Article ▸ Thinking Goes Back to School: Providing Better Vision Therapy to Patients with Autism Spectrum Disorder

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ABSTRACT

Background: Autism Spectrum Disorder (ASD) is a developmental disability characterized by difficulties in social interaction and sensory processing. When vision therapy is indicated, the optometrist may be challenged to provide a vision therapy program that the patient can successfully complete or that produces results that generalize to more naturalistic settings due to challenges associated with ASD.

Methods: From a series of case vignettes, challenges in providing vision therapy are identified. Drawing upon the DIR Model/Floortime and Visuo-Cognitive Therapy, clinical strategies are presented to address these challenges so that the patient can succeed in a vision therapy program.

Results: Ten clinical pearls for providing vision therapy to patients with ASD are summarized.

Conclusions: The DIR Model/Floortime and Visuo-Cognitive Therapy offer optometrists additional tools and strategies to enhance vision therapy provided to patients with ASD.

Keywords: autism spectrum disorder, DIR Model/Floortime, vision therapy, visuo-cognitive therapy

Introduction

Patients with autism can challenge the most experienced optometrists and vision therapists. Autism or autistic spectrum disorder refers to a group of brain development disorders associated with difficulties in social interaction, verbal and nonverbal communication, and repetitive behaviors.[1] Since the publication of the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) in May 2013, autism spectrum disorder (ASD) includes the conditions of autistic disorder, pervasive developmental disorder-not otherwise specified (PDD-NOS), and Asperger syndrome, which used to be diagnosed separately.[2]

Among individuals who have autism, vision problems are common and include hyper- and hypo-sensitivities in processing visual stimuli, reduced convergence, poor ocular motility function (including poor fixation, pursuits, and saccades), poor visuo-spatial awareness, poor visual-motor processing, problems in inter-sensory and sensorimotor integration, difficulties in processing faces, and problems integrating central and peripheral visual stimuli.[3-5] Vision therapy as a treatment modality is used to treat many of these vision problems.

The Problem

When vision therapy is indicated, the optometrist and vision therapist may encounter multiple challenges in providing treatment to these patients. Some common challenges with these patients include: (1) The patient's attention is fragmented and he or she cannot sustain interaction with the clinician. (2) The patient does not have intentional language and has poor language comprehension. He or she has little or no speech or the patient talks a lot in "scripts," but what he or she says is not appropriate to the context or situation or does not convey meaning. (3) The patient has great difficulty transitioning from one task to another. (4) The patient has motor planning problems, hypotonia (low muscle tone), and apraxia (difficulty executing movements when asked) and cannot operate traditional optometric equipment. (5) The patient is tactile defensive and resists wearing equipment that touches his or her face, including glasses, goggles, or patches. When vision therapy is provided to patients with ASD using conventional approaches, progress may be limited as the patient cannot perform the procedure, refuses to complete the tasks, or spends so little of the time on-task that not much is accomplished.

The conundrum for the clinician is that the ASD population includes many individuals who need quality comprehensive vision care, yet these individuals have characteristics and behaviors that make the provision of quality vision care difficult. Optometrists who provide vision therapy have responded to this challenge in several ways:

- The optometrist creates a treatment plan that does not include active in-office vision therapy but may use passive treatments such as lenses, prisms, or colored filters.
- The optometrist selects the procedures for a vision therapy treatment program and instructs a non-optometric provider such as an occupational therapist, educator, or parent how to do these activities. The non-optometric provider then implements the program.

- The vision therapy program is spread out over time by alternating in-office vision therapy with breaks to allow more time for integration and development. A possible schedule might be three months of in-office vision therapy followed by a three-month break, then followed by another three months of in-office vision therapy and another three-month break.
- The optometrist modifies the procedures and approach of how vision therapy is provided to meet the challenges of the patient with ASD.

If optometrists could provide effective vision care to every symptomatic patient with ASD—what would it look like? Is there a better clinical model to provide active vision therapy than what optometrists are currently using?

Visuo-Cognitive Therapy

In 1975, Harry Wachs published the classic work, *Thinking Goes to School*.[6] Co-written with Hans Furth, a psychology professor at the Catholic University of America, *Thinking Goes to School* presented visual spatial function as an aspect of intelligence. Wachs and Furth proposed that intelligence was dynamic and could be developed through sensorimotor experience. Building upon the work of developmental optometrists G.N. Getman and others, Wachs combined visual/spatial activities with an emphasis on cognitive awareness and discovery. Visuo-Cognitive Therapy, then, focused on the development of cognitive and visual abilities through active vision therapy.

Later in his career, Wachs collaborated with Serena Wieder, PhD as they co-managed many patients with ASD. Their collaboration resulted in a refinement of Visuo-Cognitive Therapy. As a child psychologist, Wieder understood the importance of emotions in child development. For children to develop resilience, coping skills, and the ability to tolerate stress, learning needed to include emotional, affect-based experiences within a relationship. Therapy, including vision therapy, was based upon back-and-forth affective gesturing between the patient and the therapist. The therapist identified a child's initiations and preferences and supported the child in expanding these into meaningful play, i.e. "following the child's lead." Good therapy was a result of matching the patient's developmental level. By observing the patient's spontaneous behaviors and interacting with the child in ways that were meaningful and even enjoyable to the child, the clinician could infer the patient's underlying visual/spatial cognitive abilities and developmental and emotional functioning profile.

Spontaneous behaviors often observed in children with ASD include wandering aimlessly in new environments without purpose, not noticing or exploring novel objects, lining up toys, habitually placing toys at eye level, insisting that objects stay in the same place, demanding to play with the same toys over and over, seeking an item randomly, and not directly gazing in an intentional way. For a complete discussion of frequently observed behaviors and their links to gaps in visual spatial development, the reader is referred to Wieder's and Wachs' definitive text, *Visual Spatial Portals to Thinking, Feeling, and Movement*.[7]

Developmental Individual-Differences Relationship-Based Model/Floortime

The Developmental Individual-Differences Relationship-Based (DIR) model is a clinical model used to provide therapeutic intervention to children with ASD developed by Greenspan and Wieder in the 1980s.[8,9] The model is interdisciplinary and includes the work of occupational therapists, speech and language professionals, general and special education teachers, mental health professionals, behavioral therapists, pediatricians, psychiatrists, and other professionals, including optometrists.[10] The Developmental aspect of the model refers to the functional emotional developmental capacities for children to be able to maintain attention and to stay calm and regulated, to engage and relate to others, to initiate and respond to communication including social affect and gestures, to show shared social problem-solving and intentional behavior in a continuous manner, to use ideas to communicate needs, to think and play, and to connect ideas in logical ways.[10] Individual-Differences refers to the biologically-based processing that each child uses to gather, to regulate, to respond to, and to comprehend sensory information such as vision, sound, touch, and balance, as well as to sequence motor movements. Relationship-based refers to the idea that learning occurs when the individual engages in meaningful activity with a caring therapist who provides affect-based interactions to facilitate progress.[10] Within the DIR model, therapy is provided using the specific techniques of Floortime. Floortime interactions occur when the therapist follows the patient's natural emotional interests (lead) while at the same time supporting the patient in reaching higher levels of social, emotional, and intellectual abilities. Within Floortime interactions, the therapist's use of affect is conveyed through facial and body gestures, pacing, and rhythm, and the emotional tone of voice helps the child understand the meaning of what is being communicated. This experience of feeling or emotion is critical. Affect provides the "glue" to maximize the patient's attention and comprehension, and it promotes his or her ability to initiate with and respond to others. Effective therapy happens when meaningful interactions occur between the therapist and the patient. Both the therapist and patient initiate and respond in order to create reciprocal exchanges or circles of communication within activities. Floortime therapists refer to the act of initiating the exchange as "opening the circle" and responding to the exchange as "closing the circle."

The DIR model is of interest to optometrists and those interested in vision because it recognizes the important role that vision plays in human development. The model reflects Harry Wachs' work linking Piaget's model of cognitive development to vision development.[7] The therapist working in the area of

TABLE 1: Visual Goals in the DIR Model

Early Goals - Response to Visual Environment
The child uses visual spatial strategies systematically to explore and to discriminate desired objects. The child is able to:
1. Observe and focus on desired object
2. Alternate gaze (initiate joint attention visually)
3. Follow another's gaze to determine the object of their attention and their intent
3. Switch visual attention back and forth between self and another
4. Differentiate salient visual stimuli from background stimuli (visual figure ground)
5. Actively search for object that is hidden
6. Can explore two areas of room and search for desired object
7. Can explore more than two areas with active visual assessment of space, shape, and materials
Later Goals - Visual Spatial Abilities
The child demonstrates mastery of the following visual spatial abilities:
1. Body awareness and sense – Develops knowledge of body parts and the ability to coordinate these parts for purposeful movement, guided by all five senses
2. Location of Body in Space
3. Gross and fine Visual Motor Integration
4. Ocular motor control, accommodative function, and binocular sensory and motor fusion
5. Visualization, pictorial mental imagery
6. Visual spatial analysis, visual tactile, visual auditory integration
7. Visual logic

vision works at the child's developmental level, building upon the child's strengths to increase his or her emotional capacities, tolerance to frustration, and progress up the developmental ladder. In the earliest stages, treatment is most similar between different types of providers: Occupational Therapists (OTs), Speech and Language Pathologists (SLPs), teachers, and other professionals as the first goals are to engage, to form relationships, and to establish two-way communication. As the patient progresses, the intervention becomes more and more differentiated to that of a particular discipline.

In the early stages of treatment, the visual goals are basic. As therapy progresses, visual goals become more specific and resemble those in traditional vision therapy programs (Table 1).

The therapist working within the DIR model must also have some understanding of the patient's individual differences in other areas. What is the patient's ability to regulate (stay calm) when presented with auditory or tactile stimuli? Does he or she strive to obtain or avoid the stimuli? For example, a patient with auditory hypersensitivity might put his hands over his ears, while a tactile-seeking patient who sees a spongy object may want to touch or squeeze it. What is the patient's ability to control his or her posture and to orient, respond, imitate, or motor plan to carry out a task? How does the child respond to language, gestures, and sounds? How does the child communicate with vocalizations, gestures, utterances, or words? How well can the child understand, organize, and carry out unfamiliar motor actions? By understanding the patient's profile in development and sensory motor functions, the clinician can select and modify tasks, make them meaningful to the patient, and add affect (emotional expression) to help the child perform.

Figure 1: *Furreal duck used in stick-in-a-straw procedure*

Vision therapy procedures are traditionally highly structured. Clinicians working with patients with ASD will realize quickly that many mainstay procedures may not work in their original format. For the procedures to be meaningful and meet the developmental level of the patient, the basic procedure must be modified in terms of the equipment used, its context, or how the patient is taught to do it. The clinician also may need to adjust the pace of the procedure by recognizing when the patient takes longer to respond, following the patient's lead in determining what a good pace is, and waiting when necessary for the patient to have enough time to plan and complete the procedure.

A very simple example is the vision therapy procedure of "stick in a straw," in which a child reaches to place a toothpick or pickup stick into a straw. The procedure targets fixation, visual motor integration, visual spatial awareness, and visually directed reaching. For some patients with ASD, however, this procedure may seem abstract and lack meaning. By substituting an animal toy, such as the Furreal Friend Newborn White Duckling, for the straw and the duck's bottle for a stick, the activity now becomes concrete and developmentally meaningful. The therapist can then add affect by telling the patient, "Oh… the duck is hungry," while he or she makes a sad face. "Can you feed the duck?" The same task then becomes cognitively and emotionally engaging, while the visual goals of obtaining accurate fixation, visual spatial awareness, and visual motor integration are achieved (Figure 1). Similarly, other tasks can be modified or reframed while retaining the critical visual demands. The DIR model and Visuo-Cognitive Therapy has been used successfully in optometric private (Green MDA, June 2014). This report is to share the application of the DIR model and Visuo-Cognitive Therapy in an academic setting.

Method

The Pediatric Optometry and Binocular Vision Service of Nova Southeastern University (NSU) is a teaching clinic that delivers high quality patient care, serves as a teaching facility for students and residents to learn, and provides a patient base for clinical research and scholarship to occur. The service provides care to a diverse patient population with complex visual conditions and serves as a referral center for local optometrists, psychologists, educators, occupational and speech and language therapists, ophthalmologists, and pediatricians. The clinic serves patients who cannot be treated using the conventional therapy approach due to the patients' many challenges in the areas of language, motor planning, attention, and sensory processing.

Through active tutoring, reading, case review, and co-mentoring, the faculty was able to incorporate the DIR model into the optometric service, providing comprehensive vision care, including in-office vision therapy, to patients with ASD who previously could not be treated. In addition, the DIR/Floortime model was used for patients with ASD whose progress had stagnated; these patients had initially made progress but gradually became uncooperative, unmotivated, or disinvested in their vision therapy programs. The expertise of the DIR/Floortime faculty and the Profectum program that provides training in the model was used to apply non-optometric aspects of using this model.[11]

In working with numerous "unique" cases, the faculty observed consistent behaviors on the part of the clinician that resulted in successful or improved performance by the patients in their vision therapy programs. This article reports these experiences with the insight of Serena Wieder, PhD, an expert in DIR/Floortime, Visuo-Cognitive therapy, and child development. Using this collaboration of clinical experience, this report identifies a series of clinical pearls that may be helpful for optometrists and vision therapists who are providing active vision therapy to patients with ASD. This report is not meant to teach basic vision therapy procedures, or sequencing of procedures for vision therapy programs, nor does it provide comprehensive training on how to be a DIR/Floortime therapist. Instead, it is intended to report on how therapeutic sessions and procedures may be modified to increase the success of patients with ASD in completing them.

Clinical Pearls

Clinical pearls are defined as "small bits of free standing, clinically relevant information based on experience or observation...part of the vast domain of experience-based medicine, and can be helpful in dealing with clinical problems for which controlled data do not exist."[12] Clinical pearls also provide general rules or tips that can be used for future care or for teaching other practitioners how to manage certain types of cases.[13] The authors report ten clinical pearls that may help clinicians in providing vision therapy to patients with ASD.

Figure 2: *Finger puppet dance using plexiglass barrier*

Clinical Pearl 1 – Don't be afraid to modify a vision therapy procedure to meet the patient's developmental, social, communication, cognitive, and/or motor challenges.

Case Vignette: An eight-year-old boy with ASD was diagnosed with oculomotor deficits including poor fixation, saccadic, and pursuit function. The patient had limited speech and had not yet begun to read. He had poor visual-fine motor integration and motor-planning abilities. He was hypersensitive to auditory stimuli. He also struggled to stay on task and to remain engaged and interactive with the therapist. When presented with a visual task, he responded with random glimpses of short fixation and did not look intentionally at visual targets. Consequently, he was unable to complete conventional therapy procedures such as the Wayne saccadic fixator, Michigan tracking workbooks, and Hart charts.

To enable this patient to complete a vision therapy task to develop ocular motility skills, the following steps were taken. The therapist and the patient each put a finger puppet on their index fingers. Using affect, the therapist demonstrated how to move the finger to make the puppet dance to softly hummed music. The patient began to dance his puppet as well and began to sing a familiar tune. The therapist then joined the patient, showing the patient how to make the puppets dance together. A clear plexiglass board was placed between the two puppets. The therapist and patient worked face-to-face. As the patient moved his puppet and tapped against the plexiglass board, the patient had increased tactile and proprioceptive feedback as to where his puppet was located. As the patient began to make his patient dance with the therapist's puppet, the therapist began to lead the puppet dance, eliciting the patient's attempt to look intentionally, fixate on the puppets, and move his puppet to match the therapist's puppet. The therapist and patient then expanded the activity to make the dance more elaborate, moving through more visual field and making more complex movements (Figure 2).

Patients with ASD vary greatly. A patient with little verbal language, motor planning problems, and many sensory demands often will be unable to complete traditional vision therapy procedures in a highly structured format. For example, when choosing a therapy procedure early in the vision therapy program to improve visual scanning and saccadic accuracy, the saccadic fixator may be too fast, require too much dexterity, and/or be too difficult to attend to. By setting up a vision therapy task that is face-to-face with the therapist, enabling the therapist to incorporate affect to engage the child, slowing the task, and reducing the motor demand, the patient can begin to work on accurate fixation, visual spatial localization, and saccadic accuracy. As the patient progresses in their vision therapy program, fewer supports will be needed. The patient will be able to complete more of the therapy independently. By the end of the vision therapy program, the patient often will be able to complete more traditional vision therapy tasks.

Clinical Pearl 2 – When it's not working, "Go down to go up."

Case Vignette: A four-year-old boy with autism is completing a vision therapy program to improve the accuracy of his visual scanning, saccadic, and pursuit function and to increase vision and gross motor integration. The therapist attempts to target these skills using the procedure of flashlight tag. When presented with the task, the patient turns the flashlight on, shines the beam on the wall, but begins to act very controlling. He refuses to complete the task as directed, saying, "No, you do what I say. I make the rules." The activity ends with him refusing to participate or doing something else that does not work on his visual goals.

Clinicians providing vision therapy to patients with ASD may encounter a period when progress is not being made. The clinician observes that the patient is not attending to the task, is showing little effort, is going through the motions, or appears to be uncooperative. These behaviors may indicate that the patient has an unidentified developmental gap that is obstructing progress. In this situation, the DIR/Floortime axiom is "go down to go up." By decreasing the language, cognitive, motor, and sensory regulation demands of the task until the patient is again engaged, interactive, and mastering elements of the task, the therapist can regain a therapeutic back-and-forth interaction between therapist and patient, or in Floortime parlance, "open and close the circle."

In this example, the therapist reviewed the demands of the cognitive, motor, and sensory processing of the task. The therapist created an activity based upon symbolic play by using two flashlights, one with a stencil on the top that projects the image of a fish and the other flashlight with a head covered by red acetate that projects a small round beam, the "fish food." The therapy task is now structured as a "fish" catching the "fish food." The expressive and receptive language demands of the task are reduced. In the place of words, at first, the only sound made when the "fish" catches the "fish food" is a munching sound. In the beginning of the activity, the flashlights are projected only in primary gaze, as the patient struggles with the posture demands of looking upwards for the beams. As the activity proceeds, the therapist and the patient exchange flashlights, with each one playing the role of the "fish" or "fish food." For "eating" to occur, both the therapist and patient must work together to shine their flashlights at the same place at the same time. This requires co-regulation as well as steady fixation and accurate saccades and pursuits. Throughout the activity, the therapist is playful in his or her tone and movements, wooing the child into the pleasure of the "chase" as they increase the challenge and the child experiences the game as fun.

Clinical Pearl 3 – Work face-to-face whenever possible.

Case Vignette: A four-year-old girl with ASD was referred by a psychologist for evaluation of vision and treatment. The child is very verbal and enrolled in an inclusive preschool setting. As the clinician observes her, she engages in symbolic play games with her mother, role-playing in house or school scenarios. The patient does very little facial gazing, often looking away at other objects, when talking to her mother. Her mother reports that her frequent visual behaviors, including gaze aversion, minimal eye contact, and fleeting fixation, create problems in her preschool setting. When the patient's teachers attempt to facilitate her interaction with peers, her peers interpret her responses as a lack of interest in playing and move away from her.

As early as six months old, infants who are later diagnosed with ASD are less likely to look at people or to socially orient, that is to spontaneously, or upon request, direct attention to another person.[14] All humans look at faces to obtain a wealth of visual information; faces provide clues as to how others are feeling and offer additional context clues to the meaning of what they are saying.[15] Deficits in social orienting are present in three- to four-year-old children with autism much more frequently than in children who are typically developing or have other developmental delays.[16]

By including face-to-face interactions as often as possible in the therapy session, the therapist integrates visual work on fixation, saccades, and pursuit skills with facial referencing and social orienting. For example, when working on saccadic accuracy, bilateral integration, and visual spatial localization, instead of putting the patient on a Wayne Saccadic fixator, the therapist might start the patient on a space fixator facing the therapist (Figure 3). The therapist could have the patient touch the same target as the therapist at the same time. Her tone of voice and facial expressions convey anticipation and encouragement. The therapist can slow or speed the pace and monitor the patient's response to target the patient's ability to match that pace, i.e. shared timing. The therapist can also incorporate clues by looking to where he or she will touch in advance. This allows the patient to work on gaze following in addition to the other visual goals.

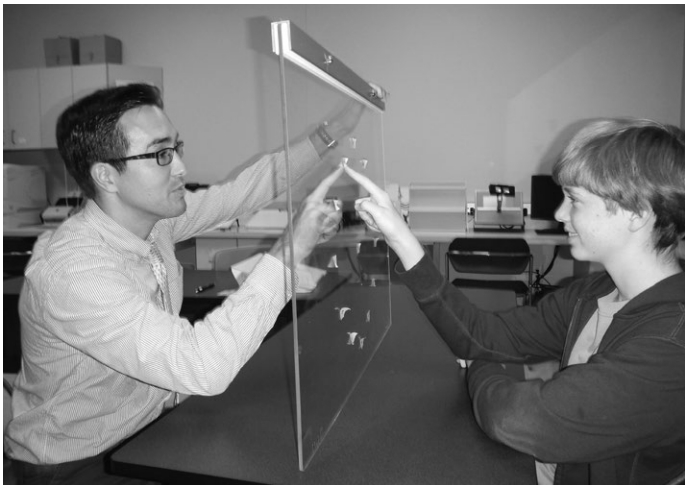

Figure 3: *Face-to-face interaction facilitated using space fixator*

Clinical Pearl 4 – Make the activity or procedure emotionally meaningful to the patient.

Case Vignette: A ten-year-old boy with ASD is being treated for convergence insufficiency. Early in the treatment program, the therapist aims to increase voluntary gross convergence and awareness of diplopia by using the Brock string. The patient has a hard time understanding the directions to "look at the bead and see two strings going in and out of the bead." Consequently, he quickly loses interest in the task. After a few seconds, he looks away, begins to look to the side, and fixates on his flicking fingers.

Patients who have not yet developed the concept of abstract representation may find the traditional vision therapy procedure of the Brock string to be meaningless. The traditional instruction set seems to be intangible. The task of the Brock string needs to be framed in a way that links it to symbolic play. For a child who has an understanding of animals, the therapist can reframe the activity by saying, "You are a hungry elephant. This string is your trunk. You are snorting up peanuts (make a funny noise). Both of your eyes are looking at the peanut." The therapist then can observe the patient to confirm whether or not he or she is converged on the bead. The therapist then can move the bead forward or backward to achieve additional convergence or divergence. The therapist also can incorporate "pauses" to create anticipation and to elongate the period that convergence is sustained.

In the DIR Model, when a patient emotionally connects with a learning activity meaningfully it is indicated by his or her "gleam in the eye." This physical sign shows that the patient is invested in the activity and that the activity makes sense and has intrinsic worth. These are the keys to learning at a deeper level and to achieving understanding, not just mastery of superficial skills.

Clinical Pearl 5 – Recognize the importance of waiting and pacing.

Case Vignette: A fourteen-year-old boy with ASD has oculomotor deficits and poor convergence. He is nonverbal and has great challenges in motor planning. When completing the procedure of bunting the Marsden ball, he begins to look away and to rely on the tactile and proprioceptive sensations of hitting the ball repetitively. He is no longer using vision to lead his motor movements and bunt the ball. After a few minutes, nothing therapeutic seems to be occurring.

To regain the therapeutic back-and-forth, it is important to restructure the task. By stopping the Marsden ball and facing the patient, the therapist can work face-to-face and incorporate affect cues to regain the patient's attention. The therapist can then slowly release the ball and allow the patient to respond by bunting it. By intermittently stopping and inserting pauses, the therapist can slow the pace. This also allows the patient additional time to organize a motor response to bunt the ball.

Patients with high motor challenges require a long time to think about, to plan, and to execute a task. The therapist may be tempted to wait for the same time that he or she would wait for a typically developing child, or slightly longer, and conclude that the patient is unable to do the task. By working at the same pace of the patient and giving the patient enough time to respond, the therapist may elicit a good attempt. Adjusting pace is necessary to establish the back-and-forth interaction for a productive therapy process.

Clinical Pearl 6 – Recognize intentionality in a patient's attempts to complete the motor demands of a task.

Case Vignette: A nonverbal fourteen-year-old boy with ASD presents with very limited use of vision. When the clinician observes him, he appears to be unaware of his surroundings. When he enters an unfamiliar environment, he does not look at the faces of the people in the room, nor does he scan the room to see what objects are present. Instead, he chooses to look down, focusing on manipulating photos on a smartphone. To target pursuit accuracy, the therapist presents the patient with the task of following a rotating pegboard. The patient struggles to complete the task, often looking away from the rotating pegboard.

For this patient, the motor demands of following the rotating pegboard are very difficult. The therapist can restructure the task by using a manual rotating pegboard that can be slowed to a much slower rate. By providing hand over hand support to the patient, the therapist allows the patient to initiate pushing the peg into the pegboard and execute the movement while following the pegboard. For this patient who has great motor planning challenges, this response is intentional and deliberate, and the patient is still completing the most critical aspects of the procedure.

Particularly in the early stages and particularly when patients have many challenges in body awareness, language, motor planning, sensory processing, and regulation, patients may struggle to execute a task, and the result may be far from the final outcome. Patients with many challenges are overwhelmingly tempted to give up, because they don't see that their efforts matter or make a difference. It is particularly

important in these cases to recognize their attempts and to identify the progress both to the patient and the parent. Recognizing intentionality rewards effort and supports the development of self-awareness and internal motivation.

Clinical Pearl 7 – Provide sensory supports for non-visual sensory regulation challenges to hasten progress in vision therapy.

Case Vignette: A five-year-old boy with ASD is referred by his occupational therapist for evaluation and treatment. The occupational therapist notes that he is having trouble with pre-handwriting skills due to his poor visual abilities.

Observation shows that he struggles to observe and to focus on an object, even when it is a toy of interest to him. He often looks randomly from object to object using fleeting glimpses and brief fixations. When presented with a task that targets the development of steady fixation and accurate pursuits and saccades, he frequently mouths objects or his shirt collar.

Children with ASD often have problems in how they respond to, modulate, and integrate sensory information. They may be under-stimulated or over-stimulated and are often drawn to objects that offer tactile, auditory, and visual feedback. For any patient with ASD to be available for learning, he or she must be self-regulated and able to take in the sensory stimuli to maintain shared attention with the therapist. It is also important to consider the stimulation of the environment, and working in a small private space is indicated.

Consulting with an occupational therapist, particularly one with expertise in sensory integration, may be particularly useful to determine how the patient modulates sensory information. In the case of a patient who is constantly seeking tactile and/or proprioceptive stimuli by touching or mouthing objects throughout the therapy session, having access to a sensory item may be beneficial. Sensory items include specially made chew toys such as chew tubes or chewable jewelry. By providing the patient a way to address his or her tactile or proprioceptive challenges, he or she may be better able to process visual information. As the patient progresses through vision therapy and his or her other therapy programs, he or she may not require the same level of sensory supports, and these may be faded.

Clinical Pearl 8 – Sequence activities with consideration toward the patient's sensory processing and modulation challenges.

Case Vignette: A six-year-old boy with ASD and ADHD is completing a vision therapy program targeting deficits in saccades and pursuits and problems in gross visual motor integration. The patient arrives to his vision therapy program after school. The patient is energetic and enthusiastic when he arrives as is evident by his constant movement, walking around the room, and touching all the equipment. His attention quickly shifts from one object to the next. He is impulsive, quickly starting one activity and abandoning it for another. He is reluctant to complete the planned vision therapy activities that target body awareness, including mental map and Randolph shuffle, as he finds them to be very difficult. When he really likes an activity, he has difficulty discontinuing it to change to another procedure. Instead, he repeats it over and over. When the therapist attempts to start another activity, the patient becomes angry and aggressive. It is difficult to complete any other activities or procedures during the remainder of the session.

Patients with ASD often have difficulty moving from task to task in a vision therapy session. For this patient, the order of the activities within the session may be important. To help the patient make the transition from traveling from school or home into working on his or her vision therapy session, start with an activity that regulates the patient before moving to a more challenging activity. For this patient, this might mean starting with an activity with rhythmic motor demands, such as bunting the Marsden ball, before proceeding to a more difficult task such as Randolph shuffle that requires bilateral integration and body awareness.

To help the patient transition from activity to activity, a visual schedule might be useful. A visual schedule uses photographs or pictures to represent the activities and procedures that will occur and their sequence. By informing patients with ASD of what will happen next, visual schedules can help patients to make transitions. For some patients, visual schedules in a hard copy or app format may be helpful.

Finally, in sequencing vision therapy tasks, the activities that are most appealing should be sequenced later. For example, for a patient who seeks tactile stimulation, activities could include desirable sensory input, such as throwing a textured and weighted bean bag.

For another patient who is very tactile defensive, activities and procedures that require wearing glasses, goggles, or patches might be problematic. This situation could be handled in several ways. If the child is ready to engage in symbolic play and pretend, a make-believe framework could be introduced. Depending on the patient's interests, this could be pretending to be a pirate, wizard, princess, or cowboy. Making the visual task part of this activity might include using accommodative targets with jewels, horses, or stars. Having the patient wear a hat or crown while completing the activity might allow him or her to become more able to tolerate equipment that touches his or her face. Eventually, over several sessions the patient might be willing to wear the patch, glasses, or goggles as part of the play scenario.

Clinical Pearl 9 – Language challenges can be multifaceted, subtle, and treacherous.

Case Vignette: A seventeen-year-old boy with ASD presents with an intermittent exotropia. The patient is verbal and is in a mainstream educational setting. A vision therapy program has been designed to work on his sensory and motor fusion abilities. To complete anti-suppression activities, the

Figure 4: *Carl's Cards*

Figure 5: *Yes-No app*

patient is wearing red-green goggles and matching shapes using Carl's Cards (Figure 4). The patient responds by indicating which cards match. At some point the patient selects a card that is the same shape, but not the same size. The therapist provides feedback when the patient's response is not correct by noting the different sizes of the shapes and pointing out the one that is larger or smaller. After providing feedback, the patient continues to make the same mistake.

To identify the source of the communication breakdown, the therapist probes the patient's knowledge of the terms used to label size differences. The therapist asks the patient what the word "larger" means; the therapist then states what the word "larger" means. The therapist then asks if their definitions are the same. The therapist repeats these steps with the word "smaller." After this process, it becomes clear that the patient does not understand the words "larger" or "smaller." The therapist then probes the patient's understanding of the words "bigger" and "littler" and determines that the patient does understand what those words mean. The patient then proceeds with the procedure using the words "bigger" and "littler" to provide feedback. If the patient correctly responds, then the therapist begins to use the word "larger" with "bigger" and the word "smaller" with "littler" to help make the association clearer for this patient.

Clinicians should note that the child who is very verbal may have gaps in comprehension. The very verbal patient who appears to have an advanced vocabulary may or may not understand language that he or she hears. A patient who does not understand the therapist's comments, instructions, or descriptions may respond by having tantrums or by refusing to perform an activity or task. Clinicians may need to probe understanding by asking the patient what something means, then telling the patient what the clinician thinks it means, and then asking the patient whether these meanings are the same. Errors should be handled gently. One way is not to indicate right or wrong, but to agree or disagree. When you disagree, the child is given the chance to re-examine his response and try again. For the child who is more sensitive to failure, the quick impact of being wrong again raises the risk of undermining his or her confidence.

To promote the patient's understanding of auditory information including directions, the clinician may wish to model the activity or to show a picture of it. If the patient hesitates to respond, the clinician may offer choices in visual form.

For other patients who are nonverbal or minimally verbal, expressive language challenges may be the issue. In these situations, the clinician should give the patient the opportunity to respond using an augmentative communication device such as a response board or Yes-No app on a smart phone or tablet computer (Figure 5). Clinicians should note that some patients with ASD who are nonverbal may understand language at a more advanced level than the clinician initially assumed. Clinicians should take care not to say anything in front of the patient that they would not say in front of a typically developing patient.

Clinical Pearl 10 – Expand an activity by varying tasks and procedures constantly to promote integration and to deepen understanding.

Case Vignette: A thirteen-year-old boy with ASD was in treatment for convergence insufficiency. With coaching, the patient could perform the Brock string task: converge on a bead close to the nose, look away identifying a distance target, and again converge to re-fuse a single image.

To integrate and master both the visual skills and the cognitive understanding of how visual space works requires that the patient practice and perform the task under multiple conditions. A patient who successfully performs one vision therapy task in the therapy room merely shows mastery of the task in one setting with one other person, the therapist. True mastery means that the patient is able to demonstrate the goal, whether it is steady fixation, gross convergence, or accurate saccades, with multiple types of targets in multiple settings and

with multiple partners. Effective therapy involves internalized learning of how to control convergence to fuse images and being able to do so at will.

To support generalization of a vision task, the following actions may be taken. The task is varied, even by a small amount, in an incremental and ongoing way during the therapy session. This may include changing the speed, distance, or target. Developmental optometrists often refer to the adding of mentally demanding tasks that the patient does while performing a visual task as "cognitive loading," but emotional components add dimension to the task. For example, in a play framework, a child converging on a bead on a Brock string may be pretending it is a gumball, and he is working in Willy Wonka's candy factory. To make the task more challenging, the child is told he still needs to point his eyes on the gumball, but now an earthquake is occurring and he needs to do so while standing on a balance board. Then the patient may be told to point his or her eyes when he hears a sound signal. This demand requires that auditory processing be included. When the child can now perform the additional visual skill under these circumstances, the probability of integration and generalization is maximized.

Summary

The optometric authors of this report have presented a series of clinical vignettes that illustrate how the therapist's modifications in the procedure or therapy program enabled a patient with ASD to successfully complete a vision therapy program. Through these many examples, they provide clinical evidence of how the DIR Model/Floortime and Visuo-Cognitive Therapy have been used in a teaching clinic. This article was written with the goal of supporting families of children with ASD and providers to overcome such obstacles. By integrating the DIR Model/Floortime and Visuo-Cognitive therapy into vision therapy programs, optometrists may better strengthen visual spatial abilities and all aspects of development.

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The online version of this article contains digital enhancements.