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# Optometric and educational considerations in the management of Attention Deficit Disorder/Attention Deficit Hyperactivity Disorder

## Abstract

The purpose of this paper is to review the current literature on Attention Deficit Disorder/Attention Deficit Hyperactivity Disorder (ADD/ADHD) and to explore the options for management of children with the disorder. The areas that are addressed include 1) a history and definition of ADD/ADHD, the signs and symptoms, the theories behind why ADD/ADHD occurs, the diagnostic procedures used to identify ADD/ADHD children, the role of the optometrist in this process, an overview of the treatment options, 2) an aid for teachers in the understanding of the visual problems associated with ADD/ADHD and the visual effects of drug treatment and the effects this has on classroom learning, and 3) vision therapy techniques and methods of classroom modification that help alleviate symptoms of ADD/ADHD.

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**OPTOMETRIC AND EDUCATIONAL CONSIDERATIONS  
IN THE MANAGEMENT OF ATTENTION DEFICIT  
DISORDER/ATTENTION DEFICIT HYPERACTIVITY  
DISORDER**

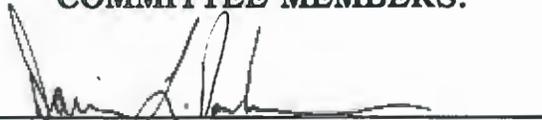
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In partial fulfillment for the Master of Education  
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at Pacific University

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## ABSTRACT

The purpose of this paper is to review the current literature on Attention Deficit Disorder/Attention Deficit Hyperactivity Disorder (ADD/ADHD) and to explore the options for management of children with the disorder. The areas that are addressed include 1) a history and definition of ADD/ADHD, the signs and symptoms, the theories behind why ADD/ADHD occurs, the diagnostic procedures used to identify ADD/ADHD children, the role of the optometrist in this process, an overview of the treatment options, 2) an aid for teachers in the understanding of the visual problems associated with ADD/ADHD and the visual effects of drug treatment and the effects this has on classroom learning, and 3) vision therapy techniques and methods of classroom modification that help alleviate symptoms of ADD/ADHD.

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## REVIEW OF ADD/ADHD

### Introduction

Many optometrists are aware that a strong link exists between learning disabilities and visual dysfunction. As a result, optometrists spend a good portion of their time working with the remediation of various vision conditions commonly associated with learning disabilities in a co-management situation with other doctors, parents, and teachers of the learning disabled child. While the number of Attention Deficit - Hyperactivity Disorder (ADD/ADHD) diagnoses increases in the school-aged population, optometrists acquire the responsibility of the cooperative treatment of these children for their condition. This paper is divided into three sections in order to illustrate some of the issues revolving around ADD/ADHD children in the schools. The first section introduces the history and definition of ADD/ADHD, the common signs and symptoms, the theories behind the occurrence of the disorder, the diagnostic procedures used to identify a child as ADD/ADHD, the role of the optometrist in differential diagnosis and co-management of ADD/ADHD, and an overview of the popular treatments for the condition. Second, this paper will focus more specifically on aiding teachers in the understanding of the visual problems associated with ADD/ADHD and the visual effects associated with the stimulant drug treatment of ADD/ADHD and how this relates to learning in the classroom. Finally, this paper will discuss vision therapy techniques as well as methods of teaching and classroom management that can help alleviate the symptoms of ADD/ADHD in addition to and in the absence of stimulant drug therapy.

### History of ADD/ADHD

Symptoms of Attention Deficit Disorder (ADD) and Attention Deficit Hyperactivity Disorder (ADHD) begin to appear in the medical literature several hundred years ago. One author notes the mention of "inattentiveness" in the writings of John

Locke in 1762 (Ford, 1990). Early definitions of the disorder focused on the notable hyperactivity displayed by these children and often associated this symptom with other disorders including mental retardation. In the 1930's, society more carefully considered the education of children in this country and it then became increasingly necessary to define and categorize the learning and behavioral difficulties that afflicted children in the school system. Better definitions of these problems could presumably lead to better treatments and effect a positive change over education in the United States. During this period of redefinition, researchers focused on the attention deficit issue as the main symptom rather than the hyperactivity. Thus, two similar classifications of the disorder evolved: attention deficit disorder with and without hyperactivity.

This reclassification of ADD/ADHD (published in 1980 in the Diagnostic Manual of Mental Disorders, Third Edition (DSM-III)) recognizes the disorders as separate conditions and requires children to have deficits in each of three primary areas: sustained attention, impulsivity, and motor hyperactivity (Fick & Lahey, 1991). This multidimensional approach to diagnosis allows for various factors to contribute individually to the overall diagnosis and then places ADD/ADHD on a continuum of severity (Ford, 1990).

Following the DSM-III, another revision of the manual known as DSM-III-R published in 1987, reclassified ADD/ADHD as one common unidimensional disorder. According to this most recent system, "a child is considered to manifest ADHD if he/she exhibits 8 or more of a list of 14 symptoms that reflect difficulties in attention, impulsivity, or motor hyperactivity; and where the onset of symptoms is before the age of seven" (Fick & Lahey, 1991, p. 164). This classification does not allow the characteristic symptoms of the disorder to occur independently of one another and makes it possible for a child to be labeled as ADHD even if they are not showing hyperactive behavior. In addition, research done by Fick & Lahey on how teachers classified ADD/ADHD behavior did not support the unidimensional model but rather showed that attention

deficits and motor hyperactivity have separate causes in the children (1991). This critical difference affects the efficacy of a treatment for ADD/ADHD.

In this paper, ADD and ADHD will be treated together with the understanding that all other aspects of ADD/ADHD including the diagnosis and treatment of the disorder remains the same for both cases. The one notable difference that involves the hyperactivity designation is the possibility that this symptom may be a reason that teachers and parents refer these children for diagnosis and special services. The hyperactive child tends to elicit more response from a teacher due to his behavior than a student with equal attention-deficit issues but without the hyperactive component.

### Signs and Symptoms of ADD/ADHD

The details of the psychological classification of ADD/ADHD, whether multidimensional or unidimensional, all require a specific set of behavioral signs and symptoms for the diagnosis of the disorder. Generally, ADD/ADHD children have a long term childhood pattern characterized by excessive restlessness and inattentiveness (Safer & Allen, 1976). The specific behavioral symptoms are classified into four major categories: Inattentiveness, learning difficulties, behavior, and immaturity. These behaviors typically begin in early to middle childhood and steadily decrease during adolescence. In order to meet the classification criteria, the symptoms must be consistent and stay with the child for several consecutive years rather than being present one year and gone the next. A learning disability often accompanies the restlessness and hyperactivity and may be due to the fact that the child cannot sit still and complete a task thereby undermining the learning process, or the learning disability may occur separately from the inattention. However, inattentiveness rather than hyperactivity makes more difference in the learning ability of the child (Norris & Hoffman, 1996). The learning impediments in ADD/ADHD children are generally perceptual-cognitive and occur in the area of language acquisition. The hyperactive children's symptoms persist mostly in

situations requiring the child to sit and listen for a prolonged period of time in a classroom, a church, or similar restrictive environment. Parents and teachers also often complain that the child talks excessively and never fully explores one particular thought before jumping to the next. These children display impulsivity, immaturity, trouble relating to peers and low self-esteem. Because of the potentially detrimental social effects of these symptoms on the growing child, it is imperative to understand why this occurs and how to prevent and treat these symptoms.

### Theories Behind the Causes of ADD/ADHD

The current theories as to why ADD/ADHD occurs center around a genetic predisposition that affects the neurological control centers for attention in the brain. Hynd hypothesizes that the genetic predisposition to ADD/ADHD can be triggered by exposure to environmental pollutants, chromosomal aberrations, and allergies (1991). The environmental pollutants such as lead poisoning cause a lag in the maturity of the central nervous system. Children with disabilities caused by chromosomal damage such as Fragile X syndrome, Down's syndrome, and Turner's Syndrome also may display the ADD/ADHD behavior characteristics. Ben Feingold, the author of The Feingold Cookbook for Hyperactive Children, (1979) implicates that allergies to food additives and dyes also cause ADD/ADHD, but other researchers (Hynd, 1991) have not been able to find a correlation between ADD/ADHD and particular food additives.

Specific insults to the fetus, either before, during, or shortly after birth can cause the lag in maturity noted with ADD/ADHD children (Table 1) and contribute to the development of the disorder (Safer & Allen, 1976). Safer & Allen note that these incidents are minor correlative features in the history of some hyperactives. However, most ADD/ADHD children did not experience these difficulties. The research does strongly support, however, that a familial history of learning disorders, behavioral disorders, and/or hyperactivity suggests a genetic predisposition for the disorder and

exposure to any of these insults may trigger presence of ADD/ADHD in children (Safer & Allen, 1976).

**Table 1: Factors Related to the Development of ADD/ADHD**

Vaginal Bleeding during Pregnancy
Preeclampsia resulting in swelling, high blood pressure and proteinuria during pregnancy
Low Birth Weight
Prematurity
Respiratory Distress
Slowing of the Heart Rate
Low Apgar Score
Congenital Disorders
Colic
Delayed Developmental Milestones
Incidence of Strabismus or an eye turn
Family History of ADD/ADHD

Based on the theory that a developmental lag in the central nervous system causes the symptoms of ADD/ADHD, much research has been done to isolate the most affected parts of the brain. According to Hynd, the structures implicated involve areas thought to regulate arousal states and motor control (1991). These structures include the thalamus and hypothalamus, the reticular activating system, the frontal lobe, and several other related structures. The underlying commonality between these structures is their use of the catecholamine neurotransmitters. The treatment methodology centers around the hypothesis that by supplementing the ADD/ADHD children's catecholamine supply, the brain may be able to function more properly.

#### Diagnosis of ADD/ADHD

The initial suspicion of the need for an ADD/ADHD diagnosis comes often from teachers and parents who have the opportunity to observe a child in particularly troublesome settings, such as in learning environments. The parent must obtain the medical opinion of a pediatrician, psychologist or other doctor qualified to make the diagnosis of ADD/ADHD. If an optometrist suspects that a patient has ADD/ADHD, she

can be instrumental in ruling out contributing visual dysfunctions, making the appropriate referral to another professional for diagnosis and management, and possibly aiding in the management of ADD/ADHD and any co-existing visual dysfunction. The differential diagnosis of ADD/ADHD from similar or concurrent disorders such as visual dysfunction, learning disabilities, conduct disorders, and anxiety disorders is crucial to the appropriate management of ADD/ADHD.

The diagnosis of ADD/ADHD often begins with teacher observation of the behavior difficulty in the classroom as it is likely that the teacher will notice right away which children have difficulty attending to their school work. A child that constantly gets up, moves around the room, and distracts other students could potentially be an ADD/ADHD child. In order to help with the diagnosis process, teachers have available to them several types of behavior evaluation checklists. These checklists provide a guide for teachers to track the behavior of children that may have attention deficit issues. Found in Table 2 is an example of a checklist displayed by Safer & Allen that includes six discrete areas of observation (1976).

1. Classroom Behavior
2. Group Participation
3. Response to Authority
4. Other Behavior
5. Teacher Estimation of Achievement
6. Additional Comments

The checklist allows teachers to rate the student in all of these areas on a continuum of how severely the child displays the behavior. The teacher can then repeat the observations at a later date and compares new results to the previous observations. By applying a simple calculation to compare the two surveys, teachers informally determine if any improvement has been made or if the child still displays the same behaviors. If the behaviors persist over a period of time, the teacher may then want to refer the child out

for special testing. It is important for teachers to remember that children who have attention deficit disorder may not always be hyperactive. In this case, a behavior checklist will miss these students and a modification of the checklist should be substituted. The pediatrician may specifically request that the teacher complete a checklist in order to help in the diagnosis of ADD/ADHD.

Similar to the teacher behavior checklist, the parent questionnaire is an informal assessment used to help determine if a child has ADD/ADHD. Though more variable and less reliable than the teacher assessment, this type of information provides an insight into whether the symptoms of ADD/ADHD persist outside the classroom and establishes a baseline of activity before treatment intervention. The parents use these checklists and compare their observations of the child with the teacher's observations. This is just another means of assessing the child's behavior. The parent checklists are similar to the teacher's but focus on situations that occur outside of school, including how the child behaves during mealtime, play, and homework time. Doctors also collect pertinent background developmental and medical information about the child from the parents in order to develop a complete picture of the child.

Education specialists also use formal assessments such as the Bender-Gestalt test and a test of auditory memory skills to determine the level of learning disability that usually accompanies the behavioral symptoms. The Bender-Gestalt test measures a child's visual-motor integration skills by asking him to copy a series of pictures increasing in complexity (Safer & Allen, 1976). The performance on the test has been normed across several populations and by several categories such as grade level and gender. Visual-motor integration skills are often notably delayed in ADD/ADHD children. Children suspected of having attention deficit disorder respond similarly to the Bender Gestalt test.

Educators also administer formal tests of auditory memory skills to children suspected of having an attention deficit disorder. Due to the high correlation of learning

disabilities with ADD/ADHD, understanding how the child acquires auditory information as well as visual information can help teachers and parents uncover the best learning modality for a particular student. The digit span test is one example of an auditory memory test (Safer & Allen, 1976; Barkley, 1990). In this assessment, the examiner calls out a sequence of digits and the child must call the numbers back correctly and in the proper order. A modification of this test involves asking the child manipulate the numbers in his head and recall them in reverse order. Results of such tests provide insight into how the child attends to auditory information as well as the capacity of his short-term memory stores.

A number of other specialists including psychologists and speech pathologists are qualified to administer special tests to children suspected of have ADD/ADHD. Among these tests are the Wechsler Intelligence Scale for Children-Revised (WISC-R) and the Peabody Picture Vocabulary Test (PPVT). The WISC-R is divided into twelve subtests that test the children in areas of Verbal Ability, Spatial Construction, and Freedom from Distractibility. Even though this test is a useful tool to determine the intelligence level of ADD/ADHD children, it has a limited ability to distinguish ADD from ADHD and ADD/ADHD from other learning difficulties. The results of this test should be used in combination with other information about the child but not used alone to diagnose ADD/ADHD. The WISC-R can help doctors assess the ability level of the child in order to construct the appropriate management of any concurrent learning difficulty (Barkley, 1990). The PPVT is also frequently used with ADD/ADHD children to measure the latency of the child's responses. This latency period can give the examiner an idea of the child's impulsive tendencies. The test can be used with children as young as three years old and the information gained is useful in determining recommendations for classroom instruction of the ADD/ADHD child early in his education (Barkley, 1990).

In addition to the educational and psychological tests that specialists use to determine the diagnosis of ADD/ADHD, medical doctors synthesize all of the

information previously gathered by the parents and teachers to confirm the diagnosis of ADD/ADHD and select the proper treatment. Since the medical doctor usually has limited exposure to the children, she relies heavily on questionnaires and interviews with the parents and teachers to obtain the pertinent data leading to a diagnosis.

The optometrist has the potential to play a key role in the diagnosis of ADD/ADHD. Due to the fact that many forms of visual conditions (Table 3) can contribute to inattention in children (Groffman & Solan, 1994), optometrists are the most qualified health professionals to make sure none of these issues are interfering with the child's ability to attend. Uncompensated refractive error refers to a collection of

**Table 3: Visual Conditions that may Contribute to Inattention**

Uncompensated Refractive Error:

Myopia-- difficulty with distance vision

Hyperopia-- difficulty with near vision

Astigmatism-- unequal refractive area in the two meridians of the cornea

Vergence Dysfunction-- difficulty working the two eyes together

Accommodative Dysfunction-- difficulty focusing

Visual Information Processing Disability-- difficulty with activities requiring complex visual processing such as reading

Oculomotor Dysfunction-- difficulty controlling the extraocular muscles in the eye

conditions that affect the child's ability to see clearly in the distance, at near or both.

Vergence dysfunction defines a group of conditions that affect the child's ability to move his eyes in a conjugate manner and keep them aligned together at all times.

Accommodative dysfunction describes an inability to focus properly on the plane of regard or to sustain that focus for long periods of time including reading. A visual information processing disability could affect the child's general ability to learn how to read and complete other complex tasks in his visual environment. Lastly, oculomotor dysfunction refers to an inability to properly move the eyes in a slow pursuit fashion or a quick saccadic fashion. The lack of properly developed eye movements hinders the process of learning to read as well as eye-hand and motor coordination ability.

In his study “Use of a sustained visual attention task to determine children at risk for learning problems,” Jack E. Richman, O.D. suggests methods of testing visual attention in children that can help predict the presence of a learning disability (1986). Richman studied the attention behavior of 42 first grade students. The students were instructed to watch letters on a television monitor and respond by pressing a buzzer only when the letter “X” was presented. This task lasted 9.5 minutes as the researchers were attempting to simulate the amount of time a child is expected to concentrate on a worksheet or on teacher instruction. During this task, an examiner sat behind the television screen and monitored the eye movements of the child. By watching the reflection of the television in the child’s eye, the examiner was able to assess when the child’s fixation drifted from the screen. The amount of time that the student was not concentrating on the television screen was termed “off-task looking time.” After this 9.5 minute task, the children were given an impulsivity test in which they were required to match familiar figures. This test was scored by the amount of time it took the child to respond and the total number of incorrect choices. By studying the “off-task” looking time of children and their impulsivity and then correlating this with a behavior checklist provided by the teachers, Richman found a statistically significant relationship between sustained visual attention, impulse control, and teacher observations of classroom behavior (1986). Completing these specific tests with children in the office and comparing them with parent and teacher observations of the child, optometrists may be able to differentially diagnose ADD/ADHD from a visual dysfunction or determine the co-existence of ADD/ADHD and visual dysfunction. This determination will help address the underlying cause(s) of the disruptions and lead to appropriate treatment of the condition.

Optometrists also have the expertise to use other diagnostic tests to differentially diagnose ADD/ADHD from a visual skills dysfunction. The Northeastern State University College of Optometry (NSUCO) eye movements test, the Developmental Eye

Movement Test (DEM), the Ober/Visagraph, and the Groffman Visual Tracing Test (GVTT) are all ways that optometrists can evaluate the eye movements of children suspected of having ADD/ADHD.

The NSUCO eye movement test is a normed, systematic test in which optometrist can quantify the eye movements of children (1995). The optometrist requests that the child stand up and watch a small moving bead. The doctor assesses the child's ability to do this task by rating the accuracy of his saccadic and pursuit eye movements and by noting if the child can complete this task without moving his head and body. The DEM is also a normed eye movement test that requires the child to call off numbers from a sheet of paper. The DEM includes two sets of these tests: one in which the child calls off numbers down in columns; and the other in which the child calls off numbers across in rows. The speed and accuracy in which the child can perform these tests can then correlate to the developmental level of his eye movements (Groffman & Solan, 1994). The Ober/Visagraph is an instrument that can quantify eye movements using an infrared detection mechanism. The child wears goggles with infrared detectors and then reads a passage from a computer screen and answer comprehension questions about the passage. The passages are normed for each grade level. The computer is able to analyze the eye movement patterns of the child while reading the passage and determine how much information the child looked at for each eye movement and if the child needed to look back to previously read information (regressions). The GVTT assesses the child's ability to use self-generated ocular pursuit eye movements to "visually trace lines that are embedded in other curving, tangled lines" (Groffman & Solan, 1994, p. 108) This is a visual-spatial task in which the child must be able to differentiate between the figure of the line he is tracing and the distracting ground of the other lines. Children are given a score for speed and accuracy for their performance on this test which is then translated to a Z-scored and compared to the population of scores.

Using these tests in finding the existence of such deficits in visual skills could lead to the underlying cause of the inattentiveness and distractibility of some children in the classroom. Optometric remediation of these eye movement skills could subsequently make a difference in the behavior and learning ability of the children. Optometrists also co-manage these patients with educators, psychologists, and pediatricians in order to treat visual symptoms that accompany the ADD/ADHD or arise from the use of stimulant drug therapy treatment that will be further illustrated later in this paper.

At the Oregon Health Sciences University Children's Development and Research Center in Portland, Oregon, I had the opportunity to observe their particular medical and psychological procedure that led to a possible diagnosis of ADHD for one young boy . This example serves as an illustration of the extensive psychological and medical examinations that children undergo before being diagnosed with ADD/ADHD.

#### Case Presentation of Diagnostic Procedure

P, a five-and-a-half year old male patient, was referred to the Children's Development and Rehabilitation Center by his kindergarten teacher. Due to the patient's behaviors in the classroom, his teacher was concerned that he may have Attention Deficit Disorder or Autism. Some of his behaviors include physical aggression, impulsivity, screaming, inflexibility to change, inability to sit still and complete a task, and other disruptive behaviors.

P's developmental history is unremarkable except for the fact that he did not talk until the age of two when most children say their first word around one and a half years of age. He also has been involved with an early intervention program in order to help him become ready for kindergarten. Early testing on this patient showed him to be deficient in the areas of cognition and socialization.

This patient was first seen by the education specialist. The tests in this session included picture identification, elementary math concepts, number identification, riddles, and analogies. Upon observation of this patient during the session it became clear that he is a very bright, social child with an active imagination. The education specialist found that the patient tested above average on all of the tests, but may be having some significant difficulty with math concepts.

The psychological evaluation began with an interview with the mother. The psychologist found that P is very resistant to change, employs some rocking behaviors, and is sensitive to loud noises, so much that he is unable to participate in music classes. P also has social problems and his very aggressive behavior causes most other children to avoid playing with him. The psychologist also performed a number of tests on the patient during which she found him unable to keep himself on task. She also felt that P was not trying to answer the questions to the best of his ability. She did find, however, that the patient's performance IQ and verbal IQ on the Wechsler Intelligence Scale for Children III (WISCIII) were above average at 118 and 110, respectively.

A speech pathologist also worked with P. She performed a picture vocabulary test on him and found his vocabulary ability beyond his expected grade level and into the expected high school range. On the Peabody tests (Safer & Allen, 1976; Barkley, 1990), the patient scored the age equivalent of nine years and on the expressive vocabulary test he scored in the range expected of seven year old children. The patient did not miss any of the linguistic concepts portion of the tests.

After the sessions with all of the specialists, the staff concluded that P is very bright and may simply be bored with kindergarten activities. His teachers, based on his low social skills, recommend that he spend only a half day in first grade next year and possibly the other half back in kindergarten. The CDRC team, however, recommends that he stay in first grade full time and even spend some time in a second or third grade classroom. The team believes that an active and challenging school regimen as well as

adequate discipline at home may help to regulate the disruptive behavior of this child. If these suggestions fail, then the diagnosis of ADHD may be imposed and medication may be necessary for the child to function at an appropriate level.

This case presentation illustrates how the classic symptoms associated with ADD/ADHD manifest in this individual child as well as the particular diagnostic procedure used at the CDRC to try to uncover the cause of P's behavior difficulties. The purpose of all of the testing that P experienced is to provide as broad a picture as possible of how his condition affects his everyday life. The team was careful to collect data about P from his parents, teachers, and other medical professionals and not to diagnose in haste. In order to properly treat P and help his learning process, the underlying cause must be addressed. In an attempt to do this, the team suggested alternate routes of treatment and further testing before labeling P with ADD/ADHD.

#### Treatment of ADD/ADHD

The most common treatment for ADD/ADHD is stimulant drug therapy (Safer & Allen, 1976; Barkley, 1990). Doctors prescribe stimulants such as Ritalin, Cylert, and Dexedrine in order to help control hyperactive behavior. This method of treatment seems to help most children, although there are some cases in which the child's behavior remains unchanged with the medication. The dosage of these medications is once or twice daily depending on the particular medication and the response of the child to the medication. Researchers claim that stimulant drug therapy does in fact help improve learning abilities in the areas of visual-motor skills, visual and auditory discrimination, short term learning (Safer & Allen, 1976), attention, and impulsivity (Montiero, 1997). These gains, however, are described as state-dependent learning because once off the medication, the ability to perform better declines (Barkley, 1990). The use of these medications also causes short-term and long-term effects in the child. Short-term effects of Ritalin include headaches, nausea, skin pallor, decreased appetite, insomnia (Safer &

Allen, 1976), and irreversible Tourette's syndrome (Barkley, 1990). Long-term effects of the medication have not been adequately explored, but growth suppression has been reported in some cases (Barkley, 1990). Other problems associated with the use of pharmacological treatment of ADD/ADHD include the question of how long to keep a child on the medication and will the symptoms of the disorder will diminish over time. In order to determine this, the child needs to be taken off of the medication about once a year to see if his behavior still warrants the medication. While research shows that stimulant drug therapy helps children control their impulsivity, hyperactivity and learning, this form of treatment does not address the underlying cause of the attention deficits (Barkley, 1990) and only represents short-term management of ADD/ADHD. The key to treating the condition permanently is to find the underlying cause and then train the child to control his behavior on his own without the help of medication.

The most common non-pharmacological treatment for ADD/ADHD is behavior modification therapy. This choice is popular with parents uncomfortable with keeping their children on drugs and with parents of children who do not respond favorably to a regimen of stimulants. Parents and teachers can use several types of behavior therapies to train children to control their impulsivity and keep attention longer. One approach involves training the visual-perceptual and visual-motor skills that are consistently delayed in ADD/ADHD children (Lahey, 1979). This is one area where an optometrist can help in the treatment process. Other behavior modification therapies include the employment of positive reinforcement of good behaviors in the classroom and at home. For example, rewarding the child with a favorite toy or snack can serve as positive reinforcement for behaving well in school. By paying positive attention to desired behaviors it may be possible to shape the behavior of the child and draw him away from negative behaviors that receive no adult attention. The same concepts can be applied with the use of negative reinforcement, such as punishment, of the negative behaviors. This technique is less popular and less effective than positive reinforcement, but are

available to try if other behavior modification efforts fail. The benefit of trying behavior therapy with ADD/ADHD children rather than prescribing medications is that it teaches the child to control his or her behavior. By using a combination of positive reinforcement in the classroom and at home with visual-motor, visual-perceptual, and attention training in vision therapy, the condition may be better managed in the long run without the complications of stimulant medications.

A third option for the treatment of ADD/ADHD is based on the theory that the problems with childhood behavior and attention stem from an allergy to the preservatives and additives in our food supply. By eliminating synthetic chemicals from their diets, these problems will be eliminated as well. Feingold is the major proponent of this theory and has written many books, including The Feingold Cookbook for Hyperactive Children, (1979) that help to guide parents toward eliminating synthetic preservatives and additives from the diet. The diet suggestions are very strict and require complete compliance for good results. Feingold also requires that the entire family follow the diet so that the ADD/ADHD child is not tempted by foods he is not allowed to eat in the household (1979). Like behavior therapy, this holistic approach to the treatment of ADD/ADHD, attempts to cure the underlying cause of the attention deficit disorder rather than mask the cause and treat the symptoms as in the case of drug therapy.

The available literature on the topic of ADD/ADHD is extensive as many researchers seek to gain a deeper insight into the causes of this disorder and the best way to manage these children. The importance of studying this topic is clear when considering the number of students in the school systems suffering from this condition. It is likely that we will never fully understand why ADD/ADHD occurs in so many children, but it is important to evaluate the way in which we manage the condition of these children. In the remainder of this paper, I will illustrate some problems concerning the use of stimulants for the treatment of ADD/ADHD and then offer suggestions to teachers for the management of ADD/ADHD in the classrooms.

## VISUAL PROBLEMS ASSOCIATED WITH ADD/ADHD

### Introduction

Due to the increasing number of children diagnosed with ADD/ADHD in the classroom, teachers must understand the relationship that this disorder and its treatment has with the visual system. Since the specific causes for the limited attention symptoms are unclear, it is not unreasonable to suggest that one component of this condition may involve the child's visual skills. Children rely heavily on their visual skills while performing many different tasks in the classroom, including reading and writing, copying information from the chalkboard, and interacting in the classroom environment with their peers. Effective learning cannot easily take place for any child when he is constantly trying to overcome a visual deficit. Visual dysfunction may contribute to the behavior of the child and may also accompany a true ADD/ADHD diagnosis, especially when there is a concurrent reading or learning disability as is not uncommon in ADD/ADHD children (Cantwell & Baker, 1991). By understanding the visual system of ADD/ADHD children on medication, a teacher can better understand the needs of these students. The following review describes the visual skills necessary in the reading process, the way in which stimulant drug therapy treatment may affect the visual system, the way in which drug treatment affects reading ability, and the existence of certain manifestations of ADD/ADHD in which stimulant drug therapy is contraindicated for the child.

### Visual Skills Summary

In order to learn to read successfully and then read to learn information, the child must develop several visual components including: vergence, the ability to aim the eyes at the page; accommodation, the ability to focus on the page; saccades, the ability to make rapid eye movements; and visual attention, the ability to selectively attend to a large amount of visual information. If any of these components of vision are lacking or

underdeveloped, frustration with the difficulty in efficient reading may prompt behavior resembling the disruptiveness of attention deficit disorder (Birnbaum, 1993). A child who is deficient in a specific visual skill might easily learn to avoid the difficult task and become distractible as a result. A differential diagnosis of ADD/ADHD from a specific visual dysfunction may be impossible as it is likely that the two conditions occur concurrently in many children.

### Effects of Ritalin on the Visual System

With the understanding that certain visual skill deficits may be present in ADD/ADHD children and contributing to their behavioral issues, it is also important to understand the effects that drug therapy might have on a student's visual system. The most common drug treatment for ADD/ADHD is the stimulant methylphenidate, more commonly known as Ritalin (Barkley, 1990; Maino, 1995). While oftentimes this drug helps to control the behavior of ADD/ADHD children, it has significant effects on the visual system that could hinder the learning process (Trachtman, 1991). While these children are able to sit still and attend a little better, they may not learn effectively.

The widespread use of Ritalin and other stimulants including Dexedrine and Cylert for the treatment of ADD/ADHD, has prompted studies in the optometric literature investigating the ocular and visual effects of the medication. Ocular effects of these drugs include blurry vision, allergic reaction of the lids and conjunctiva, mydriasis or dilation of the pupil, and an increase in nystagmus and general movement of the eyes (Maino, 1995). These ocular effects may cause discomfort in the ADD/ADHD child and further hinder the ability of that child to learn effectively.

The possible mydriasis and decrease in accommodative amplitude that the child experiences are the most devastating to the development of visual skills necessary to read. The stimulant drugs used with these children tend to simulate the actions of the sympathetic nervous system. When the sympathetic system activates, the ability of the

eyes to focus up close decreases. In addition, the sympathomimetic effect of Ritalin may create an increase in the amount of manifest hyperopia in the child and at the same time reduce his accommodative facility (Trachtman, 1991). Accommodative facility involves the ability of the eyes to quickly change focus from far away to near and then far away again. This ability is crucial in such tasks as copying from the blackboard to a paper on the desk. This medication makes that activity harder for these children. With an increase in pupil size, the depth of focus of the eye decreases. This means that the child needs to put more effort into focusing accurately on the page. But, focusing ability decreases due to the drugs, so the child is physiologically unable to put the necessary focusing effort into seeing up close. This increased effort just to keep letters on a page clear, leaves little energy available for the child to concentrate on his task and what he is learning. It is for this reason that Trachtman asserts “Ritalin would be contraindicated for hyperactive children with learning problems” (1991, p. 180). This evidence supports the assertion that stimulant drug therapy should be carefully considered when treating a child with ADD/ADHD.

In addition to the effects that Ritalin has on the accommodative system of ADD/ADHD children, the drug also has effects on the eye movement systems also important for reading. Two recent theses from Pacific University College of Optometry studied the saccadic and pursuit eye movements of ADD/ADHD children both on and off medication. The first study by Lee & VonRoekel in 1995 attempted to provide evidence that the eye movements of ADD/ADHD children was inferior to those skills in normal children. The subjects for the study were all diagnosed with ADD and between the ages of eight and thirteen. The subjects were given the Groffman Visual Tracing Test (GVTT), the Developmental Eye Movement Test (DEM), and the Peabody Picture Vocabulary Test (PPVT), all of which have previously been normed for a normal population of children. The Groffman Visual Tracing Test requires the patient to visually track one line embedded in other curving and tangled lines (Groffman & Solan,

1994). Optometrists then evaluate pursuit and tracking eye movement ability based on the success of the patient in visually tracing the lines. The Developmental Eye Movement Test measures quick saccadic eye movements and the ability to automatically verbalize the numbers being read. This test is specifically designed to differentiate between saccadic eye movement difficulties and visual-verbal processing difficulties. The Peabody Picture Vocabulary test is a measure of verbal intelligence and was used to show that this population of ADD/ADHD children had average verbal intelligence.

Possibly due to the low subject pool size in this study, the researchers did not achieve statistical significance in the relationship between ADD/ADHD children and poor eye movement skills. The subjects did, however, show “a tendency to exhibit poor eye movement skills on the DEM” (Lee & VonRoekel, 1995, p. 10). Low DEM performance may be related to the poor reading ability present in ADD/ADHD children. This study began to address the visual issues that accompany the diagnosis of ADD/ADHD. A visual skills dysfunction including a possible saccadic eye movement deficit may be a factor in some children with ADD/ADHD.

The second study that attempted to look at these issues was done by Ziskrout & Ichiyama in 1997. Expanding upon the idea that the condition of ADD/ADHD has coexisting visual dysfunction and that the stimulant drug therapy may also well have adverse visual effects, these researchers recruited thirty-six children between the ages of 8 and 13 who were taking psychostimulant medication for ADD/ADHD. Like the previous study, these researchers also gave the children the GVTT, the DEM, and the PPVT. In addition, the Visagraph (an instrument that uses an infrared detector to measure eye movements) was used to evaluate the eye movements of these children. In this study, some of the children were given the tests both on and off their medication in order to determine the effects that the medication has on these visual functions.

The results of this study were similar to those obtained in the study by Lee & VonRoekel. Some of the ADD/ADHD subjects exhibited poor eye movements on the

DEM. While this was not shown for all of the subjects, it appears from this and the previous study that there is a subset of ADD/ADHD children with significant eye movement difficulties. It is important to recognize that when treating ADD/ADHD children, there may be more issues than just the attention deficits. These children could benefit from several treatment approaches including vision therapy for the eye movement deficits.

This study also found that some ADD/ADHD children performed normally on the DEM when not medicated and significantly worse on the DEM when medicated with the psychostimulant drugs. The authors state that “there was no clear indication of improved eye movement performance while they were taking their regularly prescribed medication(s)” (Ziskrout & Ichiyama, 1997, p.23). One flaw in this study design was that all subjects were first tested in the “on drug” condition and then in the “off drug” condition. It is possible that the effects seen were solely due to a learning effect of the tests rather than a drug effect. This result, nevertheless, raises issues of the efficacy of the drug therapy for the treatment of ADD/ADHD when eye movement difficulties are co-existing in the student. Doctors, teachers, and parents should address this issue when deciding whether or not to put a child on Ritalin. Will the drug cause problems associated with learning disabilities and does the possible positive effect it has on the behavior of the child outweigh the seriousness of the impingement on the learning of the child?

#### Effects of Ritalin on Reading Ability

The studies illustrated above begin to delve into the issues surrounding the efficacy of drug therapy for the treatment of ADD/ADHD when there is a concurrent learning disability or eye movement disability. Other recent research has been able to determine that learning to read and overall academic performance may be inhibited by the drugs. In a 1991 study on the effects of stimulant drugs on reading performance in hyperactive boys, researchers found that there seemed to be little substantial

improvement from methylphenidate on reading performance in the subjects of his study (Forness, Cantwell, Swanson, Hanna, & Youpa, 1991). The authors found this effect when they tested the functional reading skills of these children across three different dosages of medication. Not all of the children in the study were classified as learning disabled along with their hyperactivity, but regardless of the classification, reading skills were reduced when on the medication.

In 1992, Forness, Cantwell, Swanson, Hanna, & Youpa did a follow-up of their original study on the effects of stimulant medication on reading performance. This study attempted to see if the reading performance increased after being on the medication for a sustained period of six weeks. The only group that showed improvement in reading abilities, specifically reading comprehension, was the group with the mixed diagnosis of hyperactivity and conduct disorder. The ADHD group did not show improvement with sustained use of the medication. This result makes room for the hypothesis that “the combination of ADHD and conduct or oppositional disorders perhaps sets the stage for response to stimulant medication that is different from that accorded to pure ADHD” (Forness, Cantwell, Swanson, Hanna, & Youpa, 1992, p. 120).

#### Contraindication for the Use of Ritalin in ADD/ADHD

The review of these studies on Ritalin and its effects on the child’s visual system and overall learning ability serves two purposes. First, the studies show that parents, teachers, and doctors should be more selective when discussing stimulant drug therapy for an ADD/ADHD diagnosed child. There are clear instances when further testing is needed to find out if the child has a co-existing visual skills dysfunction or other learning disability that will not improve with the use of Ritalin. In this case, if Ritalin is still the treatment of choice for the behavior difficulties, parents should also consider some type of behavioral modification, visual training, educational support, or some combination of these treatments to supplement the drug therapy. The second important reason for

understanding this research is to alert teachers to the possibility that the ADD/ADHD children in the classroom on Ritalin may also have learning difficulties which are related to the medication itself. Teachers aware of these side effects will be able to more effectively help the child learn. The next section of this paper will offer styles of teaching and classroom management that have been shown by educators and researchers to aid in the control and remediation of the behaviors and learning difficulties associated with the diagnosis of ADD/ADHD in children.

## IMPLICATIONS FOR CLASSROOM TEACHERS

### Introduction

Recent research implies the need to be more careful when prescribing stimulant drug therapy to children with ADD/ADHD (Lee & VonRoekel, 1995; Ziskrout & Ichiyama, 1997; Forness, Cantwill, Swanson, Hanna & Youpa, 1991; Forness, Cantwell, Swanson, Hanna & Youpa, 1992). In fact, “individual educational programs, and appropriate psychotherapy appears to be the most successful documented approach to treating children with attention deficit disorders” (Maino, 1995, p.139). Therefore, children who have an accompanying visual dysfunction or learning disability may not benefit from stimulant drug treatment. As a result, it is important to develop other means of dealing with these children including vision therapy and classroom modification techniques that help eliminate visual distractions for the children.

### Vision Therapy for the ADD/ADHD Child

A vision therapy program designed to target the particular learning and visual difficulties of an ADD/ADHD child can offer a successful management alternative and supplement to drug therapy. Vision therapy techniques can be used to help treat an accommodative dysfunction that may occur as a result of stimulant drugs, to improve eye movement ability helping the child read more easily, and to learn to sustain visual attention (Garzia, 1996). The Optometric Extension Program emphasizes that

“Vision Therapy improves skills that allow a person to pay attention. These skill areas include visual tracking, fixation, focus change, binocular fusion and visualization” (OEP, 1996)

If an ADD/ADHD child exhibits any of these visual symptoms, vision therapy should accompany other treatment considerations for these children. Parents and teachers must

be aware of the visual and ocular effects that result from the use of methylphenidate. In cases where the positive behavioral effects of the medication outweigh its other more detrimental effects, optometrists may need to prescribe glasses and/or vision therapy for the child in the drug-induced state. For example, if there is an increase in hyperopia and/or an accommodative dysfunction while on methylphenidate, reading glasses and accommodative vision training may help the child overcome these deficits while on the medication.

The following is a case example of a patient that is currently being treated at the Pacific University College of Optometry Vision Therapy Service. The case of G serves as an example of how pharmacological intervention and vision therapy are being used concurrently to help manage G's specific behavioral and visual difficulties.

#### Case Presentation: Vision Therapy Combined with Pharmacological Intervention

G, a 10 year old male patient was seen at the Pacific University Family Vision Center. The patient's history form indicated that G is having reading problems and often needs to use his finger to keep his place while reading. He skips words and has trouble copying information from the blackboard to his desk. G is presently in fourth grade but was found to be reading at a second grade level. G does not do much reading outside of school. The patient reported that he sees well and there are no other visual complaints.

The patient's developmental history indicates that he was born a full term baby two weeks early. He was hospitalized for croup for one day. There are no known medical allergies and G never had any ear infections as a child. Because of his reading difficulties, G has been tested for learning disabilities and it was found that his analytical skills and vocabulary skills were all normal. G is also currently taking Ritalin during the school year. G is taking the medication in order to rule out the diagnosis of ADD/ADHD. G does not have a diagnosis of ADD/ADHD at this time, but the medication does seem to

help him concentrate. G's reading ability does not seem to be improving with the increased concentration that the medication allows him.

After this initial primary care evaluation, G was found to be hyperopic. G also was found to have convergence insufficiency and accommodative insufficiency. Convergence insufficiency (CI) is a condition in which the eyes ability to work together and aim directly at a near target is limited. Accommodative insufficiency (AI) is a condition in which the eyes focusing ability when looking at a near target is also limited. The doctor also found the G had a hard time tracking objects with his eyes when he was asked to process auditory input. After this initial assessment, G was referred to the vision therapy service for further evaluation and remediation.

In the vision therapy clinic, several additional tests were run on G in order to find other areas of deficiency, besides the CI and AI, that could be contributing to his inability to read at grade level. The additional perceptual battery that was performed on G is presented in Table 3.

<b>Test</b>	<b>Score for G</b>
Beery Visual Motor Integration (VMI) Test	11.2 years
Birch Belmont Auditory-visual Integration Test (AVIT)	9-9.5 years
Developmental Eye Movement Test (DEM)	7.11-8.2 years
Test of Auditory Analysis Skills (TAAS)	13 years

The Beery VMI requires the patient to copy a series of 24 geometric forms beginning with simple figures and progressing to more complicated drawings. The harder the picture the patient is able to copy, the higher his level of visual motor integration (Groffman & Solan, 1995). On this task, G scored at 11.2 years of age, slightly above his age of 10. The Birch-Belmont Auditory-visual Integration test requires the patient to listen to a pattern of taps made by a pencil or a coin and then match the tap pattern to corresponding dot patterns. This task requires the child to integrate auditory

patterns and translate them into a visual code and be able to identify that code on a piece of paper (Groffman & Solan, 1994). G scored between the ages of 9 and 9.5 on this task, slightly below the expected level for a 10 year old. The DEM is a test of eye movement skills and can be a good indicator of the level of the eye movement skills that are required for good reading. The patient is required to call out a series of numbers arranged both vertically and horizontally on a piece of paper as quickly as possible. The vertical subtest of the DEM is designed to rule out any visual-verbal difficulty that may hinder the patient's ability to complete the task. The patient's performance on the vertical subtest is compared to his performance on the horizontal test and a score for the eye movement ability of the child is derived. G scored in the age equivalent of 7.11-8.2, significantly below the expected eye movement ability of a 10 year old. The final perceptual test that was administered to G was the TAAS. The TAAS requires the patient to manipulate auditory information in his head and then verbalize the answer. For example, one of the test questions asked the child to "Say cowboy" and then to "Say it again, but don't say boy." On this task, G scored at the level of a 13 year old.

Analysis of this testing battery shows that G's visual system is normal in the following areas: clarity of eyesight, visual interpretation, visual memory, and combining vision with writing. However, G is performing below the expected level for a child his age in the following areas: eye tracking, eye coordination, focusing strength, focusing sustainability, and connecting seeing and hearing. These conclusions give a good picture of why G is having trouble reading.

The recommended treatment for G's reading difficulties includes prescribing glasses and vision therapy. In G's initial eye exam, he was found to be a low hyperope and glasses will be prescribed based on the refractive findings in order to help him see with less effort at near. G is also going through vision therapy. The goals of this therapy include in office and home exercises in order to improve accommodative ability, to improve convergence ability, to improve auditory-visual integration, and to improve eye

movement ability. The therapy is projected to take one 1 hour session per week for approximately 8-12 weeks.

There are several vision therapy techniques that the doctor can use with G in order to achieve these goals and help bring up his reading performance. An example of in office therapy activities for G include the use of the Visagraph (a computer device used to monitor and train eye movements while reading), and the use of different powers of lenses and prisms to help train accommodation and vergence ability. G is also sent home with a variety of different activities to practice every night. G is instructed to read for a period of time through various lenses while patching one eye in order to help train his focusing ability. G also works on his eye movement ability at home with the help of a chart with several rows of letters known as the Hart Chart. G is instructed to call out a letter from a Hart Chart mounted on a wall and then call out the next letter from a chart that he is holding at near. Mastering this exercise will help G with activities such as copying from the blackboard to the paper at his desk. These activities are just an example of the types of exercises that G will be learning to master in vision therapy. Throughout the course of the therapy the activities will be modified and the skills will become more challenging. G will have a progress exam in the middle of the therapy sequence in order to monitor his progress and see that the goals are met within the projected time frame for this patient.

G is an example of a patient who is taking Ritalin to help him concentrate in school, but is still having difficulties reading. From the results of the vision exam and the additional perceptual tests, it is clear that G has some visual and perceptual difficulties hindering his ability to read. The improved concentration that the Ritalin offers G does not seem to be helping his reading ability. This supports the conclusion that his apparent lack of concentration is not the main factor limiting his reading ability. Hopefully, the vision therapy sessions will proceed as planned and G's reading will improve. At that

time, if he is having no other difficulties in school, it may be possible to take G off his medication permanently.

### Classroom Modification

Teachers are aware of several behavior modification techniques to incorporate into a classroom setting in order to control ADD/ADHD behavior. Some of these same techniques can also be adapted to help the ADD/ADHD child that has an accompanying visual dysfunction or learning disability. In their article “Treatment of Attention Deficit Hyperactivity Disorder: A Multi-Modal Model for Schools”, Maag & Reid suggest five areas in which teachers can modify the classroom for the ADD/ADHD student (1996). The areas include environment, materials, instructional, altering criteria, and altering curriculum. These general areas provide a framework in which to summarize observations that have been made by several researchers and educators that work with ADD/ADHD children in the classroom. Table 5 illustrates the areas in which classroom modifications can be made to enhance the visual performance of the child.

<b>Table 5: Examples of Classroom Modifications for Enhanced Visual Function</b>	
Classroom Environment	Proper lighting with a combination of direct task lighting, sunlight, and florescent lights
Classroom Materials	High contrast text, black on white with large print

The first area modification involves the classroom environment. Teachers aim to structure the classroom in such a way as to minimize distractions (Maag & Reid, 1996). One way to accomplish this goal is to create different spaces for different activities. The place in which the child needs to do desk work should be separate from the group work area for example (Goldner, 1997). This will help to reinforce the need to accomplish work while the child sits at his desk. Another classroom strategy includes employing a predictable daily schedule. This way, the teacher prepares the children for whatever activities will occur during the day. In addition, the rules and regulations in the classroom should also be predictable. The children should understand the rules and the rules should be posted in the room (Barkley, 1990). Clear boundaries for behavior will

help to minimize disruptions in the classroom. One interesting environmental suggestion for helping to control ADD/ADHD behavior involves giving the child two separate desk areas in the classroom. ADD/ADHD children have a tendency to need to get up fairly often and move about the room. Although this alternative may be economically unfavorable, having an empty desk elsewhere in the room, gives this child somewhere else to be that is just as appropriate as sitting in his regular chair (Fields, 1996). A highly structured, highly interesting classroom environment will serve to keep an ADD/ADHD child busy and continually interested hopefully helping to minimize behavioral disruptions.

There are other environmental modifications that can help the ADD/ADHD child's visual system function at an optimal level. For instance, proper classroom lighting is crucial for peak performance. In her paper "Lighting and the Learning Space," Joan Schultz (1977) describes the various aspects of classroom lighting and what types of lighting increase comfort and learning potential. The type of light available in the classroom should approximate natural daylight as much as possible. Teachers can achieve this by using full-spectrum fluorescent light rather than the standard bulbs that are biased toward the shorter wavelengths. Schultz also recommends combining fluorescent light with warmer incandescent bulbs for direct task lighting. This type of light is good for quiet study areas in the classroom or to help emphasize artwork and displays. Fluorescent and incandescent light should be supplemented by natural daylight whenever possible while taking care to eliminate any glare that may be coming from outside. The ambient lighting in the classroom should be at least 50 foot-candles. Teachers can monitor the amount of light in the classroom by using a photometer. In areas of the room that are not at least this bright, task lighting can be installed. Task lighting of 50-60 foot-candles increases the contrast on a piece of paper and helps to eliminate eye strain. Schultz also recommends that glare be eliminated from surfaces

whenever possible. Proper lighting in the classroom can serve to make the room more visually comfortable for the easily distracted children as well as the rest of the students.

The next area of modification involves the classroom materials. Maag & Reid (1996) suggest that classroom materials should be 1) novel 2) high feedback, self correcting materials, and 3) used in interspersed short lessons with instructional prompts and cues. And, according to Barkley (1990) academic assignments should be brief and provide immediate feedback regarding accuracy of assignments. These academic tasks should also be well matched to the child's individual intellectual ability level (530) as well as their visual ability level. One way in which teachers can alter material involves employing the method of instruction developed by Grace Fernald in 1929 known as the Visual-Auditory-Kinesthetic-Tactile approach (VAKT). Fernald worked with learning disabled children and found that by using a rich combination of sensory modalities, children were able to learn to read (Cook & Earley, 1979). While her approach is very strict, the concept that using all of the senses in a variety of different ways is helpful with many types of students, including ADD/ADHD children. Since ADD/ADHD students tend to be mainly tactile/kinesthetic learners (Fields, 1996), they can learn from doing a variety of hands-on activities including making objects with clay, tracing in sandboxes, and finger painting. Active lesson plans that especially involve the use of the motor system help to access and utilize some of the excess motor hyperactivity that is common in these children. These activities give immediate feedback to children through their different senses and allow ADD/ADHD children to have fun and learn without having to be sitting at their desk for extended periods of time.

Classroom materials can also be modified to match the visual ability of the children. Text that is high contrast black on white with big letters is easier for the child with eye movement difficulties to read. The bigger letters require less accurate eye movement ability and high contrast text makes it easier for the child to distinguish the important textual material from the background of the paper. Children should also be

encouraged to read a comfortable distance away from the page. Reading material too closely can cause unwanted eye strain, especially if the child has an accommodative dysfunction. Another way to help the child with eye movement difficulties read more accurately is to allow the use of a finger to track the words on a page. While this method encourages the child to rely on his finger to keep his place rather than learning to do this with his eyes, it may be a temporary solution to keep the child reading while his eye movements are still developing.

Another strategy that helps with controlling the behavior of ADD/ADHD children includes the incorporation of specific instructional styles into classroom teaching. Instructional modification suggestions by Maag & Reid include 1) channeling the ADD/ADHD child's "excess energy," 2) maintaining "a positive, up-beat, non-threatening teaching approach", 3) teaching "organization and independent learning skills", and 4) creating an "emergency signal" for the child to use if he feels in danger of losing control. (Maag & Reid, 1996, p.39). Teachers can utilize the extra energy of an ADD/ADHD child by recruiting him as the class helper and allowing him to run errands or give extra help for classroom projects (Fields, 1996).

Due to their impulsive nature, ADD/ADHD children have difficulty predicting the consequences of their inappropriate behavior. In his handout on "Methods for Helping Children Develop Their 'Future Muscle'," Ray Levy suggests 1) Giving children choices which allow him to have some control over his future and teaching him how to make decisions, 2) Help reinforce positive behaviors by noticing when the children are doing what you want them to do, and 3) Don't tell children the exact consequences for a misbehavior. When children don't know the consequences of their actions, it forces them to look ahead (Levy, 1995). All of these strategies are designed to help ADD/ADHD children control their impulsivity by thinking of the consequences of their behaviors. These ideas are methods by which the teacher can shape positive behaviors and help promote independent learning and organization in the ADD/ADHD child.

The last areas suggested by Maag & Reid that can help control ADD/ADHD behavior in the classroom involve altering criteria and altering curriculum to suit the individual ADD/ADHD child. The components of these two areas include 1) changing the length of assignments based on the attention span of the child, and 2) focusing on “social skills curriculum” for the ADD/ADHD child (Maag & Reid, 1996, p.39). Many of the common behaviors associated with ADD/ADHD such as inattentiveness, can hinder the learning process and “negatively affect educational functioning” (Maag & Reid, 1996, p. 38). It is necessary then, that teachers structure the criteria and curriculum in such a way that the ADD/ADHD child has the opportunity to experience success with his schoolwork. Damico & Armstrong (1996) note that students with ADHD are influenced by the failure and difficulty they experience in social and academic contexts. This failure may cause the child to avoid difficult tasks and situations in the future placing him further behind his peers in academic and social development. By shortening assignments to manageable lengths for the ADD/ADHD child, teachers can create successful, positive learning experiences for these children and help them to develop academically and socially.

The teaching and classroom modifications described above assume that the teachers and the school system have the resources available to employ them. There are several other issues involved in implementing complicated classroom structure and pedagogy changes. Some of these obstacles include the availability of funding to implement such changes and train teachers on how to better manage ADD/ADHD children. In addition teachers are under pressure from administration and curriculum boards to develop their classroom structure to meet new standards in education for all students. The suggestions provided to help with the management of ADD/ADHD children should be viewed as ways in which the classroom can provide an interesting setting for the different learning types of all children.

## CONCLUSION

ADD/ADHD is a common diagnosis for children with behavior difficulties in the school systems today. These children need extra attention in the classroom and special treatment outside of the classroom in order to overcome the symptoms of this condition and learn to progress through school and through life. There is no definitive theory as to why this disorder occurs in these children nor is their consensus about how best to manage children with ADD/ADHD. Children with this disorder often have other problems including visual, social, and learning disabilities and all of the issues affecting a child must be addressed in the management of the child.

Classroom modification techniques and vision therapy describe useful strategies for managing children with ADD/ADHD in combination with or in place of pharmacological management. Recognizing the multifaceted nature of this disorder and the tendency to manifest itself in many different clinical pictures with a variety of symptoms affecting the child is crucial in the development of the proper treatment for the child. Due to the multifaceted nature of the disorder, it is reasonable to assert the treatment method be multifaceted as well. In a situation where behavior modification and diet have failed and medication is necessary to control the behavioral issues, it may not help alleviate the other accompanying symptoms of the disorder. If an accompanying learning disability or visual dysfunction is present, the child must get the appropriate help in those area including educational tutors and vision therapy.

Lastly, these children will need counseling throughout their journey to adulthood. Children with ADD/ADHD should be encouraged to find careers in which they can exploit their extra energy and be productive members of society without a lifelong dependency on Ritalin for control of their behavior.

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