of therapy.[55] Therapy to improve accommodative amplitudes resulted in a concurrent improvement of positive and negative fusional amplitudes, as well as stereopsis.[56] It was concluded that orthoptics/vision therapy is the method of choice in eliminating asthenopic symptoms associated with accommodative anomalies.[57] In those patients who could not participate in orthoptics/vision therapy, plus lenses were successful in decreasing symptomatology. This study was published in a peer reviewed ophthalmological journal (*Doc. Ophthalmol*).[57]

Another double-blind prospective study to determine the effects of monocular accommodative amplitude therapy on asthenopia showed that the patients in the experimental group had a dramatic improvement in their amplitude of accommodation, a decrease in their dynamic accommodative response time, and a significant reduction in symptoms on a rated, scaled asthenopia questionnaire. There was no change in the control group. When the control group crossed over and underwent identical therapy as the initial experimental group, a similar reduction in symptoms and normalization of accommodative function was found.[58]

The above studies demonstrate that accommodation may be altered via accommodative therapy with a resultant change in accommodative amplitude, accommodative facility, and a reduction in symptoms. They demonstrate changes in symptomatology and clinically measured amplitudes. Therapy may also result in changes in the magnitude, velocity, and the gain of the accommodative response.[59] Accommodative therapy not only eliminates symptoms but shows objective changes in the velocity of the accommodative response and a concurrent decrease in recorded time constants.[60] Therapy provides improvement in time characteristics of the accommodative response including the latency and velocity.[60,61]

Koller indirectly challenges the integrity of vision therapists by describing one therapist who may have advocated the use of vision therapy for a variety of questionable diagnostic categories. To condemn a discipline for one boisterous claim is outlandish. People in glass houses should not throw stones! Optometrists often have to respond to questionable claims made by ophthalmologists. For example, how many times have optometrists listened to patients state that a pediatric ophthalmologist told them their child would go blind if he or she didn't have surgery for an esotropia or intermittent exotropia? How often do pediatric ophthalmologists tell patients that most strabismus surgery is cosmetic? How often have you or your colleagues told an insurance company that most strabismus surgery is for cosmetic purposes? Neither you nor I can be responsible for the actions of a few of our colleagues.

Now let me ask a few questions. *Show me one prospective, randomized, double blind study that demonstrates that strabismus surgery improves quality of life.* The literature describes a few poorly performed studies by ophthalmologists which attempt to show that patients after strabismus surgery improve their subjective responses on a Worth 4 Dot Test or with a Bagolini Striated Lens Test. Please provide some scientific evidence that improvement on these tests relates to an individual's performance. Even if I accepted the scientific merit of these studies, tell me how experimental biases or ordering effects were controlled? Let's go one step further, presuming that surgery can improve stereopsis in a small number of patients, show me one study that demonstrates that there is an improvement in quality of life or functioning when one aligns the eyes and improves stereopsis.

The criteria of success in many ophthalmological retrospective studies on strabismus surgery are in serious scientific question. For example, most of the studies on esotropia and exotropia define a cure as cosmetic alignment (within 5 prism diopters) without any mention of performance or functioning! Let's define a cure, as optometry previously has, so we may "talk" the same language. Optometry has defined a cure as an outcome whereby the patient is perfectly straight 95% of the time with diplopia upon rare deviation, has normal fusional amplitudes, is asymptomatic, and demonstrates normal stereopsis (40 sec or better on line stimuli and the appreciation of a large disparity random dot stereogram.) How many surgical procedures achieve this simple goal? In summary, studies evaluating the effectiveness of strabismus surgery are not nearly as well controlled or designed as the studies evaluating the effectiveness of vision therapy which have been presented in this paper.

When one uses a gold standard to judge a treatment protocol of another profession, one should maintain that standard for himself. I challenge Dr. Koller to show me one double blind, prospective study that demonstrates that lowering intra-ocular pressure stops visual field progression. Now find me one ophthalmologist who is willing to take all of his patients off ocular hypotensive medications since the appropriate well-controlled double blind studies have never been performed. There are numerous conditions where double blind, prospective studies have not been performed. It behooves the clinician to interpret the literature and provide the best treatment for the patient on the basis of our current clinical knowledge.

Dr. Koller's article goes on to describe a host of medical conditions to check for in the pediatric learning-disabled population which he infers are related to a learning disability. Please provide evidence that there is some relationship between developmental cataracts, juvenile glaucoma, congenital corneal dsystrophies, mesodermal dysgenses, etc. and learning disabilities. Dr. Koller then states that pediatric migraines are the most common systemic disorder presented by children recommended for vision therapy and references one of his own articles (not a research article) to support this statement. I have never seen any optometric or ophthalmological article or textbook that suggests that pediatric migraines are a reason to perform vision therapy. If Dr. Koller is correct in that optometrists do not know how to differentiate between headaches related to accommodative vergence abnormalities vs. migraines, then the study performed by Cooper, et al.,[36] demonstrates that vision therapy eliminates migraines. The study

found that the experimental group reported that their headaches disappeared with vergence treatment while the control group did not report a decrease in symptoms related to a headache. (I do not believe that to be the case since the patients in that study had ocular headaches which are not vascular, surrounded by an aura, eliminated by aspirin, associated with increased near work,etc.)

The cover of the journal sends a message that vision therapy is quackery. The editorial about quackery and how to attack the quacks is both unnecessarily inflammatory and unprofessional. Actually, Stan Herrin's treatment of the subject is more distasteful than Dr. Koller's article. All professional journals have a moral obligation to make sure their content is accurate and they should be careful not to publish articles just to create sensationalism. The publication of this article with the accompanying editorial was unprofessional and has caused unnecessary hostility between the professions. Mr. Herrin, having been the editor of both *Review of Optometry* and *Review of Ophthalmology*, has a responsibility to have been the bastion for eliminating the smoldering war between the two professions. It is time for optometry and ophthalmology to work together for the welfare of all patients.

Lastly, it is time for some ophthalmologists to eliminate their own biases, use an intellectual approach and try to help people rather than stroke their own egos. The editorial by Mr. Herrin and the article by Dr. Koller represent the opinion of two individuals, but are represented as if they represent the majority viewpoint. Most of the pediatric ophthalmologists I know would never put their names on a paper of this quality.

In conclusion, Mr. Herrin and Dr. Koller owe an apology to the profession of optometry and should strive to be more careful in their journalistic pursuit of the truth.

Sincerely yours,

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Part of this letter was adapted from the Optometric Clinical Practice Guideline Care of the Patient with Accommodative and Convergence Anomalies copyright American Optometric Association 1998 and has been reproduced with their permission.

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GUEST EDITORIAL continued from page 114

ing and identification. These integrated processes involve selecting and organizing, from the available visual array, that which is necessary to direct action and to derive meaning.

It is not my mission to confirm Skeffington as a prophet. Frankly, I think there were some gaps in his organization of these concepts. Nevertheless, it is noteworthy that it took 30 years for others to come up with an almost identical statement of the basic hypothesis. But, Skeffington had an edge: he was an optometrist. He appreciated the clinical reality that a model of visual function limited to the mechanisms of convergence and accommodation is insufficient to explain the pervasive role of vision in human behavior. The dismay I felt when reading the opening passage came from knowing that the impetus for the research to develop the hypothesis did not come from *optometry*.

My primary interest is to foster optometry's utilization of these ideas in meaningful and productive ways. The processes involved in determining "where" and "what" are separable to some degree and are not identical to the mechanisms of convergence and accommodation. Although I personally am comfortable with the words centering and identification to describe these concepts, I would be amenable to suggestions of better words. In the meantime, let's not continue to cloud the issue. The acts of accommodation and convergence are certainly a part of the visual process and should not be discarded, but used in the proper context. Optometry, however, should recognize that these mechanisms per-se do not fully explain the total visual process. Discussions about how an individual uses the visual process to construct solutions to visual problems can require all four terms.

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VISION THERAPY

Information for Health Care and Other Allied Professionals

A Joint Organizational Policy Statement of
the American Academy of Optometry
and
the American Optometric Association

Introduction

Society places a premium on efficient vision. Schools and most occupations require increasing amounts of printed and computer information to be handled accurately and in shorter periods of time. Vision is also a major factor in sports, crafts, and other pastimes. The efficiency of our visual system influences how we collect and process information. Repetitive demands on the visual system tend to create problems in susceptible individuals. Inefficient vision may cause an individual to slow down, be less accurate, experience excessive fatigue, or make errors. When these types of signs and symptoms appear, the individual's conscious attention to the visual process is required. This, in turn, may interfere with speed, accuracy, and comprehension of visual tasks. Many of these visual dysfunctions are effectively treated with vision therapy.

Pertinent Issues

Vision is a product of our inherited potentials, our past experiences, and current information. Efficient visual functioning enables us to understand the world around us better and to guide our actions accurately and quickly. Age is not a deterrent to the achievement of successful vision therapy outcomes.

Vision is the dominant sense and is comprised of three areas of function:

- *Visual pathway integrity* including eye health, visual acuity, and refractive status.
- *Visual skills* including accommodation (eye focusing), binocular vision (eye teaming), and eye movements (eye tracking).
- *Visual information processing* including identification, discrimination, spatial awareness, and integration with other senses.

Learning to read and reading for information require efficient visual abilities. The eyes must team precisely, focus clearly, and track quickly and accurately across the page. These processes must be coordinated with the perceptual and memory aspects of vision, which in turn must combine with linguistic processing for comprehension. To provide reliable information, this must occur with precise timing. Inefficient or poorly developed vision requires individuals to divide their attention between the task and the involved visual abilities. Some individuals have symptoms such as headaches, fatigue, eyestrain, errors, loss of place, and difficulty sustaining attention. Others may have an absence of symptoms due to the avoidance of visually demanding tasks.

Vision Therapy

The human visual system is complex. The problems that can develop in our visual system require a variety of treatment options. Many visual conditions can be treated effectively with spectacles or contact lenses alone; however, some are most effectively treated with vision therapy.

Vision therapy is a sequence of activities individually prescribed and monitored by the doctor to develop efficient visual skills and processing. It is prescribed after a comprehensive eye examination has been performed and has indicated that vision therapy is an appropriate treatment option. The vision therapy program is based on the results of standardized tests, the needs of the patient, and the patient's signs and symptoms. The use of lenses, prisms, filters, occluders, specialized instruments, and computer programs is an integral part of vision therapy. Vision therapy is administered in the office under the guidance of the doctor. It requires a number of office visits and depending on the severity of the diagnosed conditions, the length of the program typically ranges from several weeks to several months. Activities paralleling in-office techniques are typically taught to the patient to be practiced at home to reinforce the developing visual skills.

Research has demonstrated vision therapy can be an effective treatment option for:

- Ocular motility dysfunctions (eye movement disorders)
- Nonstrabismic binocular disorders (inefficient eye teaming)
- Strabismus (misalignment of the eyes)
- Amblyopia (poorly developed vision)
- Accommodative disorders (focusing problems)
- Visual information processing disorders, including visual-motor integration and integration with other sensory modalities

Summary

Vision therapy is prescribed to treat diagnosed conditions of the visual system. Effective therapy requires visual skills to be developed until they are integrated with other systems and become automatic, enabling individuals to achieve their full potential. The goals of a prescribed vision therapy treatment regimen are to achieve desired visual outcomes, alleviate the signs and symptoms, meet the patient's needs, and improve the patient's quality of life.

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Special commentary

Vision, Learning and Dyslexia

A Joint Organizational Policy Statement of the American Academy of Optometry and the American Optometric Association

Vision and Learning

Many children and adults continue to struggle with learning in the classroom and the workplace. Advances in information technology, its expanding necessity, and its accessibility are placing greater demands on people for efficient learning and information processing.[1,2]

Learning is accomplished through complex and interrelated processes, one of which is vision. Determining the relationships between vision and learning involves more than evaluating eye health and visual acuity (clarity of sight). Problems in identifying and treating people with learning-related vision problems arise when such a limited definition of vision is employed.[3]

This policy statement addresses these issues, which are important to individuals who have learning-related vision problems, their families, their teachers, the educational system and society.

Policy Statement

People at risk for learning-related vision problems should receive a comprehensive optometric evaluation. This evaluation should be conducted as part of a multidisciplinary approach in which all appropriate areas of function are evaluated and managed.[4]

The role of the optometrist when evaluating people for learning-related vision problems is to conduct a thorough assessment of eye health and visual functions and communicate the results and recommendations.[5] The management plan may include treatment, guidance and appropriate referral.

The expected outcome of optometric intervention is an improvement in visual function with the alleviation of associated signs and symptoms. Optometric intervention for people with learning-related vision problems consists of lenses, prisms, and vision therapy. Vision therapy does not directly treat learning disabilities or dyslexia.[6,7] Vision therapy is a treatment to improve visual efficiency and visual processing, thereby allowing the person to be more responsive to educational instruction.[4,8] It does not preclude any other form of treatment and should be a part of a multidisciplinary approach to learning disabilities.[6,7]

Pertinent Issues

Vision is a fundamental factor in the learning process. The three interrelated areas of visual function are:

1. Visual pathway integrity including eye health, visual acuity and refractive status;

2. Visual efficiency including accommodation (focusing), binocular vision (eye teaming) and eye movements;

3. Visual information processing including identification and discrimination, spatial awareness, and integration with other senses.

To identify learning-related vision problems, each of these interrelated areas must be fully evaluated.

Educational, neuropsychological and medical research has suggested distinct subtypes of learning difficulties.[9,10] Current research indicates that some people with reading difficulties have co-existing visual and language processing deficits.[11] For this reason, no single treatment, profession or discipline can be expected to adequately address all of their needs.

Unresolved visual deficits can impair the ability to respond fully to educational instruction.[12,13] Management may require optical correction, vision therapy, or a combination of both. Vision therapy, the art and science of developing and enhancing visual abilities and remediating vision dysfunctions, has a firm foundation in vision science, and both its application and efficacy have been established in the scientific literature.[14-17] Some sources have erroneously associated optometric vision therapy with controversial and unfounded therapies, and equate eye defects with visual dysfunctions.[18-21]

The eyes, visual pathways and brain comprise the visual system. Therefore, to understand the complexities of visual function, one must look at the total visual system. Recent research has demonstrated that some people with reading disabilities have deficits in the transmission of information to the brain through a defective visual

pathway.[22-25] This creates confusion and disrupts the normal visual timing functions in reading.

Visual defects, such as a restriction in the visual field, can have a substantial impact on reading performance.[26] Eye strain and double vision resulting from convergence insufficiency can be a significant handicap to learning.[27] There are more subtle visual defects that influence learning affecting different people to different degrees. Vision is a multifaceted process and its relationships to reading and learning are complex.[28,29] Each area of visual function must be considered in the evaluation of people who are experiencing reading or other learning problems. Likewise, treatment programs for learning-related vision problems must be designed individually to meet each person's unique needs.

Summary

1. Vision problems can and often do interfere with learning.

2. People at risk for learning-related vision problems should be evaluated by an optometrist who provides diagnostic and management services in this area.

3. The goal of optometric intervention is to improve visual function and alleviate associated signs and symptoms.

4. Prompt remediation of learning-related vision problems enhances the ability of children and adults to perform to their full potential.

5. People with learning problems require help from many disciplines to meet the learning challenges they face. Optometric involvement constitutes one aspect of the multidisciplinary management approach required to prepare the individual for lifelong learning.

This Policy Statement was formulated by a Task Force representing the College of Optometrists in Vision Development, the American Optometric Association, and the American Academy of Optometry. The following individuals are acknowledged for their contributions:

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VIEWPOINTS

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

The 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

Continued on page 69

Continued from page 66

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

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

Abnormal spatio-temporal processing, attributable to transient visual system dysfunction, has been demonstrated in over 75% of individuals with specific reading disability.[44,45] 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.[44-48] 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.[44,49]

Visual factors in dyslexia

Learning to read involves both phonetic and eidetic processes.[50] 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.[51-57]

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.[53]

Although auditory-linguistic dyslexia outnumbers the visual-perceptual type by at least four or five to one,[50,53,58-60] 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.[61] 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[62-64] 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.[63,64] 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[65]

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[66] 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.[67,68]

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.[66]

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

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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 he/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/and 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),[1-3] 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.[4,5]

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.[6,7] 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.[8] 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.[9] 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.[10]

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.[11] 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.[12]

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.[13]

Conclusion

The optometrist examines all patients as thoroughly as the situation requires, employing those tests that provide the information 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.[14]

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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In perspective

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The dichotomy of vision and learning in optometric practice: implications for delivery of care

Background

The visual system operates on multiple levels, gathering information at the pre-retinal level (cornea, pupil, and lens), and computationally processing information in retinal and extra-retinal pathways. Though the parallel and concurrent processes of vision are distributed throughout the brain, clinical assessment of vision can be divided into *tests of efficiency*, involving input and output measures, and *information processing*, involving perceptual or cognitively mediated responses. Remediation of efficiency problems shares common ground with orthoptics, whereas processing therapy is more educational in nature. These distinctions help account for differing opinions about the interrelationship of vision and learning. Differentiating orthoptic from processing therapy will reduce confusion about these issues. The dissociation of orthoptics from the balance of optometric vision therapy will also serve to limit expectations of third-party payment for services, which have significant impact, but are not medically necessary.

It would seem intuitive that vision is integral to the learning process.[1] Nevertheless, the extent to which vision plays a role in learning remains elusive to some professionals.[2] A view of the eye and visual pathways that dissociates the eye from the brain may serve useful for defining how a professional envisions his or her role. However, it defies neurobiological fact and camouflages the exquisite neurocomputational interplay between vision and learning.

Pablo Picasso was once asked in a train compartment by a fellow passenger why he did not paint people "the way they really are." Picasso asked what the man meant by the expression. The man pulled a snapshot of his wife out of his wallet and said, "That's my wife." Picasso responded, "Isn't she rather small and flat?"[3] It is little wonder that simplistic, stick-figure accounts of vision disavow any meaningful relationship between vision and learning.[4]

In contrast, numerous optometric organizations have come forward to reaffirm the fact that vision,—beyond considerations of eye health and visual acuity—can influence one's ability to learn effectively and efficiently.[5] Unfortunately, it is typically the patient who is caught in the crossfire of professional disagreements that ensue, and is left with some confusion as to the role of the eye care practitioner in detection and management of learning-related vision problems.[6]

The purpose of this article is to examine the factors that have contributed to the current state of affairs, and to provide a framework for the delivery of orthoptics and learning-related vision care services in optometric practice. The role of vision in learning is sufficiently complex that no single source can address all of the issues involved. However, the trend toward specialization in optometry, the shift toward a medical model of care, and the influence of third parties invite a closer look at the applicability of vision and vision therapy to the learning process and the delivery of these services in optometric practice.

The dichotomy of vision and learning

We learn to see. Although sight is mediated by the eye, visual learning occurs in the brain. The paradoxical divide between vision and learning is not unique to philosophical differences between eye care practitioners. As noted by Zeki,[7] the genesis and lineage of the idea of a separation between seeing and understanding—the former a passive and the latter an active process—can be found in differences of opinion among neurologists—and even within Kant's philosophical distinction between sensing and understanding. However, before suggesting a model to resolve the differences of opinion about the role of vision therapy services in learning, and implications for reimbursement, it will be helpful to review historical perspectives.

In the first half of the twentieth century, there were signs of agreement among eye care practitioners on the relationship between seeing and understanding. Read the following statement, then consider the source:

> "For some time it has been growingly apparent to those who have to deal with the eyes and their functions that optics, and even physiology, are only preliminary and preparatory phases of vision; that, ultimately, vision and visual reactions are an affair of the mind, and an exceedingly complex psychological affair, at that. It is not, in the end, the image that is registered on the retinae or in the occipital cortices, but the image which emerges from all the associative and organizing processes of the mind, some innate and some acquired, that shapes and determines the visual reactions... From a clinical standpoint, the psychological factors of perception, attention, interest, emotions even, play a determining role in those neuromuscular reactions and coordinations which nowadays form so important a field of visual investigation and training. They must be reckoned with in our test methods, in the interpretation of our findings, and in the devices we employ for re-education."[8]

It may surprise you to learn that this passage was written by the ophthalmologist, Thomas Atkinson, as an introduction to a book on Psychological Optics in 1938. Atkinson also was not far from the mainstream, having authored both an encyclopedic dictionary on vision[9] and a text on the analysis and management of visual problems.[10] One would imagine that at the end of the twentieth century, many of Atkinson's colleagues might find his use of the term "re-education" puzzling in the context of ophthalmic practice.

Orthoptics—which was the precursor of vision therapy—was once widely referred to as *visual re-education.*[11] In considering orthoptics to be re-educative, the implication is that normal visual development is a learned process and therefore subject to change. It also implies that orthoptics involves education or learning principles—at least as they relate to the areas of visual change or improvement attainable through orthoptics.

At about the same time that Atkinson was encouraging the clinical applicability of psychological optics in ophthalmology, Skeffington et al.[12] were independently developing clinical regimens based (in part) on Renshaw's work in psychological optics. Whereas the applications of developmental psychology to vision and learning ultimately propelled Optometry toward greater involvement in education, Ophthalmology progressively lost interest in the rigors of vision re-education (formal orthoptic programs), and virtually disavowed any relationship between vision and learning.[13,14]

While the influence of a medical model of vision can partially account for differences in the approach to learning-related vision probems, it has not been the only factor. As reviewed by Scheiman and Gallaway,[15] models of perceptual motor development and their influence on vision and learning have been useful for some optometric clinicians, but unappealing for those who prefer standardized or normative data to sophisticated, qualitative observation. Many doctors found themselves with inadequate time to devote to first-hand observations, and found tests that could be delegated to assistants—or scored at a later time—more cost effectively. In addition, normative tests provided a more universal language through which results could be communicated to parents and other professionals.

The work by Groffman and Solan[16] was a substantial contribution to the field in bridging these two approaches, and served to integrate more contemporary views of cognitive processing into motoric models. At the present time, Scheiman's model of learning-related vision problems is widely used to differentiate the clinical conditions involved in vision and learning (*see* Box 1). A recent joint policy statement of the American Academy of Optometry and the American Optometric Association is supportive of this model.[17] I have therefore adopted Scheiman's approach as a framework to re-configure the presentation of vision and learning services.

Visual efficiency and processing

Beyond considerations of eye health, learning-related vision problems can be divided into two major areas: *visual efficiency* and *visual information processing.*[18] *Visual efficiency skills* include the components of amplitude, accuracy, facility,

Differentiation of efficiency and processing

Efficiency disorders

Condition	Potential symptoms
Refraction	Blur
Binocular vision	Asthenopia
	Intermittent diplopia
	Instability of print
Accommodation	Variable blur
	Asthenopia
	Pseudo attention deficit
Saccadic eye movements	Inaccurate tracking when reading

Processing disorders

Condition	Potential symptoms
Laterality/directionality	Reversals/transpositions
Visual form perception	Letter knowledge/reproduction
	Inconsistent word recognition
Visual memory	Difficulty visualizing learned knowledge
	Poor spelling/sequencing/chunking
Visual motor integration	Difficulty spacing letters
	Difficulty copying from board

Box 1

and stamina in the interrelated systems of eye movements, accommodation, vergence, and sensory fusion.[19] *Visual information processing* generally refers to perceptual, motor, and cognitive abilities, with clinical testing centering on laterality and directionality, form perception, visual memory, and visual motor integration.[20,21] Clinical observations may also include the patient's visual processing styles—such as central versus peripheral—or reflective versus impulsive, as reviewed by Birnbaum.[22]

Many educational activities (such as reading) are complicated aspects of broader information-processing functions, including perception and higher cognitive processes.[23] The information-processing model is a major paradigm in cognitive psychology that lends itself to aspects of visual processing that occur in stages.[24] Although somewhat simplistic, it is generally accepted that visual functions such as motion, resolution, color vision, and reflex actions reflect lower or earlier levels of vision, and that recognition and consciousness itself reflect later or higher levels of visual processing.[25,26] Recognizing different levels of visual processing opens the door to a broader understanding of differences in opinion about the role of vision in learning.[27]

If we accept hierarchical levels of vision as indicative of various stages of processing, an analogy between computer software and hardware is useful.[28-31] Visual efficiency relates more to the hardware of the system traditionally probed in eye examinations, such as refractive status, binocular status and range, accommodative amplitude and accuracy, and ocular motility. These are items that are driven by stimulus input, and that we can directly inspect or measure. They are considered relatively early or low-level aspects of visual processing. In contrast, visual processing involves high-level function, including activation of stored information about the properties of objects and events. High-level processes affect all cortical visual input, including extraretinal sources of information.[31-35] Given the deep and pervasive effects of high-level processing during perception, it is no wonder that clinical tests oriented toward processing involve considerably more time and are more difficult to plan and execute.[36,37]

Third-party payment for vision and learning services

The ability to draw lines between clinical services that address visual efficiency and visual-processing functions is of more than philosophical interest. Many families come to optometric practices anticipating that some or all of their expenses will be covered by a third party.[38] Insurance reimbursement for optometric vision therapy can be anticipated if it is classified as a medical service.[39] The limiting factor in this premise is that insurance reimbursement is linked with the CPT (Current Procedural Terminology) codes, and there is no code for optometric vision therapy. The most apt descriptor for services provided in vision therapy is CPT code no. 92065, which is defined as orthoptic and/or pleoptic training, with continuing medical direction and evaluation (*see* Box 2).[40]

Although there is no dispute that optometric vision therapy incorporates orthoptics, it has evolved well beyond the current orthoptic milieu.[41,42] Orthoptic authorities and ophthalmologists have emphasized that

orthoptics does not extend beyond the training of binocular fusion abilities, and certainly does not incorporate eye tracking or perceptual therapy.[43-47] Considering the limited scope of contemporary orthoptics, vision therapy is comparatively educational in nature, and is periodically classified as educational by medical claims reviewers.

In the past, when insurance plans were liberal in equating optometric vision therapy to orthoptics, it was in the best interests of the patient for the doctor to adopt an equally broad interpretation of orthoptics. Before the proliferation of managed care plans, doctors and patients could anticipate vision therapy being classified as a medically necessary service. More recently, third-party plans have begun to challenge the extent to which services performed during vision therapy sessions meet the criteria of orthoptics. Rarely is the patient cognizant that the individual reviewing claims for vision therapy is usually a nurse or physician unacquainted with the issues involved (*see* Box 3).

In addition to differentiating vision therapy from orthoptics, there has been a recent trend among carriers to limit the number of orthoptic sessions, adopting the position that much of orthoptics can be done at home, with no need for regular office visits. Unfortunately, in an era of reimbursement expectations, patients become increasingly reluctant to pay for care they view as elective or nonessential. They tend to adopt the stance that if a significant number of office sessions were necessary, the insurance carrier would extend coverage.

Attributes of orthoptics

- Clarity
- Binocular vision
- Facility and stamina
- Stereopsis
- Eye movements

Attributes of visual processing

- Visual attention
- Processing speed
- Simultaneous/sequential processing
- Auditory–visual recognition
- Cognitive/motor planning
- Visual thinking/integration

Box 2

Contrasting orthoptics and visual-processing case types

Primary orthoptic case types

Amblyopia
Strabismus
Accommodative dysfunction
Nonstrabismic vergence dysfunction
Eye movement abnormalities*

Primary visual-processing case types

Visual attention deficits
Letter reversals or transpositions
Visual disorganizaton/sequencing
Graphomotor abnormalities
Limited visualization/visual memory

* Eye movement abnormalities are a swing category between orthoptics and processing. The ICD-9-CM classifications of eye movement disorders includes a wide variety of binocular abnormalities, nystagmus, saccadic deficits (OKN), smooth-pursuit abnormalities, and irregularities such as opsoclonus.

Box 3

To address these conflicts of interest, one possible approach is to "opt out" specialty services from a more general relationship with a third-party provider.[48] My personal experience has been that third parties are reluctant to modify contracts on an individual basis. Another alternative is to avoid participation in third-party plans that limit the provider's ability to prescribe treatment plans according to what is in the patient's best interests. As an example, some carriers will not reimburse for vision therapy services when the doctor is a participating provider, but will reimburse the patient directly when going to a nonparticipating provider. The nonparticipating provider can serve as an advocate for the patient, assisting the patient in obtaining reimbursement to which they are entitled. In due time, balance may be restored to the primary obligation of the doctor to deliver optimal care, and the patient's primary obligations to participate in and pay for that care.[49]

Vision therapy reimbursement

Orthoptic therapy	Visual-processing therapy
CPT code no. 92065	No CPT Code
Insurance reimbursable	No insurance reimbursement
Medical	Quasi-educational
Improves visual efficiency	Improves learning

CPT, Current Procedural Terminology.

Box 4

Differentiating learning-related and medical services

Attempting to use the orthoptic procedure code (92065) to represent all the procedures conducted during vision therapy is no longer in the patient's or doctor's best interests. It places disproportionate emphasis on expectations of reimbursement for needed care, and encourages the parties involved to search for medically necessary labels. Indeed, if the principal aim of the therapy is not directed toward fusion, but is intended to develop visual processing with maximal transfer to learning abilities, then identification of the therapy as medically necessary is potentially fraudulent.[50]

In reviewing patient care records, some carriers have begun to deny appeals for multiple office sessions by noting that it does not meet the guidelines for orthoptic care. When we forward guidelines from optometric organizations such as the AOA or COVD, which support considerably more visits, they are careful not to dispute the efficacy of multiple visits, but to dispute equating optometric vision therapy with orthoptics. For example, a typical program of orthoptic treatment for convergence insufficiency might consist of only six weekly half-hour visits with an orthoptist with 10 to 15 minutes of daily home therapy.[51]

It therefore appears timely and necessary to dissociate medically necessary orthoptic services (CPT code no. 92065) from non-medical, learning-related vision services. I accomplished this in our practice through two major changes. The first step was to establish a Vision and Learning Center as a subcomponent of the practice, which would provide the physical framework for non-orthoptic services. The second step was to implement a vision-processing program in which the emphasis was clearly on perception and cognition rather than orthoptics. I elected to use a commercially available compilation of activities because of its management structure and compatibility with the model presented,[52] though there are other useful models of cognitively based optometric programs that are complementary to these concepts.[53,54]

Parents with children who have learning problems must stop focusing on insurance coverage as the principal determining factor in pursuit of visual-processing therapy. It is as inapplicable as consideration of whether or not to use the services of a private learning consultant based on third-party payment. At present, we will only enter into a discussion about potential insurance reimbursement issues if a primary care or sensorimotor examination justifies the principal concern in therapy as an orthoptic case type. If it is apparent that the principal concern relates to visual processing, then there is no discussion about insurance (*see* Box 4).

Optometrists who adopt the approach I am suggesting should explain that visual processing therapy is not a medical service and will be classified by health insurance carriers as educational in nature. As noted by Furth and Wachs,[55] education is constantly appealing to and utilizing the various information processing systems—most notably visual and auditory. However, parents must learn to appreciate that not every relevant service that supports education should be provided by, or paid for by the schools. The percentage of students who require visual processing therapy is relatively small, and it has therefore become an outside specialty rather than having become part of special education.[56] For select children it is an important part of the discrepancy between the child's capacity to learn and current levels of performance.[57,58]

Conclusion

Optometric vision therapy is a hybrid service comprised of orthoptics and visual processing therapy. The principal relationship of orthoptics to learning is indirect, and involves remediation of eye strain. Visual-processing therapy is distinct from orthoptics, develops and enhances visual cognitive function, and relates more directly to learning-related vision problems.

Understanding this distinction helps account for differences in

opinion about the relevance of optometric therapy to the learning process. It also provides the opportunity to focus on the delivery of necessary services without the entanglement of insurance issues. Orthoptics is a medically related service predicated on disease entities (ICD-9-CM classifications), meets ophthalmology's limited definition of vision, can be dissociated from the brain and learning, and may be subject to the vagaries of third-party reimbursement.

Visual processing therapy—rooted in optometric applications of behavioral and cognitive science—helps people learn more effectively and is not classified as a medical service.

Practitioners must assist patients in understanding that visual processing therapy is a service that may be necessary, even though it is a non-medical service. As a non-medical service, it is removed from considerations of medical necessity and value judgments by physicians or third-party carriers. Educationally supportive services (such as visual-processing therapy) can have a significant impact on a child's present and future achievement, and may be warranted even though payment is solely the patient's responsibility, and not that of an insurance company or school district.

The distinctions I have made between orthoptics and other forms of vision therapy have been alluded to elsewhere.[59] It is also pertinent to note that before the prevalence of third-party payment for optometric services, optometrists effectively communicated the benefits of vision therapy to patients—along with their financial obligation to pay for services rendered. Rather than being constrained by the designations of what is medical care and what is not, providers and patients must reach back to a time when deciding what was in a child's best interests was their decision. Some things are still worth investing in.

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Editorial: Optometric Vision Therapy & Training for Learning Disabilities and Dyslexia; DVD Surgery; Curing Complications of Strabismus Surgery

Since we started planning this issue, things have changed. As we go to press, we have yet a new war with optometry, this time over its efforts to achieve, in every state, laws to mandate preschool formal eye exams, not just screening, for all kids, by an O.D. (or an M.D.). This was revealed just this past week by the national press (see Hyde Park editorial, page 65) to be an effort by optometry and the eye glasses manufacturers to exploit this market for kids' glasses because, thanks to longer term wear contact lenses and the popularity of LASIK surgery, they aren't selling glasses like they used to.

In response, a press release just last night sponsored by the AAO, the AAP and the AAPOS, calling for "Increased Pre-School Vision Screening" instead of mandatory eye exams.

Under these circumstances, our lead guest editorial by an optometrist on a related area of contention should be a most popular item with our ophthalmologist readers- really dynamite!

Well, the new bone of contention is an addition to this older one, increasing the conflict - ***and the need for some sort of solution or resolution. It does no good for either or any profession to be having public disagreements and wars.***

Instead of trying to sway and persuade our legislators with more and more money to favor one professional group over the other, wouldn't it be better (and cheaper!) to find some common ground and objectives? Talking with your opponents is, I understand, the best way to open the door to accomplishing this. Dr. Press came to *our* meeting last year. In return, we gave him space to make his argument. Optometric journals have printed my letters and editorials. I plan to attend an optometric meeting myself in the near future. Maybe others should too.

Press LJ. The interface between ophthalmology and optometric vision therapy *Binocul Vis Strabismus Q* 2002; 17:6-11

First, for reference, note that we have reprinted the one page summary of the current AAO position paper, [inadequately] entitled: "Vision therapy for learning disabilities" on page 49. This is just the summary!- the entire statement is twelve pages long and we can send you a copy, or you can retrieve it yourself from the AAPOS website- or the AAO.

First, we would like to correct the terminology to describe or name it, properly, in such a way as to avoid the common and obvious confusion and unnecessary portions of conflict resulting. To wit, we think the proper name for the crux of the conflict should be as stated above in the title:

Optometric Vision Therapy (or Training) for Learning Disabilities and Dyslexia abbreviated hereafter **OVTTLDD**

If you don't do this, what is your defense to the lay public who asks: "You are an eye doctor? Then how on earth can you be opposed to "vision therapy" or "vision training"? Such treatment, by the common use of these words, almost just has to be OK, good and useful and recommendable, doesn't it? So how can you oppose "vision therapy" or "vision training"? Do you oppose it just because it is something practiced by a competing group of eye doctors? And tell me, what is the difference between an "eye doctor" and an "eye M.D.", anyway!!!

We must admit that optometry has successfully gained "the moral high ground" by adopting these terms. We know from the political wars, that just finding the best words can often win the battle. Now, just to offset their advantage in the contest we must and can only adopt more specific terms to chip away at their lead in this department.

Another one of *our* problems with "vision therapy" is just handling that term. We are inclined to feel such a title is largely false or misleading or both. We know that, baring specific ocular pathology, there is little or nothing one can do to make best corrected vision better than it is (except maybe now that we have wavefront technology for LASIK). In areas where apparently or presumably vision related performance can be changed or improved (as in athletes?), it is not "vision" per se that is being improved except in the broadest sense; rather it is perception that is somehow enhanced.

But this is really only a difference in thinking and semantics here - does vision = only "visual acuity", or is "vision" an appropriate term to describe also the entire sphere of binocular vision and perception, including reading. That, I think, is part of the difference and disagreement between the two disciplines.

But I am not opposed to the use of the term (generic) "vision training" (See my Hyde Park Editorial, **BV&SQ**:4(2): 92-93, 1989). "Vision training" is in fact what most of all education and learning is about. You know that if you have not been trained to SEE things that are there, you won't. Isn't 'most all your medical training in fact "vision training" - teaching you to recognize visually what you need to know? Did you recognize a retinoblastoma before you were "vision trained"? Did you know how to look for a cyclovertical muscle paresis before you were "vision trained" to recognize it? Since 80% of information is taken in through vision, but untrained vision is almost useless, I can say that I am very much in favor of "vision training" and in fact I use it all the time! It's called education!

Now many who practice such, freely substitute the word "therapy" for "training". That is what Dr. Press uses but please also notice in Dr. Press' appendices what is included under that term. It includes the prescription of spectacles, and/or prisms, the use of occlusion therapy, and even vergence treatment. So we as ophthalmologists already regularly use "vision therapy" all the time. Therefore we should not oppose it in general. We treat many cases of amblyopia with "vision therapy" every day! Maybe that is what we should say what we do when we talk to our patient's parents. "Vision therapy" sure sounds a lot better, more official and more professional than "patching"! (Could we possibly learn something from optometry? They do pay a lot more attention, in education and practice, to marketing and politics, than we do.)

We also undertake to treat all 14 of the conditions they list as "amenable to" OVTT save one, "visual processing deficits". In their appendix 2, under "amblyopia" we prescribe at least two of their six modalities and used to prescribe a third regularly; under "accommodation" we prescribe one of their five modalities; under "vergence", 2.5 of their six, and under "strabismus" two of seven methods.

In fact, since there are a number of items which overlap with what we do, how can we criticize general "OVTT" not otherwise specifically defined or delimited? If we do we are condemning ourselves - literally shooting ourselves in the foot. The fact of the matter is that we ophthalmologists practice "vision therapy or training" too, and regularly!:

A Personal Historical Note: I have found myself at war, one way or the other with optometry and optometric vision therapy for over 30 years. When I went to Chicago in 1969 to

take over the eye service at the Children's Memorial Hospital, the local optometrists were "all over" the school system, pitching everyone they could find, from parents to school nurses, about their vision training as a remedy for dyslexia, which was then just getting off the ground as a popular childhood disease.

My most memorable experience in this regard was undertaking the care of a young lady, ten years old with an esotropia, no learning disability. She was the daughter of a Chicago policeman. (They were Chicago heroes before 9-11 ever happened.) He had had to sell his home to pay for years of optometric vision training for her esotropia, which had not responded at all. We took good care of her for free.

Soon enough I found myself, as an "organized" pediatric ophthalmologist, an obligate supporter of organized policy statements to the effect that the eyes and vision had absolutely nothing to do with learning disabilities and dyslexia. In fact, I wonder even today if that acute "never" stance may have been an intentional overstatement to compensate for the great intensity of the optometric vision training offensive for dyslexia. It was at that time a response to a perceived attack on all "our" children!

Then I had a personal epiphany: My incoming journals began to pile up on my "to be read" table. And pile up and pile up... over a year. I just stopped reading. You could call it dyslexia - "a level of reading ability (i.e., zero) markedly below that expected on the basis of the individual's level of overall intelligence or ability in skills." I thought I had lost my intellectual or academic interest in things and even started to consider alternatives to my career of teaching and researching.

Then I got my first pair of bifocals. My dyslexia disappeared! And so did the piles of journals.

If early presbyopia (minimal insufficiency of accommodation) could give me the symptoms of dyslexia, is it hard to imagine how such might produce dyslexia or a subconscious dislike for reading or a learning problem in a school child?

We even wrote up my epiphany up for Bob Reinecke's column "Insights" in *Ophthalmic Surgery* 19(9):672-3, 1988.

This seriously influenced my thinking about dyslexia and learning disabilities since then. I think **the first medical step must be ruling out any and all eye and vision problems including minor or subclinical defects of the eyes, especially any deficiency whatsoever of accommodation or vergences.**

So I was hardy shocked when we received a report, submitted in 1984 for consideration for publication, from an orthoptist claiming a therapeutic effect on reading and learning disabilities from improving fusional vergences, nor when it passed the scrutiny of peer review (Atzmon D. Positive effect of improving relative fusional vergence on reading and learning disabilities. *Binocul Vis* 1985-86; 1:39-43). Publication caused such a ruckus that the authors went back and did it again, only better, and got the same result (Atzmon D, Nemet P, Ishay A, Karni E. A randomized prospective masked and matched comparative study of orthoptic treatment versus conventional reading tutoring treatment for reading disabilities in 62 children. *Binocul Vis* 1993; 8:91). This study and further editorials resulted in Dr. Press' first contribution to **BV&SQ** and some other very interesting Letters (Atzmon D, Romano PE, Ticho BH, Nemet P, Press LJ, Greenburg RM. An interdisciplinary round table of correspondence on dyslexia, learning disabilities, orthoptics, convergence exercises, vision training, vision development and optometric vision training. *Binocul Vis* 1994; 9:91-95). All this did not resolve the debate or the question. Rather, it only seemed to feed it!

As both Leonard Apt and Gunter K. von Noorden attest by quotation elsewhere in this issue, (pages 7 & 64 respectively), ophthalmologists have tended to dismiss such problems as significant, to learning disabilities or even otherwise.

The most difficult task I had over the years was teaching the importance of accommodation problems, both to monocular vision and to binocular vision and alignment. I really had to pound and pound and pound it into my students, orthoptic and ophthalmologic. How often we had to have patients come back specifically for examination of accommodation because they got "dropped" before anyone thought about that sort of a problem. In fact, I think our capability to dilate and cycloplege our patients may be an outright handicap to our studying and appreciating accommodation and subtle defects thereof. In most outpatient ophthalmology facilities, a technician routinely and without much thought takes a vision and if there is no obvious strabismus, directly immediately "drops" the patient. The optometrist who cannot or does not routinely instill cycloplegics early in an exam has the benefit of having a live patient who can still respond physiologically to the examination of their accommodation and vergences.

But back to the conflict: In an earlier and longer version of his essay, Dr. Press gave many examples of not very professional direct attacks by pediatric ophthalmology and/or individuals on optometric vision therapy.

This is not good and it doesn't work anyway. We are not going to persuade the ODs to stop optometric vision therapy and training. And we are not going to persuade the public to avoid them. We do give both professions a black eye by fighting about it, and similar matters.

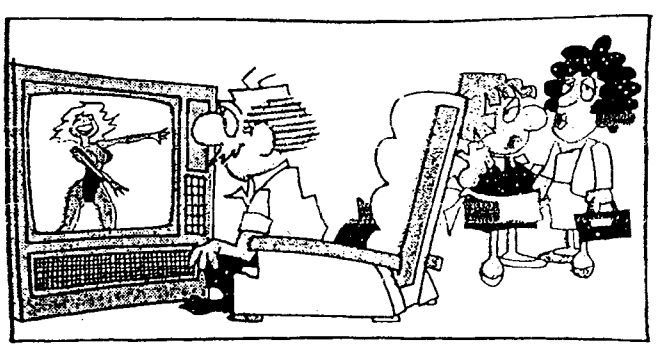
If you insist that one party must be right and the other is wrong, then I would ask you to consider how often that turns out to be a poor method in the long run:

1. I know I have been wrong many times in my life about both medical and non medical business.

2. Organized medicine (i.e., the AMA) has been terribly wrong about a lot of things over the years. Just look how successful organized medicine has been in warring against chiropractic... or all the other forms of alternate medicine!!! Did you know there are now 600 veterinary chiropractors who treat both human patients and their pets! That's as many as "us".

3. Organized ophthalmology (i.e., the AAO) has been wrong about a lot of things over the years including contact lenses and refractive surgery and IOLs (Apple DJ. Sir Nicholas Harold Ridley, 1906-2001.[Obituary] *Am J Ophthal* 2002; 133:131-133).

4. Many of my fellow ophthalmologists have been error-prone (i.e., wrong) in their research, as we found for traumatic



"HE'S EXERCISING HIS EYES."

"THE LOCKHORNS" BY BILL HOEST

hyphema, after meta-analysis, that 57% of ..."papers reviewed have serious flaws and doubtful or uncertain results or conclusions." - See Romano PE, Phillips PJ. Traumatic hyphema: A critical review of the scientifically catastrophic history of steroid treatment thereof; and a report of 24 additional cases with no rebleeding after treatment with the Yasuna systemic steroid, No Touch Plus protocol. *Binocul Vis* 2000; 15:187-196. There are more examples in the literature.

5. Many of my fellow scientists are terribly wrong about statistics and "statistical significance:" Most still believe that a totally arbitrary and unfounded traditional probability of <0.05 is more important than "medical/clinical significance" (Romano PE. Why and how we should replace "statistical significance" with "medical/clinical significance". *Binocul Vis* 1999; 14:39).

6. We cannot even define what are acceptable scientific studies: The AAO believes that any study short of random controlled trials (RCT's) should be disregarded. This is wrong, as good observational studies give the same results (Benson K, Hartz BK. A comparison of observational studies and randomized, controlled trials. *N Engl J Med* 2000; 342:1878-1886).

7. I have other examples not fit for publication!!!!

So why should I think that my fellow ophthalmologists are correct about dyslexia and learning disabilities virtually never being a real eye problem and amenable to some eye/vision directed therapy?

I must trust my own 30 years of personal experience. There is no doubt in my mind that the exams most orthoptists, ophthalmic technicians and ophthalmologists, including pediatric ophthalmologists, perform for the learning disabled or the dyslexic child are too often inadequate or incomplete and are unable to find these "subtle abnormalities of monocular and binocular vision which may give rise to these problems..."

Also I simply do not believe the current organized ophthalmology-pediatric ophthalmology mantra that virtually nothing with regard to binocular vision (except maybe convergence insufficiency) can be affected, altered or improved by anything other than surgery. There are too many other areas in medicine where change is achieved without drugs or surgery.

But I wonder if attending that AAPOS meeting changed any of Dr. Press' views on OVTTLDD? He didn't say so.

Guest Editorial: The Interface Between Ophthalmology And Optometric Vision Therapy

LEONARD J. PRESS, O.D., FCOVD, FAAO

ABSTRACT: Considerable disparity lies between ophthalmologic impressions of optometric vision therapy, and the reality of optometric vision therapy as practiced in the United States. The viewpoint shared by ophthalmology in particular, and the medical field in general, is one that is filtered through organizational policy statements and the isolated experiences of influential individual practitioners. This has resulted in a skewed portrayal of optometric vision therapy. The purpose of this paper is to present a balanced perspective on this subject, and one that should be of assistance in creating an interface between ophthalmology and optometry that better serves the public.

INTRODUCTION

The impetus for this paper stems in part from a meeting that I attended almost a year ago on March 21, 2001 in Orlando, Florida. Reviewed in a prior issue of this journal (1) the meeting entitled "Why Can't EYE Learn?" was jointly sponsored by the Jefferson Medical College and the Section on Ophthalmology of the American Academy of Pediatrics (AAP). The subtitle of this meeting was: "Learning Differences and Visual Perception from a Pediatric Ophthalmology and Neuropsychology Perspective."

My participation during this meeting was serendipitous. Dr. Harold Koller, whom I had known from my days in the Philadelphia area, was the Chair of the meeting. During his presentation, Dr. Koller made several passing references to optometry and vision therapy. Following his invitation to me to give a short [impromptu] presentation on the subject, I joined the group on the podium for a panel discussion. The questions to me from the audience touched on six areas of concern that I will address at the end of this paper.

THE EVOLUTION OF OPTOMETRIC VISION THERAPY

To appreciate the science and substance of optometric vision therapy, it is insightful to consider vision therapy as an outgrowth of orthoptics. This evolution has been chronicled in detail elsewhere (2), and several points need to be elaborated. Although ophthalmologists pioneered orthoptics, it was neither cost- nor time-effective in their hands. Orthoptics had its heyday from early to mid 20th century, but was gradually transformed from an active therapeutic service into a marginal service. The number of certified orthoptists in the United States dwindled, and those remaining progressively engaged in assisting with pre- and post-strabismus surgical measurements and monitoring rather than in performing non-surgical therapeutic services. The service itself was diluted from an active approach to amblyopia and strabismus therapy to a passive approach for a handful of convergence problems.

This raises an obvious question. Why, if orthoptics was efficacious for a broad spectrum of binocular applications, was the field virtually vacated by ophthalmology? The answer, to be succinct, is that orthoptics was more than most ophthalmologists could manage. This belief is supported by an authoritative textbook on orthoptics from 1949 by Mary Everist Kramer, supervisor of the Orthoptics Department at the George Washington University Hospital in Washington, DC (3). The text was edited by Ernest A.W. Shepard, M.D., Professor of Ophthalmology at the George Washington University School of Medicine. In the Preface, we find the following candid observation:

> "When ophthalmologists discuss or write about orthoptics, their views are generally based upon the work of an orthoptic technician, the results of whose work they have observed. Since few ophthalmologists have had the opportunity to observe good orthoptists, there is a wide variance of opinion regarding the role of orthoptics in the treatment of ocular imbalances."

Consider the following guidelines for successful orthoptic treatment as outlined by Kramer (pp. 154-169):

1. Necessitates frequent office visits at first, with gradual reduction as the training is carried out at home.
2. Approximate length of time of treatment is usually from two months to two years.
3. If surgery is indicated, the ophthalmologist may prefer to give orthoptic training before surgery, or institute surgery before orthoptic training. The decision rests upon the type of case, the age, the physical and mental development of the patient, the cooperation of the patient and parents, and the ease or difficulty of making weekly visits to the doctor's office.
4. The training must be intensive to be effective. Breaks in training should be given when the child reaches a point of saturation after intensive training.
5. More than treating "a pair of eyes", orthoptics consists of treating the person as a whole, since much of the success of restoring normal binocular vision depends upon the personality, cooperation and enthusiasm of the child.
6. Training should be adapted to a child's mental capacities as well as to his ocular skills. Some children learn faster than others, some retain knowledge better than others, some have greater concentration ability than others, some are more attentive than others.
7. Causes for failure in orthoptics include inexperience or poor judgement on the part of the ophthalmologist or orthoptist, and termination of orthoptic training before establishment of good binocular stability.

8. Success in administering orthoptics hinges on a personality profile of dignity without arrogance, humility without subservience, mental alertness without perceptive tension, and necessary forcefulness without aggressiveness.
9. The ability to impart knowledge is the essence of orthoptic training, for in reality it is a course of instruction which the orthoptist gives to the patient. A good orthoptist possesses an artistic temperament and intelligence with all the virtues. She is teacher, nurse, friend, confidante, advisor, and healer to the patient. Her enthusiasm and genuine interest can make the difficult seem easy. These qualities are the piece de resistance in the accomplishment of a rapid and lasting cure for her patients.

Ophthalmologic practice drifted from the holistic attributes required for success as outlined by Kramer. As ophthalmology was becoming an increasingly medical and surgical practice, optometry in mid-century was rendering vision therapy services well-suited to the attributes for orthoptic success. Another text published in 1949 is essential in understanding the pivotal role that optometry was about to play. Entitled "Vision: Its Development in Infant and Child", this text, by Gesell et al, represented a fusion of optometry, ophthalmology, orthoptics and psychology (4).

Pediatric ophthalmologists should be conversant with the collaboration that took place among these fields at the Yale Clinic of Child Development. Arnold Gesell, MD, and Frances Ilg, MD were substantially aided by Vivienne Ilg, OD and Gerald Getman, OD in this effort. Their work was unparalleled in the field of child development. The melding of orthoptics with an optometric perspective served to broaden the basis for optometric vision therapy as it would be practiced in the second half of the 20th century. Permit me to quote from the preface of this text:

> "The authors have attempted to achieve a close acquaintance with the interrelations of the visual system per se and the total action system of the child. This finally entailed the use of the retinoscope and of analytic optometry at early age levels where these technical procedures are ordinarily not applied. The examinations of the visual functions and of visual skills were really conducted as behavior tests, not only to determine the refractive status of the eyes, but also to determine the reactions of the child as an organism to specific and total test situations."

Although the Yale physicians anticipated ophthalmologic interest in this work, that was not to be the case. The Optometric Extension Program, and the optometrist A.M. Skeffington in particular, proved to be influential in post-graduate studies in vision development and vision therapy. They are acknowledged by Gesell et al in the preface to their text. In contrast, one is hard pressed to find a reference to the work done at the Yale Institute of Child Development in traditional ophthalmologic sources. This is not as much an oversight as it is evidence of the disinterest of ophthalmology at that time in visual development from a behavioral perspective.

OPHTHALMOLOGIC INITIATIVES TO DISCREDIT VISION THERAPY

Nature abhors a vacuum and, as optometrists began to improve their patients' performance through vision therapy programs, ophthalmologists found themselves having to address inquiries about how a child's vision might be influencing behavior, development, or school performance. In 1972, the AAP, the American Academy of Ophthalmology and Otolaryngology (AAOO), and the American Association of Ophthalmology issued a policy statement entitled "The Eye and Learning Disabilities", which denied any relationship between vision and learning. The inaccuracies in this policy statement were swiftly pointed out in an article in the *Journal of the American Optometric Association* by Flax (5).

Despite Flax's scholarly refutation of the points raised in the 1972 paper, an ad hoc working group of the American Association for Pediatric Ophthalmology and Strabismus (AAPOS), and the AAO, issued a policy statement in 1981 entitled "Learning Disabilities, Dyslexia, and Vision" offering conclusions similar to those in 1972. Again Flax, this time with two associates, authored a scholarly response considering each of the points raised (6). The article unmasked the sweeping negative generalizations aimed at optometry with no conclusive supporting documentation. It pointed out how the references offered are misconstrued, nonapplicable and grossly distorted.

Organized ophthalmology not only chose to ignore the legitimate critiques of its policy statement, but conscripted the AAP in its efforts. As recently as 1998, a subject review of this area chose to depict visual training as controversial, unscientific and virtually irrelevant to learning (7). Published in the journal *Pediatrics*, this joint policy statement was the latest in an effort to ensure that as many parents as possible would be dissuaded from undertaking optometric vision therapy. It is important to note that the pediatric/ophthalmologic policy statements overlooked a landmark paper (8) published in the *Journal of the American Optometric Association* on the efficacy of optometric vision therapy, including over 200 references. More recently, a joint policy statement was issued by the American Academy of Optometry and the American Optometric Association, pinpointing flaws in the criticisms of ophthalmology and pediatrics against optometric vision therapy (9).

In one of the more candid discussions to appear in print on this subject, several pediatric ophthalmologists revealed their concern about the collective insouciance of their profession. Their remarks can be found following (in Discussion of) a paper in the highly esteemed *Transactions of the American Ophthalmologic Society* in 1989 by Mazow et al (10) on accommodative and convergence insufficiency, and its relationship to learning. Consider the following remarks (by Leonard Apt, MD, page 171):

> "My impression is that many ophthalmologists handle this disorder poorly. Too often they consider most cases of asthenopia in young persons as instances of uncomplicated convergence insufficiency and treat these patients with simple [visual] push-up exercises. This unsophisticated approach oft times is not helpful and

APPENDIX 1: PRIMARY DIAGNOSTIC CONDITIONS AMENABLE TO OPTOMETRIC VISION THERAPY*

Diagnostic Condition	ICD-9-CM CODE
Accommodative excess	367.53
Accommodative insufficiency	367.50
Accommodative infacility	367.50
Amblyopia	368.01
Convergence excess	378.84
Convergence insufficiency	378.83
Divergence excess (DE)	378.24
Divergence insufficiency (DI)	378.85
Esotropia	378.35
Exotropia	378.15
Intermittent exotropia (DE or basic)	378.23
Intermittent esotropia (DI or basic)	378.21
Vertical deviations	378.43
Visual processing deficit(s)	315.90

- The clinical practice guidelines delineating these diagnoses can be found in the following monographs published by the American Optometric Association (St. Louis):

1. Care of the Patient with Strabismus: Esotropia and Exotropia (1995)
2. Care of the Patient with Accommodative and Vergence Dsyfunction (1998)
3. Care of the Patient with Learning Related Vision Problems (2000)

APPENDIX 2: SAMPLE METHODS FOR OPTOMETRIC VISION THERAPY

AMBLYOPIA

Sequence:
1. Appropriate Rx
2. Occlusion therapy
3. Eye-hand coordination
4. Ocular motor accuracy
5. Accommodative therapy
6. Fusion enhancement

Methodology:
For 1) and 2) standard approaches
For 3) letter tracking sheets; pointer-in-straw
For 4) Haidinger Brush device (foveal fixation)
For 5) loose lens accommodative rock
For 6) Polaroid vectrograms

ACCOMMODATION

Sequence

1. Appropriate Rx
2. Monocular accommodative stimulation
3. Monocular accommodative relaxation
4. Binocular accommodative stimulation
5. Binocular accommodative relaxation

Methodology

For 1) standard approach including multifocal if indicated
For 2) through 5) loose lens and lens flippers
For 2) through 5) letter charts of various sizes utilized at appropriate dioptric demand distances

VERGENCE

Sequence

1. Appropriate Rx
2. Monocular accommodative and ocular motor activities if evidence of inequality OD vs, OS
3. Bi-ocular phase of 2) if suppression evident
4. Physiological diplopia therapy if spatial localization deficient
5. Expansion of fusional vergence ranges
6. Integration of accommodative and fusional vergence ranges

Methodology

For 1) standard approach using prism if indicated
For 2) amblyopia and accommodation above
For 3) septum or prism dissociation
For 4) Brock string (beads)
For 5) Computerized random dot stereograms/adapted stereoscopes
For 6) Stereoscopes; orthopic and chiascopic fusion/lens flippers

STRABISMUS

Sequence

1. Appropriate Rx
2. Monocular accommodative and ocular motor phase
3. Monocular activities in a binocular field
4. Anti-surppresion; bi-ocularity
5. First, second, third degree fusion (select free space or instrument stimuli based on correspondence and depth of suppression)
6. Integration of fusion with vestibular-motor feedback
7. Integrate sensorimotor functions including accommodation (including AC/A and CA/C effects)

Methodology

For 1) standard approach using multifocals and prism if indicated
For 2) anaglyphic or polaroid targets
For 4) anaglyphic, septum, or prismatic dissociation targets
For 5) major amblyoscope; adapted mirror sterescopes; computerized vergence stimuli
For 6) egocentric/oculocentric balance activities (may preceed anti-suppression when indicated by clinical assessment)
For 7) orthopic and chiascopic free space fusion stimuli with lens flippers and variable viewing distances and angles

the patient leaves dissatisfied. Many ophthalmologists do not fully appreciate the role and function of the process of accommodation and convergence, their interrelationship, and how to study their dysfunctions. Thus proper treatment is not given. Many of these patients end up under the care of optometrists."

But Optometry has clearly demonstrated its body of knowledge in this area, with notable works that summarize its clinical relevance and validity (11-13). Ophthalmology has not undertaken Dr. Apt's challenge to develop a more sophisticated clinical approach to vision problems that contribute to learning difficulties. Rather than objectively evaluate ongoing optometric contributions to this field, ophthalmology continues to take a simpler and less responsible approach. The quintessential low road was taken in an article published several years ago in *Review of Ophthalmology*(14). Dripping with innuendo, the title of the article "Is Vision Therapy Quackery?" speaks for itself.

Permit me to illustrate the sensationalism of this approach with an analogous title for a prospective article: "Is Strabismus Surgery A Hoax?" In such an article I might point out that strabismus surgery was accepted as a legitimate approach in medicine without the benefit of controlled scientific studies, and that its outcome as other than a cosmetic cure relies principally on anecdotal evidence. Even if I were to present an even-handed analysis, I have successfully cast aspersions by virtue of how the question of its efficacy was couched.

The shallow intentions of the "Quackery" article, and its willful or unintended ignorance of studies that should have been evaluated, were exposed by one of the foremost optometric researchers in accommodation and convergence, Dr. Jeffrey Cooper (15). However, as has been our experience in optometry, no matter how thoughtful and scholarly our responses are to the ophthalmologic aspersions cast on optometric ision therapy, the negative campaign continues.

FALLACIES INHERENT IN OPHTHALMOLOGIC CRITIQUES OF VISION THERAPY

The picture painted thus far does not seem to bode well for bridging the gap between ophthalmologic and optometric viewpoints about optometric vision therapy. However, several observations may serve ophthalmologists and pediatricians well in their efforts to serve as informed patient advocates. There is a common flaw that is shared by the joint organizational policy statements of ophthalmology and pediatrics, Koller's quackery article, and the opinions of local ophthalmologists inclined to discredit optometric vision therapy and its practitioners. It is counterintuitive that material taught in every College of Optometry in the country, and for which there are definitive clinical practice guidelines issued by a national professional organization in existence for over 100 years (16), has no basis. This was brought to the surface by Jeffrey Bauer, Ph.D., Fulbright Scholar and Kellogg Foundation National Fellow, who noted:

> "Regarding the related insinuation that optometrists simply do not know as much as ophthalmologists, I have from firsthand experience developed considerable skepticism about the scientific basis of many things done by physicians. Several years ago - which means things should have improved in the meantime - I served as an expert witness in a hearing involving the scientific validity of optometrists' use of vision training to correct strabismus (misalignment of the eyes). Ophthalmologists had charged that the optometric research on vision training did not prove that vision training worked. They were right; some optometric literature on the subject was scientifically flawed. However, I also evaluated the research that ophthalmologists used to defend their surgical approach to correcting strabismus. The literature on surgical correction was no more scientifically valid that the comparable studies on vision training. Physicians who live in glass houses should not throw stones (17).

How does the public view the conflicting opinions of organized optometry and ophthalmology? They're likely to be reminded of the classic *New Yorker* cartoon that borrows a line from Gore Vidal. In the cartoon, two dogs wearing suit and tie are seated at a bar sipping martinis. One looks at the other and declares: "It's not enough that we succeed. Cats must also fail". Public savvy is a strong reason why The White House has issued a statement every year, for the past decade, honoring August as Vision and Learning Month.

All this begs an obvious question: If optometric vision therapy is unsubstantiated and misguided, how does it survive in the marketplace? Consider the following: Optometrists are rarely, if ever, the first professionals consulted when parents find their children struggling to learn. Optometrists who practice vision therapy are therefore seeing a skewed population, typically of children who are not performing to levels of realistic expectation in school. More than likely, they have been through a number of assessments and interventions prior to coming to our offices. Physicians harbor the notion, evident in the language of organizational policy statements, that a proposed course of optometric vision therapy when indicated somehow deters unsuspecting parents from pursuing necessary and proven courses of action. On the contrary, this fallacy is actually the basis for success of many patients in optometric vision therapy.

In many instances optometric vision therapy is successful in helping patients precisely because they have had other interventions which have ignored pertinent visual abilities. In other instances visual problems trivialized by other professionals, or the effective sensory integration of visual abilities to facilitate motor planning and multi-tasking, is lacking. *If optometric vision therapy were principally "tender, loving care", or a Hawthorne effect, the prior interventions the child had would have already supplied that effect.* Why would optometric vision therapy supply more of a Hawthorne effect than occupational therapy, or remedial reading, or music lessons, or the myriad of activities in which today's parents engage their children? It is more likely that optometric vision therapy is helping the patient

develop abilities that were a legitimate missing link in the learning process. In acquiring improved visual processing abilities, the patient is in a better position to benefit from traditional educational interventions.

IMPROVING THE INTERFACE TO BETTER SERVE THE PUBLIC

Answers to the questions posed to me last year in Orlando by pediatric ophthalmologists during the panel discussion of "Why Can't EYE Learn?" will not immediately bridge the chasm between ophthalmologic and optometric points of view, but are important steps in the right direction. Close inspection of these answers may influence ophthalmology and pediatrics to channel its efforts in patient advocacy toward interventions that truly warrant skepticism. Optometric vision therapy has stood the test of time and the metric of clinical science to the point where the practice of deterring patients from seeking this service becomes questionable.

Q1. Where is the scientific basis for vision therapy?
Ans. As mentioned, Dr Cooper's recent scholarly article (15) provides the latest references that clearly substantiate the scientific basis of optometric vision therapy. Clinical Practice Guidelines are available from the American Optometric Association on the Care of the Patient with Learning Related Vision Problems, Accommodative and Vergence Dysfunction, Amblyopia, and Strabismus. The research presented is commensurate with clinical research in fields such as occupational therapy, and is equal to or better than research traditionally presented for clinical methods in pediatric ophthalmology.

Q2. How do optometrists know which patients might benefit from vision therapy?
Ans. The Four Clinical Practice Guidelines from the AOA mentioned above provide clear guidelines for differential diagnoses. Textbooks referenced in this article, in addition to others available, provide this as well.

Q3. Is it true that optometric vision therapy patients are "in for life?"
Ans. Nothing could be further from the truth. The clinical practice guidelines above, in addition to guidelines issued by the College of Optometrists in Vision Development (COVD) (18) based on ICD codes for various conditions, are proof that this is not the case.

Q4. How might I judge if a patient is in need of optometric vision therapy, or if a person I am referring the patient to is a credible provider?
Ans. *All* optometrists receive graduate education in and are licensed to practice vision therapy. The Optometric Extension Program (www.oep.org) provides post-graduate education encompassing vision therapy. The COVD (www.covd.org) provides a board certification process, and has a national directory of providers. The American Academy of Optometry has a diplomate program in binocular vision and perception as well as in pediatric optometry.

Q5. Why is optometric vision therapy so expensive?
Ans. It is intriguing that physicians don't ask the same questions regarding the expense, scientific underpinnings, and pertinence to learning of occupational therapy, which they endorse far less critically, despite the obvious parallels between the two fields (19). To answer the question directly, the fees for vision therapy services are commensurate with other therapy procedures involving similar bodies of knowledge and time expended. Aside from the doctor's time in evaluating the patient, there are often prior reports to read that are pertinent to decisions about optometric intervention, time spent programming and sequencing activities to strike an effective balance between office and home therapy, and time spent with therapists to discuss ongoing progress.

Q6. Why does vision therapy work when it does? Eye problems shouldn't have anything to do with LD or ADD since these are CNS or brain problems.
Ans. The retina *is* brain tissue. Dissociating the role of the eye in visual processing from brain function is an artificial distinction. With regard to learning and attention systems, principles of cognitive neuroscience substantiate that interventions directed toward sensory and motor eye functions have a salutary and pervasive effect on central processes of the brain.

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