

Sensory Integration and Occupational Therapy

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Why does my child always spin himself? Why does she refuse so many foods? Why does he scream each time I change his diaper or give him a bath? Why does my daughter hum and look out of the corner of her eyes?

Occupational therapists can provide valuable insight, both practical and neurological, to help families better understand many of the questions they struggle with when raising a child with an autism spectrum disorder. Occupational therapy and sensory integration (SI) can be very effective treatment approaches for children with ASD. In order to understand how sensory integrative treatment can be effective, it is important to understand the basics of sensory integration theory and dysfunction. This chapter will provide you with a brief overview.

What is Occupational Therapy?

Occupational Therapy is a broad profession with a common goal of utilizing functional and purposeful activities to increase an individual's functional independence. In the scope of treatment of children with autism spectrum disorders, occupational therapy can be very effective in improving functional fine and gross motor skills, postural control and movement patterns, motor planning, self-help skills, hand-eye coordination and visual perceptual and spatial skills. However, perhaps most significant is the impact that a sensory integration treatment approach can have on a child's sensory processing skills. After all, if a child cannot maintain an optimal level of arousal and appropriately integrate sensory information, his or her ability to learn and acquire new skills will be greatly comprised. A child who relies of self-stimulatory, or self-regulatory behaviors to control their arousal level, or tune out adverse stimuli, is a child less available for engagement, learning and skill acquisition. Therefore, with this population in particular, sensory integration is one of the primary frames of reference utilized by occupational therapists.

History of Sensory Integration

Sensory integration is a theory and treatment approach originally developed by the late occupational therapist, Dr. A. Jean Ayres, Ph.D., OTR in the 1960's. She defined sensory integration as the ability to organize sensory information for use by the many parts of the nervous system in order to work together to promote effective interactions with the environment. Sensory integration had evolved over the years but much of the original theory remains. It is a dynamic and child-directed treatment approach based on specific principles, treatment techniques and equipment. It is a problem solving and individualized approach that requires ongoing analysis and assessment in order to monitor changes in the child and adapt the treatment accordingly. A trained occupational therapist utilizes a wide range of techniques and strategies in order to help a child achieve and maintain an optimal level of arousal. It is in this state that adaptive responses can be made to incoming sensory

information. This in turn, enables them to become more confident, successful and interactive explorers of their worlds.

While Dr. Ayers' treatment and research pertained primarily to the vestibular, proprioceptive and tactile systems, toward the end of her life, she began to look much more closely at the important roles of the auditory and visual systems. Unfortunately for all of us, she was unable to conclude her work as she lost her life to cancer. More recently, several occupational therapists have made great strides in further identifying the important roles of the auditory and visual systems. Two therapists in particular turned their research and experience into very effective and practical treatment modalities and protocols: Therapeutic Listening and Astronaut Training.

What to Expect

Typically a child will first be evaluated by an occupational therapist trained in sensory integration. This process may include a variety of questionnaires and evaluation tools including the Sensory Integration and Praxis Test (SIPT). The evaluation will also consist of interviewing with the caregivers as well as further clinical observations of the child in order to obtain insight into their sensory profile and needs. The entire process may take anywhere from a few hours to a few lengthy visits over the span of several sessions. Following a thorough assessment, a treatment plan will be formulated and a recommendation will be made regarding the frequency and duration of the child's treatment.

Sensory integrative treatment is best implemented in a therapy gym outfitted with a wide variety of specific equipment and adaptable environments. These treatment facilities are referred to as sensory gyms. Therapists, however, have found creative solutions to providing treatment with limited space and materials, such as in schools and in the home. Treatment should only be carried out by a clinician trained in sensory integration and should involve the parents /caregivers, as carry over into the home is critical. No matter how effective the clinician is, he or she may only have an hour or two a week with the child. It is therefore essential that a home program be implemented. This may include simple modifications to the home, adaptations to the child's routines, toys, clothing, etc. as well as specific, scheduled treatment strategies to be carried out in the home and/or school. This is referred to as a sensory diet. This piece is critical in ensuring optimal progress.

In treatment, you may see your child flying and spinning through space on swings hanging from the ceiling. You may see her climbing over or under enormous padded obstacles, up rope ladders or through suspended tunnels. She may zip by you on a scooter board, holding tight to a bungee cord, or jump from a platform into a crash mat or ball pit.

Treatment with another child may appear completely different... at least initially. You may see him sitting with the clinician in a dimly lit room, wearing a pressure garment, covered in heavy blankets attending to an activity. You may see him gently rocking on a swing with the clinician cradling him from behind, or slowly rolling over a soft surface to a rhythmical hum of the therapist. He may be sitting quietly in a dark corner, blowing bubbles through a hose with headphones on. SI treatment can appear very different from one child to the next as it is individualized to each child's unique sensory needs. While an experienced clinician can make treatment simply look fun and playful, rest assured careful clinical reasoning is behind every move.

The cost of an evaluation can range from a few hundred dollars to a couple thousand dollars. Private treatment ranges greatly from less than one hundred to two hundred dollars or more per one-hour session. Sessions can be as short as thirty minutes; however, the nature of the treatment tends to lend itself to longer sessions. Occupational therapy evaluations and treatment are typically covered, to some extent, by local school systems as well as Early Intervention programs for children less than three years of age.

Occupational therapists can work with children with ASD in a variety of settings. In schools, treatment often carries over to the classroom as the primary focus is improving function in school related tasks and environments. In a private practice, sensory gym, or outpatient setting, the OT typically has access to more therapy equipment and can address issues related more to the home and community, as the parents are generally more present.

What is Sensory Integration and Sensory Integration Dysfunction?

In order for a child to appropriately move through space and interact with their world in an alert, regulated and effective manner, they must take in an extraordinary amount of sensory information, unconsciously interpret it and then make appropriate adaptive responses on a rapid and continuous basis. This is an incredibly complex process that relies on an intricate network of sensory systems functioning appropriately and simultaneously. It is called sensory integration. It's an amazing process that most of us take for granted; it just happens and we never think twice about it. However, for many of the children with ASD, this is not the case.

For a child with sensory integration dysfunction, the seemingly simple task of walking across a classroom, putting on a t-shirt, finding a toy in a closet, listening to mom on a busy street corner, walking barefoot on a beach, skipping down the sidewalk, or playing in a swing in the park may be perceived as overly challenging, seemingly impossible or even terrifying. Sensory integration dysfunction can impact every aspect of development including: social-emotional, behavioral, attention and regulation, gross and fine motor, postural, adaptive and self-help, visual motor, visual spatial/perceptual, speech and language, and academic. Our ability to appropriately meet the many challenges faced in our daily lives is a result of the integration and proper "wiring" of five major sensory systems: vestibular, proprioceptive, tactile, auditory and visual.

The vestibular system is located in the inner ear and is the integral system that responds to gravitational forces and changes in the head's position in space. It is the sense that tells you when you're right side up or upside down, and is responsible for helping with balance and spatial orientation. The vestibular system is also responsible for providing a stable basis for visual function, even when the head is moving through space. Also, for example, when an object is getting larger in your visual field, your vestibular confirms that you are not moving, thus indicating that the object is coming toward you. The appropriate response can then be made, whether it's to move out of the way, catch it, etc.

Movement is a component of almost everything that we do; so vestibular function applies to almost every interaction we have with the world. It's the sense that, when over stimulated, makes one feel seasick and carsick. It's the sense that thrill seekers try to satiate with roller coasters, bungee jumping and skydiving. Because of its role in movement and space, it works hand in hand with the auditory and visual systems in order to provide us with a

sense of our three dimensional spatial envelope, compelling us to move, explore and understand. This collaborative system is referred to as the vestibular-visual-auditory triad.

Without this functioning triad, it would be impossible to appropriately process movement, space, time, and sequencing. When we enter a new restaurant for the first time, we immediately take in a sense of the room's size, relative shape, and arrangement of its contents. After navigating the delicate environment and casually taking a seat, we understand the quiet clanging of pots is coming from the open kitchen behind us and to the left, the gentle humming sound is coming from over-head ceiling fans, and the waitress walking slowly from across the room will be within a respectful distance in 7-8 seconds to kindly request a glass of water in a suitable volume level for the environment. None of these seemingly simple processes that we take for granted would have been possible without appropriate integration of the vestibular-visual-auditory triad. This same analysis can be reapplied to countless scenarios, in countless environments, on countless different levels.

“Without a properly functioning vestibular system, sights and sounds in the environment do not make sense – they are only isolated pieces of information disconnected from the meaningful whole. It is the integration of the sensory information that holds the key for finding the meaning in the world. Because movement is part of everything we do in life, it could be said that the vestibular system supports all behavior and acquisition of skills, as well as helping to balance the stream of sensory information that constantly bombards the system.” (Astronaut Training: A Sound Activated Vestibular-Visual Protocol for Moving, Looking and Listening; Kawar, Frick & Frick, 2005)

The proprioceptive system is a network of sensors throughout our muscles and joints that work together to create an internal body map. It is through proprioceptive awareness that we know the position of our body, even when we cannot see it. It is through intact proprioception that we can navigate a dark, familiar environment, or reach and grab something behind us without looking. It is also the sense that grades our pressure, allowing us to use the appropriate force when picking up a brick versus a thin paper cup of water.

Input to the proprioceptive system through deep pressure, and much more significantly, resistive muscle activation or “heavy work”, enhances serotonin release and can be very grounding and organizing. This is why some people stomp their feet or clench their fists when they are angry or overwhelmed. This is why others chew on hard plastic pen caps when their attention wanes in a lecture. It is difficult to feel secure in oneself or in one's environment without a secure sense of body scheme. The proprioceptive system collaborates extensively with the closely associated tactile system. Together, they provide us with the critical sense of body awareness.

The tactile system is made up of the largest organ of our body, the skin. It is the system that provides us with the sense of touch for pleasure, pain, discrimination and protection. Being that the tactile system is our exterior boundary, it is critical that it appropriately processes the wide variety of elements and touch sensations that surround us. If dysfunctional, pleasurable touch can be misinterpreted as noxious, or potentially dangerous sensations can go unregistered and be damaging.

Each of these systems must function properly and collaboratively in order to support appropriate sensory integration. A typical sensory system processes a wide variety and range of intensity of information and makes the necessary filtrations in order for a person

to function comfortably and without conscious effort. However, with many children with autism spectrum disorders, we find that one or more of these systems does not function properly. Any of the sensory systems can be hyper-responsive (sensory avoiding) or hypo-responsive (sensory seeking) to incoming information.

This can be easily demonstrated with an example of the tactile system. A hyper-responsive tactile system (sensory avoiding) is generally associated with a high level of arousal. This child is typically in varying states of fight or flight and is therefore less available for engagement and learning. She may avoid messy play and unfamiliar textures at all cost, may hold objects in her finger tips, avoiding contact with palms, may need to remove tags from shirts and only wear soft old clothes, may avoid standing close to peers and other people, may resist cuddling and affection even from parents and family members, may present with poor body awareness, stiff movement patterns, delayed motor planning and difficulty with fine motor skills. This girl may tend to be inflexible and rigid in her ways in an effort to attempt to control a world that she perceives as threatening.

A hypo-responsive tactile system (sensory seeking) is generally associated with a low level of arousal. This child may typically appear “tuned out” and is therefore also less available. In order to obtain input to raise his arousal, he may gravitate to messy and unfamiliar textures in an effort to better process his body and the things around them, may not seem to notice or mind when socks or clothing are twisted in uncomfortable ways or when sticky food is on his hands or face, may frequently bump into others or play excessively rough without ill intentions, and may present with poor body awareness and poorly graded, ballistic movement patterns, delayed motor planning and difficulty with fine motor skills. This boy may tend to be disorganized in his ways as he has difficulty making sense of his world.

Sensory issues can often be mistaken for behavioral problems. If a child has vestibular and visual issues, which impact his perception of his position in space, he may have great difficulty sitting upright in a chair without falling from time to time. To avoid falls or embarrassment, he may fidget to better process his body or get out of his seat often. He in turn, will present as a child who “won’t” stay seated. Another child with severe tactile defensiveness may be terrified to stand in line next to his peers due to the fear of being touched. To protect himself, he stands away from the group with his back against the wall or casually wanders out of reach. He again, will present like a child who “won’t” stay in line. With children with sensory integration dysfunction, it is important to remember that these behaviors may be nothing more than effective coping mechanisms. When the underlying sensory issues are addressed, the behavior may disappear all together.

What is Sensory Integration Therapy?

Sensory integration is a complex treatment approach. A breakdown of a few of the basic principles can help to provide a general understanding. We as humans need a wide variety of sensory and motor experiences to develop and sustain typical nervous system function. Much like plants need a full spectrum of light to grow and flower to their potential. We respond strongly to sensory information. Consider the devastating effects of prolonged sensory deprivation. Consider the positive effects of gently rocking a baby or tightly

hugging a friend in need. Within the range of typically functioning systems, we find some variance. One “typical” adult may ride roller coasters every Saturday afternoon. Another may gasp at the sight of one. With a little encouragement, perhaps, she hops on and keeps her eyes closed. These two people are quite different yet fall within a range where they experience a variety of rich sensory movement experiences. Children with ASD sometimes present with a much greater range. For whatever reasons, their nervous systems are wired differently.

Children inherently attempt to provide themselves with what they need and avoid what they are frightened by. They constantly listen to their bodies and try to regulate themselves. By listening to what their bodies tell us, we can help them to make a great deal of positive change. A therapist can provide them with calculated input that is stronger and more effective in reaching the threshold of the system the child is trying to stimulate. In turn, the child may begin to process the input more appropriately and therefore need less of it over time, demonstrating fewer sensory seeking, or self-stimulatory behaviors. Children demonstrate self-stimulating behaviors for a reason. It is our responsibility to determine why.

The child that avoids sensory input faces another challenge. They develop compensatory strategies to protect themselves and seldom subject themselves to the sensory information. Therapists utilize various strategies to help desensitize the child. This is never done through repeated exposure of the noxious experience. It often involves looking carefully at the stimuli and the relationships of the supporting sensory system. The clinician can then systematically address them in order to support sensory integration. For example, a defensive tactile system may better process touch following appropriate input to the proprioceptive system. A vestibular system may better process movement following appropriate input to the auditory or proprioceptive system.

Consider this example:

One young girl may spin around for hours and never get dizzy. Another young boy may fearfully cling to his mother when she tries to put him in a swing at the park, or even just picks him up. These ranges pose a problem. The first child appears hypo-responsive (sensory seeking) and unable to provide herself with strong enough movement input to satiate her vestibular system. This compels her to spin, climb, run, jump and crash. After all, if you were hungry wouldn't you eat something? The second child on the other hand appears hyper-responsive (sensory avoiding) and avoids movement at all cost. If you had arachnophobia would you pet a Tarantula? His vestibular system however still requires and craves input despite his interpreted fear. So almost instinctually, he has discovered that by looking out of the far corners of his eyes, by looking at spinning objects, or by closely following long linear edges visually, he can stimulate his vestibular system.

These two children are significantly impacted by this relatively simple sensory dysfunction and have developed effective coping mechanisms. However, the vestibular system works closely together with other systems to support many functions, so the ramifications may increase and broaden over time if left unaddressed. Both of these children are less available for engagement and learning.

The first child can only provide herself with so much movement input due to human limitation. A trained therapist on the other hand, can make informed clinical decisions after assessment, and assist the child in obtaining calculated rotation and movement experiences

in all planes that provide strong and organizing input to every receptor of the vestibular system. This may be followed with further resistive activities that activate her core muscles to provide additional grounding and organizing information. The movements can provide the vestibular system with its threshold of input, allowing it to better process movement and support more refined motor skills. It can also result in a substantial period of time to follow in which she seeks less movement and is more available to the world around her. Due to the plasticity of our nervous systems, this input can decrease over time as the system becomes re-wired, or integrated.

Based on the profile of the second child, he likely presents with poor tactile and proprioceptive processing. This is commonly associated with low muscle tone and poor postural control. This typically results in decreased body awareness and motor planning with one of the end functional outcomes being a fear of moving through space. If this child does not perceive his body properly when seated or walking, he most certainly will not feel safe when placed in a swing and pushed 3 feet off of the ground. A trained therapist will identify these patterns and recognize the need to address his tactile and proprioceptive systems despite the fact that the initial red flag went off when mom reported an issue that appear to be related to his vestibular system. All involved systems will be addressed in treatment.

Specific brushing /deep pressure strategies and resistive activities that connect him to the support surface can be very effective in improving body awareness. A child needs to feel connected to the ground before they can feel free in space. Core muscle activation can improve alignment and postural control and help lay the foundation for the introduction of new, controlled movement experiences. A careful sequence of movement may now be explored, paired with continued body awareness work. All activities are paired with his passions and interests. He ideally gains ownership of his body in space and begins to freely explore on his own. The timid, fearful child can now become a confident explorer.

This example provides a little insight into the SI treatment approach. These principles can be applied to a variety of issues involving all of the sensory systems. Sensory integrative treatment can effectively help to change a child's "wiring." It is the clinician's goal to provide the child with the tools necessary to create their own ideas and develop more naturally and spontaneously in a world that they can make sense of and feel safe in.