

*Integrating Neurodevelopmental Treatment and Sensory Integration-Theory and Practice in the Client with Cerebral Palsy*

*By*

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The client with cerebral palsy often shows signs of problems integrating sensory information in combination with a motor disorder. This may be, in part, due to the initial insult or cause of the CP, but may be made worse by the lack of independent movement and absence of typical development that helps children learn to integrate sensory inputs. Medical issues and alterations in tone set the stage for limiting the child's early development. The child with cerebral palsy is hindered in his ability to move against gravity, integrate primitive reflexes, experience body exploration and experience tactile, proprioceptive and vestibular inputs as typically developing children do. Additionally, children with cerebral palsy often miss out on rough housing and other types of play that yield tactile, proprioceptive and vestibular inputs, limiting the child's opportunities to develop efficient, accurate sensory processing and preventing quality sensory-motor experiences; setting the stage for or contributing to existing regulatory disorders, modulation difficulties and delays in perceptual and higher level cognitive skills. The lack of movement also prevents the child from developing postural reactions, postural control and good body scheme, the foundation for motor planning and development of good bilateral coordination. Regardless of the cause, the therapist's challenge is to aid in facilitating the child's development in the area of processing and integrating sensory information as well as his or her motor development. The question arises as to how best to do this.

Sensory Integration and Neurodevelopmental Treatment are two treatment approaches with widespread followings within the fields of Occupational, Physical and Speech therapies. Therapists often ask whether or not the two philosophies can be combined or integrated effectively in treatment. Sound clinical decision making stems from good background information. When contemplating combining therapeutic approaches, one should know how each of the therapeutic interventions was developed, the basic philosophies behind each application and how to differentiate the primary neuromuscular disorder from an underlying sensory processing deficit. The clinician must question whether the motor deficits are due primarily to a neuromotor disorder (CP) or the neuromotor disorder is complicated by sensory processing problems characterized by difficulties with modulation, sensory discrimination, praxis or other sensory-based motor problems.

### **Theoretical Base of NDT**

Neuro-developmental Treatment was developed by Berta Bobath, PT and her husband, Karel, a physician, as a treatment for children with cerebral palsy. Their work started in the 1940's and represents almost a half century of work. They stressed how the child with cerebral palsy does not undergo typical development and is hindered by a "poverty of movement" that leads to a lack of knowledge about movement. They stressed the

facilitation and development of more typical, efficient patterns of motor output or movement through the use of specific handling techniques. Emphasis was placed on normalizing tone through the acquisition of automatic postural reactions and increasing postural control. The Bobaths believed that movement is not learned, but rather experiencing the sensations of movement are what enable individuals to learn how to move effectively (DeGangi, 1990a). Recognizing the importance of sensory experiences required for learning of movement, they incorporated a variety of methods to provide sensory experiences with their facilitation techniques. Tactile inputs were included in the form of manual vibration and various methods of tapping. Proprioception through muscle activation; use of joint compression and joint traction to aid in holding in mid-positions and during weight shifts; vestibular input, through the movement of the child, primarily in response to perturbances in balance on mobile equipment or during handling, weight shifting and transitional movements.

### **Theoretical Base of Sensory Integration Theory**

SI theory was developed by A.J. Ayres, an OT and educational psychologist, starting in the 1960's. Ayres, too, in the 1950's started her work on children with cerebral palsy. She questioned whether the deficits in motor execution might be due to sensory processing difficulties rather than purely motor control. In the 1960's Ayres research started to unravel the mysteries of the contributions of sensory processing. While her research was on children with learning disorders, she identified sensory processing as a basis of functional problems for some children and paved the way to applying it to children with neuromotor disorders. (Smith-Roley, Blanche, Schaaf 2001).

Sensory integration is a dynamic process. "Sensory integration sorts, orders and eventually puts all the individual sensory inputs together into a whole brain function" (Ayres, 1979, p. 28). The results of good sensory integration allows the individual to respond to sensory and environmental demands with adaptive and appropriate emotional and behavioral responses. It is the process of sensory integration, the ability to synthesize, organize and process incoming sensory information from the body and the environment, which helps the individual to make purposeful, goal-directed responses. Because of good sensory integration the child develops good body scheme, self image, integrates primitive reflexes, develops balance, postural stability, the ability to motor plan, coordinate two sides of the body and eye-hand coordination (DeGangi, 1990a).

Through Ayres' research, extensive factor analytic studies, and the subsequent studies of others, several categories of sensory-based functional disorders, now called Sensory Processing Disorders, have been identified. These include: sensory modulation disorders which includes sensory under-responsivity, over-responsivity and sensory seeking; sensory discrimination disorders, and sensory-based motor disorders which includes postural disorders and dyspraxia (Miller, et al, 2007).

### **Clinical Applications and Philosophies in NDT and SI**

Neurodevelopmental Treatment (NDT) focuses on improving motor control and motor output to improve functional skills. The NDT therapist is challenged to identify the client's strengths and impairments with regard to functional limitations and individual

abilities: those that are limiting his or her participation and achievement of the individual's personal goals (NDTA, 2005). Through specific handling techniques, the therapist guides the client and facilitates a new variety of movement experiences and then provides the *repetition* needed to practice so that motor learning can occur across multiple environments. The treatment is *client-centered*, but *therapist-driven* with the success of treatment resting largely in the handling and observations skills of the therapist working in combination with the client to achieve mutually-determined, specific, goals.

Sensory Integration Treatment is based on Ayres' belief that sensory integration, or the ability to synthesize, organize and process incoming sensory information from the body and the environment, allows the individual to make purposeful, goal-directed responses. The therapist sets the environment with *enhanced sensory experiences and enticements to tap the child's inner drive*. The goal is to allow the child to process sensory inputs in relation to meaningful, *child-driven experiences*. The use of moveable, suspended equipment and the unique sensory challenges facilitates sensory processing, eliminate memorized responses, and *promote and sustain internal motivation and drive*. The treatment is aimed at attaining better organization within the central nervous system by providing specific sensory inputs that alter the individual's responses to incoming sensory stimuli, regulate his emotional responses and behavioral organization, and improve sensory discrimination, quality of movement, motor planning, attention, arousal, and ability to learn.

DeGangi wrote, "Both neurodevelopmental treatment and sensory integration rely extensively upon the use of tactile, vestibular and proprioceptive stimulation in accomplishing their specific goals... and are therefore, linked by common neurophysiological mechanisms" (1990a, p.4). Additionally, both theories look at motor output, but from very different perspectives. SI focuses on the output as a product of the sensory processing necessary to produce an adaptive motor response, while NDT focuses on the quality of motor output and the motor control produced by the individual.

The value of Sensory integrative theory is to look beyond the neuromotor dysfunctions to ascertain if there are a clustering of signs and symptoms that may indicate specific sensory based issues. SI Intervention relies on sensory information provided in purposeful, directed manner that challenges the child to make adaptive responses thereby facilitating the brain to integrate the information and allow for better organization of higher level motor and perceptual functions.

The value of NDT is that it provides an in-depth understanding of the neural and motor outputs and maximizes the client's physical abilities and engagement in meaningful, functional activities. The NDT trained therapist utilizes *specific handling techniques* during which the client experiences the sensation of new and varied movement patterns which assist the client in developing better organization of movements across all environments.

## **Are sensory processing problems complicating the picture?**

Neuromotor disorders, including CP, and sensory processing difficulties often co-exist. Problems related to sensory processing have been categorized as one or more of the following: Sensory Modulation Disorder, Sensory Discrimination Disorder and Sensory- Based Motor Disorder.

A problem with sensory modulation occurs when a child has difficulty matching the appropriate arousal level for the activity or task demand. The child may be over responsive demonstrating defensive or anxiety behaviors; under responsive, under reactive and slow to respond, or sensory seeking.

In Sensory Modulation Disorder (SMD), the child will have difficulty achieving and maintaining a developmentally appropriate range of emotional and attentional responses (Miller, et al, 2007, p.136). Over-responsiveness causes the person to respond to sensation faster, more intensely or for longer duration than is typical, or to exhibit defensive or aversion responses. Under-responsiveness causes the person to miss cues and not respond to stimuli. They may appear slow, apathetic, lethargic or difficult to get to respond. Sensory seeking individuals crave an unusual amount or type of sensory input. In a motorically intact individual or the neurologically impaired child, capable of moving about, this may lead to socially unacceptable, unsafe, crashing or running behaviors. In the moderate to severe neurologically impaired population you may see under responsiveness or sensory seeking behaviors expressed as sensory-based self-stimulating, or self-injurious behaviors.

Sensory discrimination problems may be seen among any of the sensory systems and contribute to: poor body scheme and body image; gross, fine and oral motor difficulties; abnormal responses to movement or tone. A Sensory Discrimination Disorder (SDD) causes difficulties in interpreting sensory information, distinguishing similarities and differences, localizing the stimuli and necessitates increased processing time. Problems discriminating tactile, proprioceptive and vestibular information leads to poor grading and coordination of motor movements. SDD in the visual and auditory systems can lead to learning or language disability (Miller, et al, 2007, p. 138).

Sensory-Based Motor Disorders yield poor postural and volitional movement as a result of sensory processing problems. The two subtypes are Postural Disorder and Dyspraxia. Postural Disorder consists of difficulty stabilizing the body during movement or at rest to meet motor task demands. Symptoms can include inappropriate muscle tension, hypotonic or hypertonic muscle tone, and inadequate control of movement or inadequate muscle contraction to achieve movement against resistance. Additionally, imbalance between flexion and extension of body parts, poor stability, poor righting and equilibrium reactions, inability to weight shift, rotate the trunk and poor ocular-motor control may exist. (Miller, et al, 2007, p. 138). Postural Disorder is characterized by poor postural control. Postural control is required for a stable, yet dynamic base off of which refined movement of the eyes, head and limbs can occur, and derives from the integration of vestibular, proprioceptive and visual information. Poor integration of these

sensory systems can contribute to the client's inability to posturally set and perform automatic postural adjustments.

Dyspraxia is an impaired ability to conceive of, plan, sequence or execute novel actions. It makes people appear awkward and poorly coordinated in gross, fine or oral-motor skills. (Miller, et al, 2007 p.138). Dyspraxia leads to poor body-in-space; trouble judging distance from objects or people; being accident-prone; difficulty grading force; difficulty timing and sequencing motor movements and difficulty learning new movements. It can limit one's ability to consider alternative methods of accomplishing tasks or alternative movement patterns than the ones already within the client's repertoire.

Difficulties arise in assessing the degree of sensory processing difficulties, as most standardized test measures presume an intact or highly functioning neuromotor status. The best a clinician can do is utilize careful observation skills and sound clinical judgments to assess how sensory processing may be affecting their client. The clearest indication of the clients sensory processing may be the client responses. Are there signs of sensory processing difficulties? Are there attention issues, atypical emotional or behavioral responses; modulation difficulties characterized by under responsiveness, over responsiveness (defensive) or sensory seeking behaviors; delays in responsivity to handling; slow processing; fear or intolerance of movement; postural insecurities; problems with body scheme or body awareness; abnormal postural tone; or signs of poor bilateral integration or motor planning? If so, then one can make the argument for sensory processing issues that may be complicating the neuromotor deficit and consider integrating sensory integration frames of reference with an NDT approach to treatment.

## **In Summary**

SI treatment aims to improve the client's processing of sensory information so that he may better regulate, organize, plan and execute more effective adaptive responses. NDT relies on a more, hands-on approach to improve postural reactions, muscle tone and motor control in order to develop a greater set of movement strategies for the client to utilize in everyday life. Although there are distinct differences between the two theories, both have the goal of increasing successful interactions and meaningful experiences in daily life.

Sensory Integration and Neurodevelopmental treatment can be integrated and benefit the individual. The addition of an SI frame of reference to an NDT intervention can improve the quality of not only the motor control but the child's affect, emotional responses and ability to integrate and synthesize information from his body and his environment to make better adaptive responses. Through using a holistic approach you can improve not only the postural control, coordination and motor output, as well as improve the sensory processing, believed to be the foundation for developing core behavioral and emotional regulation; develop the ability to regulate one's arousal and

attention and improve motor planning needed to be effective in daily life. Determining the type(s) of the sensory processing problems seen in any child requires post graduate training in Sensory Integration theory, assessment and intervention

When integrating NDT and SI there are several considerations the clinician needs to contemplate. These include: 1) Are these interventions compatible and what are the possible conflicts? 2) What factors should a therapist take into consideration when utilizing a combined treatment approach? 3) Is SI safe to implement with a neurologically involved patient? 4) What are possible contraindications? 5) What SI treatment strategies should be used with a child with limited mobility, and how should they be adapted? This requires specialized training in each of the treatment strategies, and in adapting the SI intervention safely for the child with neurological impairments and limited mobility.

The works of both the Bobaths and A. Jean Ayres have left their mark on the lives of many therapists the world over. The theories continue to live on and grow, aided by the followers of each theoretical application. These clinical applications give us both tangible and theoretical skills with which to interpret and change the lives of clients for the better. Our ethical responsibility lies in making the soundest clinical judgments with regards to the individual that we are each capable of and to use our skills with professionalism to the betterment of the client. This involves stepping out of our comfort zone; learning new theoretical points of view, and acquiring new skills and training to benefit the client.

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