The Relationship of Motility Problems to Reading Problems

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Introduction. Normal reading incorporates two major criteria: speed and comprehension. Yet, it is soon apparent that the varying ability of human performance prevents rigid adherence to these criteria, and exceptions become common. We will grudgingly tolerate an inverse relationship between the two criteria as normal and quickly agree that a child faltering on both criteria is a reading problem suspect.

However, the majority of children learn to read with very little difficulty. Even the less than normal child is capable of mastering the task with adequate effort. Moreover, we are currently spending comparatively little time with the successful reader and devoting most attention to the small percentage of children who fail to learn during the prescribed time.

Lack of success in clarifying the mechanism of failure in these children has brought about the abuse of the diagnosis, dyslexia. The word is now applied to a number of other problems which interfere with the learning process including emotional problems, low intelligence quotient, disinterest, and even ophthalmological disorders. The abuse has received little recognition as the word continues to appear. Some of this may be due in part to only a vague understanding of the neurological mechanisms involved in reading failure, but the mechanism of failure is quite easily defined when the eye is involved as a cause of poor reading, permitting the ophthalmologist to perform a specific task in the care of reading problems.

Interpretation of the printed word, symbol, or letter is a function of the central nervous system. It can be logically argued that it makes little difference by what pathway the message gets to the brain; the process of reading by interpreting the printed word can occur as long as an impulse, properly coded, has a certain minimal clarity. For example, recent experiments (1) using a tactile stimulator strapped to the skin of a blind patient demonstrated beyond question that he was able to read printed matter without ever having used his eyes. That is not to say the eyes are not a very valuable part of the reading process, but it is to say that an important part of reading occurs in the central nervous system. The eye is unsurpassed as a convenient and valuable camera providing input for the central nervous system in the reading process. It is this distinction between input and interpretation that allows one to specify the ophthalmologist's tasks so clearly. The ophthalmologist is primarily concerned with the input system, obviously the eye, for the reading process. It then becomes only necessary for the ophthalmologist to discover any process interfering with minimal clarity in the visual input system so that he can proceed, when possible, with a remedy.

There are four categories of ocular disorders that can potentially interfere with the reading process. They are refractive errors, strabismus, nystagmus, and pathologic loss of vision.

Refractive Errors. Correctable interferences with minimal clarity are the routine refractive errors encountered in the every day practice of ophthalmology: hyperopia, myopia, and astigmatism. My-

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opia, or nearsightedness, describes the child seeing very well within a few inches of his eyes and not seeing well at a distance. If the myopia is of a minor nature, the child can perform close work without lens correction but falters on tasks requiring clear vision at greater distances such as seeing a blackboard. With larger degrees of myopia, even a book held by the child at the usual reading distance is slightly blurred, and glasses are required.

Frequently with hyperopia and astigmatism, a young child has enough reserve accommodative strength in his eyes to clear the image for short periods of time. This introduces a fatigue factor. The child may perform well for short periods of time and soon become disinterested with the onset of fatigue. Therefore, hyperopia and astigmatism of a significant degree are strong indications for prescribing glasses in a school child.

It should be apparent that a child failing to perform the reading task because of an uncorrected refractive error should have lenses prescribed by the ophthalmologist. The cure rate is virtually 100%.

Strabismus. There is another quality of vision that must also be considered. Having two eyes (or two cameras) furnishing central nervous system input adds an additional burden on the visual system since it requires coordination, both motor and sensory. The advantages gained by this requirement are primarily in depth perception and increased peripheral range of vision. However, neither is a requisite to reading. Under normal circumstances, one has to see a single image in order to interpret visual information efficiently without confusion. Diplopia is an intolerable confusion to the central nervous system. Therefore, reading becomes virtually impossible when the lack of coordination between the two eyes is severe enough to result in double vision.

Reading is quite possible, frequently no more difficult than normal, if the absence of binocular coordination does not result in diplopia. For example, if there is failure to establish normal binocular coordination in the developing central nervous system of the child, compensatory sensory changes develop eliminating diplopia. With the onset of strabismus, the central nervous system soon ignores visual input from one eye as a response to an intolerable situation, diplopia. Suppression usually occurs intermittently at first as strabismus is frequently intermittent in the early stages. It later becomes a fixed pattern, and the child is no longer bothered with diplopia. Nature has thus provided a compensation for an intolerable situation. The visual input from the eye, though decompensated under these circumstances, is still adequate to perform with efficiency any visual task except refined depth perception and wide-angle viewing. Therefore, learning to read proceeds normally in the face of strabismus as long as the child has suppression, absence of diplopia, and adequate vision in the fixing eye.

Manifest strabismus is classified as a tropia state and latent strabismus as a phoria state. These suffixes identify whether the deviation is obvious, and we refer to exotropia, exophoria, and so forth, with diagnostic implication. There is another distinction that separates the two states even more solidly. The tropia, or manifest strabismus, implies suppression, and the phoria, or latent strabismus, implies absence of suppression. Practically, if the phoria becomes decompensated, as with fatigue, diplopia becomes the major symptom. Since diplopia is an intolerable confusion, it must be remedied to proceed with the learning task in reading.

Not all phoria states are symptomatic, and some children have built up considerable reserve strength allowing them to perform routine visual tasks without difficulty. Indeed, one of the goals of orthoptic or eye exercises is to build up the reserve strength and allow such a patient to perform without symptoms. It should be emphasized that this is the only time that eye exercises have any value in the treatment of reading problems. Even so, the eye exercises accomplish nothing more than a temporary goal and never cure anything permanently.

Small degree phoria states are also amenable to prismatic correction. A prism introduced in front of either one or both eyes can readily correct the entire deviation of a small degree strabismus and relieve fatigue symptoms. Prisms, like orthoptics, effect only a temporary relief of symptoms and are not curative.

Larger degrees of phoria state are beyond the reach of orthoptic exercises and prisms. Larger strabismus deviations require a constant exertion of large degrees of reserve strength, and there is comparatively little increase resulting from eye exercises. Prismatic correction is limited because the larger the prism, the greater the distortion in vision. The point is soon reached where vision is blurred below the passable level for reading.

It is also pertinent that a small amount of exophoria is normal, and any esophoria is abnormal.

The problem becomes increasingly complicated because many school systems are using diagnostic machinery with a built-in esophoria bias. Many of these have optical systems which induce a reflexive convergence of the eyes, which is then interpreted by the untrained observer as an esophoria. Such a false positive is usually discovered and remedied with an adequate examination in an ophthalmologist's office.

Phoria states are only permanently cured by surgery. One is justifiably reluctant to recommend surgery on small degree phorias. Conservative measures are more applicable. Conservative measures are also the proper choice for large degree phorias in the initial stages. If it becomes apparent that a large degree phoria causes chronic discomfort, then surgery is definitely indicated.

So far, the explanation of suppression has been elaborated only as it applied to visual infants. The child becomes a visual adult very early in life, or at approximately five years of age. After the visual apparatus has matured to its maximum level, it is no longer possible to learn to suppress vision as it is recognized in strabismus patients. Therefore, an adult acquiring strabismus (usually paretic) does not have the compensatory mechanism available to him as the young child, and diplopia becomes chronic. Then strabismus becomes a much more complicated and difficult problem. The best effort is usually surgical and directed towards the goal of getting the eyes straight in the primary position first and in the reading position second. Sometimes, with severely paretic states, even this is not possible. Some form of compensatory prism or head tilt becomes necessary for reading. A desperation treatment is simply to patch one eye while reading. Although effective, it is not the most desirable result.

Nystagmus. Nystagmus affects reading only insofar as it reduces visual acuity. There are many classifications of nystagmus, and they are based primarily on the physical characteristics rather than the effect on vision. Consequently, dealing with the classification of nystagmus as it relates to reading problems has little significance. Again the requirement for reading relates to a certain minimum of input, that is, adequate vision. Congenital jerk nystagmus not infrequently reduces the vision to 20/60 or better which is quite compatible with normal reading development. The pendular nystagmus, so frequently associated with albinism, is commonly associated with markedly subnormal vision, usually 20/200 or less, and this imposes a severe restriction to the learning process. It is not germane to discuss whether reduced vision causes nystagmus or vice versa; it is only important to emphasize that nystagmus, as it relates to reading problems, is significant only if the visual acuity loss is associated with it. Therefore, if nystagmus is to be treated with a view towards improving reading, a major effort should be directed at improvement in visual acuity. This usually amounts to correcting the subnormal vision and refractive errors frequently associated with nystagmus.

Pathologic Loss of Vision. Subnormal vision that cannot be corrected by optical devices to normal vision presents a different problem to the reader. The minimal clarity necessary to reading depends entirely on whether enough magnification can be placed in front of the eyes. The minimally clear message can be obtained by increasing the size of the print. Frequently some combination is utilized such as excessive magnification coupled with a large print book in order to improve vision to the extent that reading is possible.

In many instances, there are large refractive errors associated with the uncorrectable subnormal vision, and a corrective lens becomes necessary on that basis also. Limited optics, both in the affected eye and the corrective lenses, disallow the normal pace in reading or learning to read. Therefore, it does become necessary to make allowances for the anticipated reduction in speed of the learning process in affected children. Yet, these children still may not be classified as dyslectic, and they are quite capable of eventually learning to read as well as a normal child with the only deficit being speed. Comprehension of the printed material usually relates to intelligence and not to the basic ocular defect.

The pathologic subnormal vision that creates a reading problem has to be binocular because one-eyed children learn to read just as fast as two-eyed children. If there is one eye with normal vision and a second eye with subnormal vision, that is not a reading problem. The binocular subnormal vision children are those who present the major problem. Fortunately, binocular macular diseases are unusual. Congenital toxoplasmosis, albinism, and bilateral amblyopia associated with nystagmus are the more common entities.

In summary, the ophthalmologist's role in caring for dyslectic children is simply caring for ocular problems. It is rather easy to separate the ocular

defects from the nebulous concepts of dyslexia or learning disability. It is also easy to make the decision when and to what degree ophthalmological care is indicated with a clear and attainable goal in sight. Eye exercises or so-called visual training have virtually no value. Practically, the ophthalmologist's most valuable tool in caring for dyslexia is honesty about his results.

REFERENCES

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