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VISUAL FACTORS IN CHILDHOOD BEHAVIORAL DISORDERS

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Introduction

Children of the 21st century develop in an increasingly complex society due, in part, to the tremendous influx of information competing for their attention. This necessitates filters and barriers so that they are not overwhelmed by stimuli, yet openness and receptivity to the types of exposures associated with normal childhood development.

On the surface, behavioral disorders have little to do with eyes and even less to do with optometry. However, the fact that vision occurs in the brain and not in the eyes, and that vision co-mingles extensively with social and emotional pathways in the brain, compels us to look more closely at the role of optometry in disorders such as attention deficit (A-D/HD), oppositional defiance (ODD), bi-polar disorder, and depression. The role that patient anxiety plays in the lives of optometric patients of all ages is increasingly being given its due accord, with anxiety rating scales now being developed for clinical and research purposes (Court et al 2007). Lifestyle choices including the amount of time allotted toward outdoor activities, as well as nutrition, play a *significant* role in a child's behavioral function (Converse 2009). Abnormalities in development may be divided broadly into physical or behavioral categories. The physical challenges associated with development are usually held to be organ or system problems, distinct from behavioral issues which are brain or mind-based problems.

As an example, the DSM-IV-TR (*Diagnostic and Statistical Manual of Mental Disorders*, 4th edition, evidence-based text revision) of the American Psychiatric Association classifies behavioral disorders according to different axes (APA 2000). Axis I disorders are principally clinical conditions such as A-D/HD, or attention deficit/hyperactivity disorder, and include developmental and learning disorders. Axis II disorders are primarily major psychiatric disorders such as depression, anxiety disorders, bipolar disorder, phobias and schizophrenia. Axis III disorders designate general medical conditions such as diabetes and hypertension. In reality, multi-axial disorders often co-exist, another way of saying that mind and body are intertwined. There are no hard lines of distinction between the signs and symptoms that categorize the behavioral disorders of childhood, and we find it productive to think of them as existing on a continuum (Lemer 1996).

Although it is essential to categorize childhood behavioral disorders for the sake of communication, there are caveats (Eide and Eide 2006). The use of these labels matters deeply because labels don't just express our thoughts; they can shape them as well, often without realizing it. Many researchers no longer look at inattention and neurobehavioral disorders as separate conditions with distinct labels, but rather as a spectrum of disorders (Lemer 1996; Melillo & Leisman 2006). This will be evident in our overview of childhood behavioral disorders. Discrete conditions will be presented by their labels but the implications of co-morbidity and overlap will be presented as well. We devote the greatest attention to A-D/HD in this review, as it is a pervasive behavioral disorder exhibited in childhood that is frequently encountered in optometric practice.

Attention-Deficit/Hyperactivity Disorder (A-D/HD)

Attention deficit disorder is one of the most commonly diagnosed behavioral disorders in children, a label now given to 8.7% of children between the ages of eight and 15 (Froelich et al 2007). The DSM-IV-TR divides A-D/HD into three basic subtypes: A-D/HD 1, A-D/HD 2, and A-D/HD 1 and 2. The first group is characterized predominantly by inattention, the second predominantly by impulsivity and hyperactivity, and the third group is the

combined or mixed type. The DSM-IV-TR specifies that the behaviors that cluster to justify the diagnosis of A-D/HD must have persisted for at least six months, and be maladaptive and inconsistent with the child's developmental level.

There are other qualifiers to these A-D/HD labels. To meet the diagnostic criteria for these three basic subtypes, at least some of the behaviors must have been present prior to the age of seven. Some impairment from the symptoms must be present in two or more settings, such as in school and at home. There must be clear evidence of clinically significant impairment in social or academic functioning. Lastly, the symptoms or signs do not occur exclusively during manifestations of other behavioral disorders such as mood, anxiety, or personality disorders.

Children with A-D/HD tend to be identified at a relatively young age. Their difficulty in engaging in activities guided by others rather than themselves typically results in social or educational problems, often accompanied by disruptive behavior. There is a fourth DSM-IV-TR diagnostic category for A-D/HD, for children who do not meet the criteria for A-D/HD 1 or 2, with predominant inattention that does not manifest until after seven years of age. It also encompasses children with clinically significant impairment who present with inattention, and whose pattern does not meet the full criteria for the disorder, but have a behavioral pattern marked by sluggishness, daydreaming and hypoactivity. As we shall see, a subset of children diagnosed with A-D/HD may have vision-based inattention symptoms.

What framework exists for the interrelationship between vision and attention? Visual information from the world around us is processed by the retina, essentially the outermost structure of the visual brain, and transmitted through the visual pathways to the visual cortex. Attention to this information is mediated through a balance between anterior and posterior cortical networks (see Table 1). Different parts of the visual cortex process information from different locations around us. When we pay attention to a particular location, then there is a selective increase in the electrical activity of the brain cells that process information from this location (Saalmann, Pigarev, Vidyasagar 2007).

While this provides a conceptual framework for the role of attention in visual processing, what clinical relevance does it hold? Optometrists who examine children with vision-based learning problems often encounter children who have difficulty with directing their visual attention. This is frequently manifested in reading difficulties, and children who labor with the requisite skills complain that "reading is boring." In contrast with video games, where the stimulus is moving and varied scanpaths provide a competitive edge, reading requires a different form of visual attention. In another paper, Vidyasagar (2004) applied his visual attention concepts to reading. He presents a cogent argument that one of the core non-language deficits in dyslexia, a recalcitrant form of reading disability, is faulty visuo-spatial attention. Quite literally, these children find it very difficult to know where to allocate attention on the printed page.

The work of Harold Solan and colleagues at the SUNY College of Optometry (2001, 2003, 2007) on visual attention as related to reading supports Vidyasagar's clinical model. Of particular relevance is their success in demonstrating that therapy directed toward improving visual attention transfers directly to improved reading performance. Steinman and Steinman reinforced the basis for how integration of transient attention via the magnocellular visual pathways, and sustained attention via the parvocellular visual pathways, might be monitored and expanded through electrodiagnostic and vision therapy procedures (2007).

Thus far our overview has emphasized the influence of attention on higher order visual abilities or visual cognition, also known as visual information processing abilities. In this regard, as proposed by Solan and colleagues (2006), visual attention is the catalyst that links perception and cognition. The Scheiman and Rouse model, predominant in the optometric field, identifies visual efficiency skills as distinct from visual information processing skills (Scheiman and Rouse 2005). Acuity, accommodation, vergence, and motility (saccades, pursuits, fixations) comprise visual efficiency skills and attention plays an equally important role in these earlier or lower order visual abilities. Examination and treatment for visual efficiency dysfunction is essential when a child's history includes A-D/HD. This is particularly relevant in evaluating children whose A-D/HD is accompanied by delays in

Table 1: Neurophysiological and clinical differences between the anterior and posterior attention networks

	Posterior Network	Anterior Network
Location	Primarily parietal cortex	Primarily frontal cortex
Functions	Reflexive (transient) attention to novel stimuli (covert orienting) Shifting attention Reflexive eye movements	Voluntary (sustained) attention Decision-making about size of attentional focus and surround
Clinical Implications	Visual neglect syndrome	Reduction of attention in dementia
	Both may be affected in reading disability and in A-D/HD	
Possible Tasks for Rehabilitation	Rapidly-flashed peripheral targets	Fine foveal tasks targets

(Modified from Steinman & Steinman J Behav Optom 2007)

reading or writing skills, or marked avoidance of such tasks (Monastra 2008). Simply put, visual efficiency dysfunction can unduly tax the visual attention span.

Children with inefficient visual skills perform significantly poorer in coming to and sustaining visual attention as compared to peers who exhibit efficient visual skills (Borsting 1991). These skill-deficient children expend extra attention to gather information in a clear, single and stable manner that should be allocated toward perception and cognition. This is consistent with Peachey's minimum attention model (1991), and supports clinical impressions about children who have difficulty *paying* attention during tasks requiring sustained visual attention. For example, a child who has difficulty keeping place due to poor saccadic function will have to expend considerable attention in either slowing the rate of saccades, or excessive regressions (back-tracking to re-read) in order to attain adequate comprehension. Older children become aware of these tradeoffs, and can verbalize that unless they pay specific attention to what they are reading through use of a straight edge or guide to help keep place, they have to return and re-read the paragraph again. Providing the child with improved visual abilities helps re-allocate their attention from tracking, focusing or eye-teaming toward improved comprehension.

In their review of A-D/HD, Damari and colleagues (2000) note that visual problems can be diagnosed as attention disorders, particularly when there are difficulties in executive functions. Executive functions include the use of working memory to predict consequences, the control of arousal and emotion, and the ability to pattern one's behavior based on observation of other people's behavior. We would like to echo this, and emphasize that A-D/HD and visual problems can co-exist. Many children have A-D/HD behaviors that are exacerbated by visual problems. A classic example is the child with ample word decoding skills, attentive when listening to others read, but exhibiting limited capacity to read independently. The same child may breeze through word lists and understand grammatical rules, yet have fluency limited by problems in visual processing or efficiency. When the visual problems are treated appropriately, A-D/HD behaviors diminish, though may not resolve entirely. Problems in executive function tend to diminish with maturity (Brocki et al 2008), but most children do not "outgrow" A-D/HD, much as they do not "outgrow" problems in visual processing or efficiency.

We noted earlier that a subset of children diagnosed with A-D/HD according to the DSM-IV-TR may have vision-based inattention symptoms (Farrar et al 2001). At the primary care level, optometrists can help identify this subset of children by asking key questions, or looking for observational criteria contained in standardized optometric checklists that overlap the DSM-IV-TR criteria in Table 2.

Table 2: DSM-IV-TR classification criteria for A-D/HD and symptoms seen both children and adults with undiagnosed learning-related visual problems as well as with normal children under age seven — adapted from the Developmental Delay Resources (www.devdelay.org).

Symptoms *Inattention (At least 6 necessary):*	**ADHD (DSM-IV)***	**Learning-Related Visual Problems (Kavner)**	**Normal Child Under 7 (Gesell)**
Inattention (At least 6 necessary): Often fails to give close attention to details or makes careless mistakes	X	X	
Often has difficulty sustaining attention in tasks or play activities	X	X	X
Often does not listen when spoken to directly	X		
Often does not follow through on instructions or fails to finish work	X	X	X
Often has difficulty organizing tasks and activities	X		X
Often avoids, dislikes or is reluctant to engage in tasks requiring sustained mental effort	X	X	X
Often loses things	X		X
Often distracted by extraneous stimuli	X	X	X
Often forgetful in daily activities	X		
Hyperactivity and Impulsivity (At least 6 necessary): Often fidgets with hands or feet or squirms in seat	X	X	X
Often has difficulty remaining seated when required to do so	X	X	X
Often runs or climbs excessively	X		X
Often has difficulty playing quietly	X		
Often "on the go"	X		X
Often talks excessively	X		
Often blurts out answers to questions before they have been completed	X		
Often has difficulty awaiting turn	X		X
Often interrupts or intrudes on others	X		X

* DSM-IV-TR: *Diagnostic and Statistical Manual of Mental Disorders, 4th Edition evidence-based text revision*

As an example, the COVD Quality of Life Survey (Mozlin 2004) includes the following items:

- Difficulty completing assignments on time
- Trouble keeping attention on reading
- Skips/repeats line when reading
- Avoidance of reading/near work

The way in which we judge a child's visual attention typically involves sustained attention to nearpoint tasks. One of the hallmark features of convergence insufficiency is the inability to sustain attention when reading. Using the Convergence Insufficiency Symptom Survey (CISS), a score of 16 or greater was found to be a reliable and valid for differentiating normal binocular vision in children from those with symptomatic convergence insufficiency Table 3 (available as a PDF download in the Members' Only section of www.coavision.org). On the CISS only 8% of children with normal binocular vision reported frequent inability to concentrate when reading as compared to 43% of the children with convergence insufficiency (Borsting et al 2003). Loss of place occurred frequently for 58% of the children with convergence insufficiency as compared to only 11% of the children with normal binocular vision. This survey can easily be used in practice to determine who should have further evaluation of binocular visual skills. We might therefore suspect co-morbidity if not causality between convergence insufficiency and A-D/HD. David Granet and colleagues in the Ratner Children's Eye Center, Department of Ophthalmology at UC San Diego investigated this association through a retrospective review of clinical records (Granet et al 2005). Among the 266 charts of patients diagnosed as having convergence insufficiency, these researchers found a three times greater amount had A-D/HD than would be expected among the general pediatric population. While the authors are cautious about drawing conclusions from this, they found the correlation compelling enough to emphasize that patients diagnosed with A-D/HD should be evaluated to determine if they have convergence insufficiency.

Studies of this nature should help call attention to children treated primarily as having A-D/HD, when their underlying visual problem is left untreated. In many instances these children are medicated with Ritalin or similar drugs with amphetamine properties that have significant systemic side effects including loss of appetite, loss of sleep, and irritability. The sympathomimetic effect of these drugs can inhibit accommodation and cause accommodative insufficiency, high accommodative lag, or difficulty compensating for pre-existing hyperopia, a condition often associated with learning problems (Rosner 1989, 1997). A drug induced accommodative dysfunction can exacerbate convergence insufficiency. In these cases, from a learning standpoint, the treatment may be worse than the cure. This is particularly important because convergence insufficiency is one of the more common visual problems that optometrists help resolve through lens and prism prescriptions or vision therapy.

We are not advocating against psychopharmacologic treatment of childhood behavioral disorders such as A-D/HD. As optometrists we all have had occasion to examine the impulsive child who begins to respond before we have finished giving the instructional set, and the hyperactive child who touches everything in sight and is inquisitive to a fault. We can understand that medication may be the most expedient approach to orienting the child well enough to participate in activities requiring attentive interaction with others, and makes life more manageable not only for the child, but for teachers and parents. Indeed, in some instances, systemic medication for A-D/HD improves a child's ability to participate in and benefit from academic instruction and vision therapy. We caution, however, against medication as the initial and primary treatment without consideration of visual efficiency and processing factors.

Oppostional Defiance Disorder (ODD)

Oppositional Defiance Disorder (ODD) is described by the DSM-IV-TR as a pattern of negativistic, hostile, and defiant behavior lasting at least six months, during which four or more of the following are present:

1. Often loses temper.
2. Often argues with adults.
3. Often actively defies or refuses to comply with adults' requests or rules.
4. Often deliberately annoys people.
5. Often blames others for his or her mistakes or misbehaviors.
6. Is often touchy or easily annoyed by others.
7. Is often angry and resentful.
8. Is often spiteful or vindictive.

As with A-D/HD, the guidelines specify that any of these criteria are considered to be met only if the behavior occurs more frequently than is typically observed in individuals of comparable age and developmental level. In other words, the circumstances are beyond "just boys being boys." Oppositional defiance that does not meet criteria for ODD, but results in clinically significant impairment is called Disruptive Behavior Disorder. Approximately 5-15% of children will meet the criteria for ODD, with boys outnumbering girls, but the distribution evens out by puberty (Kutscher et al 2007). ODD overlaps with A-D/HD and bipolar disorder, as up to 50% of children diagnosed with A-D/HD also have ODD and the figure climbs as high as 75% for co-morbidity with bipolar disorder (Anglada and Hakala 2008).

Primary care optometrists encountering children with ODD will recognize the syndrome when taking case histories, particularly when a parent is in the examination room. For example, a parent might note that the child seems to have trouble seeing signs at a distance when the parent is driving, and the child immediately snaps, "No I don't." The ODD child may appear to be "throwing" the exam, insisting that anything you ask him to do is problematic despite normal findings with objective tests such as autorefractor, retinoscopy, cover test and ophthalmoscopy.

In contrast is the child who has a legitimate visual problem that has not been detected or treated, and has been accused of "crying wolf." This may for example be a child with A-D/HD secondary to convergence insufficiency who has been told he is just lazy and not trying hard enough. He has been to eye doctors who reinforce this opinion because they find emmetropia and healthy ocular structures but they do not test for or acknowledge the visual skill problems that are causing the visual symptoms. On previous exams he may have even exaggerated his difficulties in responding so that the doctor would believe him, and then labeled a malingerer. One parent has told the other to stop making excuses for the child, and to "get over this vision thing" because the doctors have found nothing wrong. The child's visual abilities become yet another point of contention at home or in the school environment, and this heightens the child's disputational nature and disruptive behavior.

Optometrists involved in vision therapy have become very sensitive to issues revolving around these children. Looking at the DSM-IV-TR criteria, these are children who sabotage their success. These patients have figured out that if they succeed on particular tasks, more will be expected of them. Responsibility for lack of progress is transferred onto others rather than being accepted by the child. Achieving success in these cases hinges on developing an approach that does not focus on blame, or concentrates on punitive measures, but heaps reward on legitimate positive behaviors.

When ODD exists at a subclinical or sub-syndrome level not meeting all of the DSM criteria, the child can simply present as non-compliant (Riley 1997). This may be the child who refuses to wear his eyewear, denying that they provide any benefit. Even placebo effects are almost non-existent, as any form of intervention is considered useless from the child's point of view unless it results in other individuals modifying their behavior. When a sudden change in behavior is exhibited, physical changes must be ruled out. Visual fields should be attempted, and general procedures followed to investigate sources of brain based changes such EEGs or imaging studies. It is important for the optometrist to bear in mind that many of these children are already under psychological care, and consulting with other professionals may be in order.

Bipolar Disorder

Taking its name from the two poles of happiness and sadness, bipolarity or manic-depression is a type of mood disorder featured by periods of time when a child feels abnormally happy or sad. Abnormal happiness that is pathologic is characterized by manic episodes — a feeling of elation for a period of at least one week, during which the child is grandiose, talkative, hyperactive, or distractible to a fault. Abnormal sadness that is pathologic is characterized by depressive episodes — extreme sadness lasting at least two weeks. During that period the child has problems with eating and sleeping, guilt feelings, loss of energy, trouble concentrating, and thoughts about death.

There is a significantly stronger genetic influence for bipolar disorder than for unipolar depression, with heritability calculated to be between 0.8 and 0.9 for bipolar disorder as compared to 0.45 for depression (Pliszka 2003). Approximately 25% of mood disorder patients experience manic or hypomanic episodes, and nearly all of these patients will also have episodes of depression. The severity and duration of the highs and lows determine the specific bipolar disorder (Morrison 2006).

One of the most extensively sub-typed behavioral disorders, bipolar disorder is broadly classified into Bipolar I and Bipolar II. The DSM-IV-TR lists six separate criteria sets for Bipolar I Disorder:

1. Single manic episode
2. Most recent episode hypomanic
3. Most recent episode manic
4. Most recent episode mixed
5. Most recent episode depressed
6. Most recent episode unspecified

Bipolar II Disorder presents with the same criteria, except the episodes of mania are less severe and therefore considered to be hypomanic.

There is another related category which is Cyclothymic Disorder, manifest as repeated mood swings without sufficient severity to be called major depressive or manic episodes. It is important to note that these classification criteria exclude mood disorders induced by drugs or disease conditions.

In summary, it appears that mood cycles or emotional valence can influence visual function. This may help explain why certain children report visual difficulties when in stressful situations that are not reflected in standard optometric findings if the examiner is able to make the child feel comfortable and relaxed. Conversely, a child may exhibit abnormal visual behaviors during an evaluation that are secondary to anxiety, such as constriction of visual span and space (Searfoss and Garzia 2000). A sense of tunnel vision requires a child to make more fixations per unit time, or to use head movement to substitute for eye movement. Children who are overwhelmed may get close to the page to operate within this collapsed area of usable vision (Streff and Gundersen 2004). Increasing plus lens power over the distance refraction, or adding base down yoked prism may effectively expand visual space, whereas binasal or other forms of sector occlusion may alter suppression effects and other timing mechanisms between left and right cerebral hemispheres (Flach and Kaplan 1983; Carmody et al 1994).

Depression

Children who are under stress who experience attention, learning or conduct disorders are at a higher risk for depression. (Woliver 2009) Depression may someday be understood in terms of its paradoxes. There is an astonishing contrast between the depressed person's image of him or herself and

the objective facts. Persons who are depressed often perform acts that seem to enhance their suffering (Beck & Alford 2009). Depression in children and teens is usually chronic and relapsing (http://www.narsad.org/dc/depression — accessed April 12, 2009). Depression may be under-diagnosed in children, as up to 50% of patients ultimately diagnosed with the disorder exhibit early somatic symptoms as primary features, such as headaches or body aches, rather than behavioral abnormalities (Whooley and Simon 2000).

From a diagnostic standpoint, depression is classified according to the DSM-IV-TR by its depth and periodicity. A single episode of a major depressive disorder is classified as ICD 296.2x. Roughly half the patients who have one major depressive episode will have another. At this point they are reclassified as having recurrent, major depressive disorder (296.3x). Approximately 25% of these patients will eventually develop a manic episode, which now shifts them into the category of bipolar disorder (Morrison 2006). According to several studies, a significant proportion of the 3.4 million children and adolescents with depression in the United States may actually be experiencing the early onset of bipolar disorder, but have not yet experienced the manic phase of the illness (http://www.bpkids.org/site/PageServer?pagename=lrn_about — accessed April 12, 2009).

To be classified as a major depressive episode, at least five of the following must be present during the same two-week period, nearly every day, and represent a change from previous functioning:

1. Depressed mood most of the day, as indicated by either subjective report (e.g. feels sad or empty) or observation (e.g. appears tearful). In children, an indication can be prolonged irritability.
2. Markedly diminished interest or pleasure in almost all activities most the day.
3. Significant weight loss without dieting (e.g. more than 5% of body weight). In children, consider failure to make expected weight gains.
4. Insomnia or hypersomnia.
5. Psychomotor agitation or retardation.
6. Fatigue or loss of energy.
7. Feelings of worthlessness, or excess or inappropriate guilt.
8. Diminished ability to think or concentrate, or indecisiveness.
9. Recurrent thoughts of death (not accounted for by bereavement) or suicide.

Every optometrist has the opportunity to influence a child's self-image in very basic ways. Consider the relatively common scenario, encountered in primary care optometry, of children who have self-image issues about wearing spectacles. At the subclinical or sub-syndrome level, it is common for children to be moderately withdrawn or introverted, and exhibit marked positive changes in personality after being successfully fit with contact lenses (Walline et al 2009). It is only after seeing the child's demeanor change that the contrast in overall mood from what previously existed becomes apparent.

Children with mild or subsyndromal forms of depression often function in the shadows (Ratey and Johnson 1998). In practices specializing in optometric vision therapy we tend to see children who have been struggling to keep their heads above water academically and socially. They have already been caught up in a vicious cycle of underachievement or failure, and diminished expectations. Put yourself in the place of a child who is trying her best, but continually falls short of what she sees her peers achieving. Your parents have engaged you in numerous interventions, in some instances with little return on investment for the effort expended.

As we noted with A-D/HD, increasingly children are being treated psycho-pharmacologically at younger ages. Our purpose here is not to dispute the appropriateness of medications for various disorders, but to note that tricyclic drugs for depression such as Imipramine and amitriptyline also produce various autonomic effects, the most frequent of which include difficulties with accommodation. Something as basic as prescribing added plus lenses for near may provide immediate benefit to the child. An overview of anti-pscyhotic, anti-anxiety and depressive medication ophthalmic side-effects is provided in Table 4.

Table 4: Ocular and Visual Side-Effects of Select Drugs for Behavioral Disorders

Drug	Indication	Side-Effects
Lithium	Bipolar disorder	Downbeat jerk nystagmus Blurred vision cortical origin Diplopia Keratitis sicca
Ritalin	A-D/HD	Accommodative dysfunction Mydriasis
Valium	Anti-anxiety	Cycloplegia
Imipramine	Anti-depressant (tricyclic)	Dry eye
Prozac	Anti-depressants (Selective Serotonin Reuptake Inhibitors) *Only anti-depressant approved for children*	Visual side effects rare

(Adapted from: Wren VQ. Ocular and visual side-effects of systemic drugs: Clinically relevant toxicology and patient management. J Behav Optom 2000;11:149-157.)

In addition, pediatricians are now integrating allopathic (Western) and complementary or alternative medicine to treat children holistically. Behavioral disorders can be caused by the unique way in which a child's biochemical and genetic makeup interact with his/her daily environment, from environmental pollutants and toxins to thoughts (Rosen and Breuner 2007). Many medications only treat and suppress symptoms without

addressing underlying causes. Using an integrative approach to a child's health concerns, developmental pediatricians strive to understand the root causes of a child's condition, correcting underlying biochemical imbalances to heal the child. Table 5 shows some of the potential dietary modifications for select behavioral disorders.

Table 5: Potential Dietary Modifications for Select Behavioral Disorders

Anxiety	Replenish adequate calories Replace inflammatory foods Taurine 200-2000 mg Carnosine 100 mg GABA 500-1000 mg Magnesium to 300 mg Epsom salts nightly with lavender Chaomile, passion flower tinctures NAC 200-500 mg
Depression	Fish oil or cod liver oil to 1 tbsp High-potency B group Tyrosine 100 mg in a.m. Rhodiola rosea 100 mg Replenish minerals to DRI
Bipolar	Replenish adequate calories EPA 3 mg Chromium to DRI Tyrosine 50-100 mg Melatonin up to 3 mg for insomnia
A-D/HD	Replenish adequate calories Replenish all essential minerals (especially chromium, zinc, magnesium) DHA to 500 mg Full-potency B group High-value protein breakfast Rule out and treat Candida or gut dysbiosis GFCF (Gluten-free Cassein-free diet)

(Adapted from: Converse J. Special-needs kids eat right. New York: The Penguin Group 2009; p. 199-203.)

Conclusion

Behavioral disorders can significantly influence a child's responses in clinical optometric settings. Superficially it may appear that some children are simply "uncooperative" for examination or vision therapy procedures. However, we should bear in mind that that psychophysical measures such as visual acuity, stereoacuity, vergence, and accommodation, and standardized visual perceptual testing, that require effort and attention toward a threshold limit of performance, provide a useful window to children's behavioral patterns (Birnbaum 1990). In some instances visual performance may be substandard due to inadequately controlled behavioral disorders such as A-D/HD. In other instances untreated visual problems making performance difficult may contribute to the behavioral disorder (Zaba 2001).

Deciding when a child exhibits physical signs or symptoms that are primary or secondary relative to behavioral disorders is not always straightforward. Take for example the child whose parent is concerned about a seemingly sudden onset of facial tics that involve frequent involuntary blinking of the eyes. This behavior may stem from emotional factors involving anxiety or stress, such as a new sibling in the family, relocating to a new city, or domestic issues among adults in the household. When onset is gradual, differential diagnosis will include rapid blinking to relieve dry eyes or allergic symptoms, as well as rapid blinking to re-focus during accommodative or binocular dysfunction. Conversely, the acute onset of the tics may be triggered by an exaggerated autoimmune response to strep infection, known as PANDAS, or Pediatric Autoimmune Neuropsychiatric Disorders (Swedo et al 1994). Effective treatment hinges on success in identifying and treating the underlying causes, in this case a strep infection, after ruling out other more common potential causes. These include those conditions noted above, as well as blinking as a side effect of medications (Ritalin and Adderal), magnesium deficiency, or other neurological conditions, such as Tourette's Syndrome.

In this review we have selected four common childhood behavioral disorders that optometrists will encounter. In multidisciplinary or specialty optometric practices, collaboration with a pediatric mental health professional can provide insight into the multifaceted nature of these disorders. Optometric treatment can enhance visual function and positively influence a child's mental state, and medical or allied mental health treatment can help in resolving visual components of brain-based behavioral disorders (Kaplan 1998). Allied and integrative interventions for childhood behavioral disorders also encompass lifestyle factors such as health and nutritional counseling that should begin at an early age (Hyman 2007; Rimland 2008).

At the primary care level, optometrists have the opportunity to collaborate with colleagues who specialize in vision therapy, visual development, and behavioral vision care. As our field continues to evolve, the care of children on the continuum of neurobehavioral disorders presents varied options including:

1. The primary application of lenses and prisms for refractive conditions co-existing with childhood behavioral disorders.
2. The application of lenses and prisms for accommodation and fusion abnormalities secondary to side-effects of medications prescribed for pediatric behavioral disorders.
3. Co-management through consultation or referral for lens and prism application or office-based optometric vision therapy.
4. Consultation with an optometric colleague for assistance in networking with other professionals who specialize in childhood behavioral disorders.

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CE Questions

1. Which of the following contains the most definitive diagnostic classifications for childhood behavioral disorders?
   a. DDR
   b. DSM-IV-TR
   c. CPT
   d. IEP

2. Which of the following childhood behavioral disorders is most likely to present with symptoms that can mimic or co-exist with vision problems?
   a. A-D/HD
   b. Bipolar Disorder
   c. Oppositional Defiant Disorder
   d. Depression

3. A child has an inability to concentrate on sustained visual nearpoint tasks when reading, but has no problem attending when listening to someone read a story. The most probable cause is:
   a. Attention deficit with hyperactivity
   b. Attention deficit without hyperactivity
   c. Convergence insufficiency
   d. Central auditory processing deficit

4. In order to be classified as A-D/HD 2, a child must have symptoms that presented:
   a. Subsequent to head injury
   b. Subsequent to high fever
   c. With onset after puberty
   d. With onset prior to age seven

5. A child who is resistant to any guidance from adult authority figures but gets along well with peers is best classified as having which of the following?
   a. A-D/HD
   b. Bipolar Disorder
   c. Oppositional Defiance Disorder
   d. Depression

6. A child who is experiencing excessive anxiety is most likely to exhibit which of the following visual behaviors:
   a. increase in hyperopia
   b. constriction of visual space
   c. decrease in astigmatism
   d. increase in visual span

7. When working with a child who has Oppositional Defiance Disorder (ODD), the best approach to gain cooperation is:
   a. reward legitimate positive behaviors.
   b. blame the child for non-compliance.
   c. develop adequate punitive measures.
   d. blame the parent for the child's defiance.

8. You consider recommending dietary modifications for a child who has behavioral disorders. Which of the following medical professionals is most likely to collaborate in management with you?
   a. Pediatric ophthalmologist
   b. Pediatric neurologist
   c. Pediatric cardiologist
   d. Developmental pediatrician

9. Tricyclic drugs for depression are most likely to impair which of the following functions?
   a. Accommodation
   b. Vergence
   c. Stereopsis
   d. Ocular motility

10. Ritalin prescribed for A-D/HD is most likely to impair which of the following functions?
    a. Accommodation
    b. Vergence
    c. Stereopsis
    d. Ocular motility

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