Sensory Processing Challenges in Children

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ABSTRACT

The identification of sensory processing challenges in children is important because the challenges can affect their behavior, learning, and the way they negotiate the world. Symptoms may be difficult to assess and can be found alone or embedded within disorders, such as attention deficit/hyperactivity disorder, autism spectrum disorder, or cognitive disorder. Left unrecognized and untreated, children are often mislabeled, mismanaged, and misunderstood. Herein we provide information regarding the identification and treatment of sensory processing challenges in children and outline the role of the nurse practitioner in helping children and families navigate these unique challenges.

Keywords: identification, nurse practitioner, sensory processing, treatment

BACKGROUND

Sensory processing theory was first described by Dr. A. Jean Ayres in 1972 to identify those children who appeared to have challenges integrating multiple sensory stimuli from visual, auditory, tactile, taste, vestibular, and proprioceptive input.[1] The theory was developed to explain the relationship between deficits in interpreting sensory stimuli from the sensation body and the environment and difficulties with academic or motor learning.[2] Research suggests sensory processing challenges are neurologically based problems stemming from the brain's inability to integrate the sensory input it receives from the sensory systems and turn the input into effective responses. Sensory modulation is the ability to regulate the degree, intensity, and nature of a response to a sensory input[3] and significantly impacts the way a child relates to the world. Sights, smells, sounds, touch, body position, and movement may be affected individually or in combination. Sensory processing challenges have been described as a "disorder,"[1] as well as a "cluster of symptoms associated with other neurodevelopmental disorders."[4]

Pediatric nurses, occupational therapists (OTs), and early intervention teams have been addressing sensory challenges in children for decades. Early intervention teams embraced sensory challenges with the publication of Zero to Three's *Diagnostic Classification of Mental Health and Developmental Disorders of Infancy and Early Childhood, Revised*,[5] which outlined criteria for regulation disorders of sensory processing. Nursing has a long history of intervening with children with sensory challenges (with or without comorbidity) and assisting families in initiating appropriate therapeutic intervention for the child with sensory issues to function optimally in the world. The American Occupational Therapy Association produced a position paper identifying the complex of symptoms called sensory processing disorder in 1982 and supported a full spectrum of approaches and intervention.[6] The Association recommends that clinicians using a sensory integration therapy approach "use clinical reasoning, existing evidence, and outcomes to create a comprehensive, individualized approach for each client, rather than using isolated, specific sensory strategies."

The American Academy of Pediatrics recommends that pediatricians not use sensory processing

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disorder as a diagnosis, "because there are no universally excepted frameworks for diagnosis."[4(p1187)] The Academy states "it remains unclear whether children who present with findings described as sensory processing difficulties have an actual disorder of the sensory pathways of the brain or whether these deficits represent differences associated with other developmental and behavioral disorders."[4(p1187)] The Academy accepts and supports the use of occupational therapy as one of the components of a comprehensive treatment plan for children who exhibit sensory challenges. Sensory processing disorder (SPD) was not included in the *DSM-5* as a separate diagnostic category; however, sensory processing challenges are noted as one of the diagnostic criteria in autism.

Research suggests sensory processing challenges may exist independently, comorbidly, or as part of a larger overarching diagnosis. Among children without disabilities, the prevalence of SPD ranges from 10% to 55%.[7] The range for children with disabilities is estimated at 40%-88%.[8] Children with disabilities, such as autism spectrum disorders,[9,10] attention deficit/hyperactivity disorder,[11,12] and cognitive disorder,[13,14] exhibit significantly more sensory processing issues than children without disabilities. Sensory overresponsivity has also been shown to be correlated with internalizing and externalizing behavior problems and poorly developed adaptive social behaviors.[7] A 2013 study by Owen and colleagues at the University of California, San Francisco, demonstrated, via the use of diffusion tensor imaging, that that children with SPD had "decreased white matter microstructural integrity,"[15(p844)] suggesting that SPD may be biologically based and distinct from other clinical conditions.

Whether or not the constellation of symptoms that present as difficulty processing sensory information is conceptualized as a disorder or embedded in a larger picture of atypical neurodevelopment, the nurse practitioner (NP) can be essential in recognizing the symptoms, providing interpretation of the findings, and developing a treatment plan.

CHARACTERISTICS

A young child's ability or inability to integrate and modulate sensory input can have a profound effect on their comfort in the world. Because children with sensory processing challenges respond inappropriately to certain sensory input and cannot organize a response in an automatic and fluent way, the result may affect the ability to adapt appropriately to daily situations, regulate attention and moods, and function appropriately in a broad arena of social interactions and learning.[10]

Children with processing challenges have difficulty detecting, regulating, interpreting, and responding to sensory input.[16] Symptoms of poor sensory processing appear to evolve over time and vary considerably depending on the sensory system(s) involved. Inconsistency in presentation, with symptoms that vary in depth and breadth, complicates the diagnostic picture and stresses family dynamics. Characteristics of sensory processing challenges may fluctuate within the day, from day to day, and across different demands. Difficulty with sensory modulation may be expressed as underresponsivity, such as failing to react to a fire alarm, or overresponsivity, such as responding to the same alarm with a negative or exaggerated response. A third response is the "sensory seeker," who persistently seeks out increased intensity, frequency, and/or duration of stimuli. This may be expressed by running, jumping, touching people or objects, or making noise.

In infants, symptoms may include problems with eating, sleeping, or playing. If underresponsive, the infant may sleep for long periods or may not demand to eat or, if overresponsive, may reject any new taste or texture placed in the mouth. Infants may be fussy and irritable when held by others, reject cuddling, or cry when new textures touch the skin. Developmental milestones may be delayed.

The toddler struggling with tactile overresponsivity may resist playing with certain toys because "it doesn't feel right." Sensory seekers may repeatedly touch things or hold objects in their hands to obtain more intense feedback. The toddler may overreact to deep touch by responding to a hug with stiffening and pushing away but accept the light touch of a kiss on the head. Moods may change dramatically.

In preschoolers, symptoms may include oversensitivity to touch (cries when hair is brushed), noises (covers ears when school bell sounds), and smells (feels sick at the smell of house-cleaning

products). Preschoolers may have difficulty dressing, eating, sleeping, and toilet training. With heightened tactile sensitivities, the child may be labeled unfriendly or isolated because he prefers to be left alone. Parents and teachers may note clumsiness, weakness, or poor motor skills. Temper tantrums are often exaggerated because of the child's inability to regulate.

School-age children have trouble paying attention, interacting with friends, and learning. The child may present with poor motor coordination for more refined gross motor skills (jump rope, ball skills) as well as fine motor skills (handwriting) and overall motor endurance. Difficulties in motor planning or dyspraxia, which enables the child to perform coordinated actions, may be present. Furthermore, difficulty executing new motor activities on the playground, for example, may lead to feelings of inadequacy, social isolation, or behavioral outbursts.

One of the many challenges for teachers and caregivers is that children with sensory processing challenges often have average to above-average intelligence, and thus there are high expectations for both achievement and behavior.[17] Children with these challenges are confusing because they present with inconsistencies between intellectual ability and ability to regulate. For example, the underresponsive child may be very bright, but may appear "lazy" or "unmotivated" because of an inability to respond in a neurotypical way. The overresponsive child may be misinterpreted as "making bad choices," or "not listening," when poor modulation prevents expected behavior.

Caregivers of these children very often perceive they are ineffective in their parenting and experience a higher level of stress than do parents of children without sensory challenges.[18] Parenting strategies for children with sensory processing challenges often differ from those that are effective with neurotypical children. Parenting strategies must be individualized according to the child's sensory profile and placed within the context of the child's daily demands.

ROLE OF THE NP

Early identification of sensory differences is important to minimize the impact these differences on the child's social, emotional, and behavioral development. The NP is in a unique position to organize and interpret sensory and regulatory symptoms, provide screening of sensory responsivity and processing, as well as assess motor tone and motor planning capacities. The NP may then determine whether symptoms are embedded in other neurodevelopmental disorders or if symptoms stand alone. In addition, the NP may use standardized measures to further understand the child's sensory profile or may make a timely referral to an occupational therapist that can complete an extensive sensory profile evaluation and outline an appropriate treatment program.

An essential role of the NP is to educate families on how to best promote regulatory functioning. Better regulation will not only impact the ability of the child to function more effectively in the world but also impact family functioning as a whole. Teaching will vary depending on the expertise of the practitioner and may be done individually or as a member of a team that intervenes with children and their families. While awaiting referral to occupational therapy, the NP may consider the following resources and strategies to help support the child and family:

- Recommended reading, such as: *Sensational Kids: Hope and Help for Children with Sensory Processing Disorder*[19]; *The Out-of-Sync Child: Recognizing and Coping With Sensory Processing Disorder*[20]; and *The Out-of-Sync Child Has Fun, Revised Edition: Activities for Kids With Sensory Processing Disorder.*[21]
- Recommended reading for children includes: *Ellie Bean the Drama Queen: A Children's Book on Sensory Processing Disorder.*[22]
- Sensory Processing Disorder Foundation online at www.spdnow.org/.
- Encouraging engaging activities for the hyporesponsive child, such as jumping on a minitrampoline, swinging, and resistive physical work, such as swimming and use of playground equipment.
- Encouraging calming activities for the hyperresponsive child, such as use of a cozy corner, tent, or bean-bag chair, and generally decreasing auditory and visual stimuli.

NPs can also contribute to the growing body of knowledge related to sensory processing and regulation through research in this area. Although research has made great strides in identification, development of standardized assessment measures and evidence-based treatment strategies are needed.[23]

DIAGNOSIS

The diagnosis of sensory processing challenges can be difficult. NPs and other health care providers must have a high index of suspicion for sensory processing challenges when children present with unusual or atypical behaviors and responses. The following case illustrates the complexity of an overresponsive 4-year-old child:

Meet Adam. It is the first week of preschool and he is not doing well. Just having turned 4, everything seems to irritate him and his behavior is different than his peers. He is considered bright and has strong speech and language skills. When the teacher asks the children to sit for circle time, he wiggles and squirms to get off his carpet square. He has trouble paying attention and seems distracted by what other children are doing. At the sensory table, Adam won't put his hands in the sand and has a meltdown if he is not given a scooper to use. When other children reach for Adam's hand to line up or try to give him a hug, he reacts by pushing them away and then running away. At snack time, Adam refuses to try any crunchy foods and will only try foods that he barely has to chew. He has trouble with motor planning and is unable to join playground activities at the same level as his classmates. Nap time is a challenge for Adam. He hates the feel of his cot and cries if the teacher puts on music. He says it "hurts his ears." By the end of the first week, the teacher calls the parents to initiate a conference. She is concerned "something is going on with Adam," and asks the family to take him for an evaluation.

To sort out this confusing picture, a comprehensive visit is needed. A review of the child's developmental, medical, and academic history coupled with the family and social history will assist the NP in forming a differential diagnosis. The physical exam includes careful observation of the child, including an assessment for genetic and neurodevelopmental disorders. Understanding the child's sensory and motor functioning in a variety of settings will also contribute to an accurate diagnosis. In this particular case, conditions such as attention deficit/hyperactivity disorder, behavior problems, anxiety, and oppositional defiant disorder, may all be considered; however, none of these disorders could

Table. Examples of Common Characteristics of Sensory Processing Disorder

Increased sensory responsiveness
- Overresponsiveness to sights, sounds, smell, touch, and movement.
- Overwhelmed by bright lights, busy environments, and close-range eye contact.
- Adverse response to low-frequency sounds, such as the vacuum, blender, and public toilets flushing.
- Hypersensitive to certain light-touch sensations, such as textures (the child will only wear certain, specific clothing).
- Resisting self-help activities, such as face and hair washing, haircuts, and brushing teeth.
- Discomfort with the application of sunscreen or lotions.
- Insecure with some movement sensations, avoiding climbing and balance activities.
- Walking stiffly due to sensitivity with changes in body position.
- Refusing to eat certain foods because of appearance, texture, taste, and temperature.
- Poor self-regulation skills with frequent "fight" (tantrums, crying, aggressive behaviors) and "flight" (running away, hiding) responses.
- "Out-of-proportion reactions."
- Difficulty transitioning between activities and settings and difficulty adjusting to change.
- Rigid and controlling behavior.
- Increased anxiety with new situations, people, or demands.

Decreased sensory responsiveness
- Decreased awareness or delayed response of visual and auditory surroundings.
- Slow processing speed.
- High pain tolerance.
- Decreased perception of personal space, often too close.
- May have low muscle tone.
- Uses too much force without realizing it.
- Lack of creativity and spontaneity in play activities.
- Appearing clumsy, having poor endurance or poor balance.

Sensory seeking
- Seeking of intense movement experiences (spinning, running, "crashing," climbing, jumping, acceleration).
- Seeking pressure through wrestling, being squished, pushing, and pulling.
- Seeking touch sensations by mouthing objects, rubbing/pinching skin of caregiver, continually touching or holding objects.
- Continual humming, vocalizations, or singing.
- Difficulty calming down for seated activities, nap time, and sleep.

fully explain all of Adam's features. A thorough history would reveal a long pattern of sensory modulation difficulty since infancy. Adam's parents would relate difficulties with auditory input (overreacting to sounds or tantrums to the sound of the toilet flushing), tactile sensitivities (hypersensitivity to new food textures or refusing to wear anything but cotton t-shirts and sweat pants), and poor proprioceptive skills (floppy infant, late walker, or unable to peddle a bike).

Although comorbidity should be considered, sensory processing challenges are often a diagnosis of exclusion. Standardized assessment tools are available to assist the practitioner in identifying individual processing differences and organizing sensory processing symptoms. The Sensory Profile 2[24] is a standardized measure to assess how processing issues may be impacting a child in multiple environments. It has the advantage of including assessing the age range from birth to 14 years-11 months, and offers computerized scoring. The Adolescent/Adult Sensory Profile is available for those > 11 years.[25] The Sensory Processing Measure[26] provides a profile of sensory symptoms at home and at school and includes children ages 5-12. Utilization of these tools is often deferred to the OT because paid time for scoring and interpretation is often difficult for the NP, and NPs may not have the training or experience to interpret the findings. OTs use standardized questionnaires and other standardized tools to evaluate motor function, praxis, and specific aspects of sensory processing. The results are compiled to provide a sensory, motor, and regulatory profile that becomes the platform for planning goal-directed care. Using standardized measures further strengthens research for evidence-based practices.

TREATMENT

Effective treatment for sensory processing challenges should be research-based and family-centered, and may involve a multidisciplinary team. Treatment from a therapist steeped in evidence-based practices increases the likelihood that strategies will be implemented effectively. Positive outcomes have been shown in the areas of sensorimotor skills, motor planning, reading-related activities, socialization, attention, behavioral regulation, and active play skills.[27]

The goal of sensory integration therapy (SIT) is based on neural plasticity and environmental enrichment[28] and is specialized to address the specific sensory needs of the child. Based on sensory integration theory, treatment is designed to provide individualized, environmentally controlled experiences that address sensory processing difficulties. A multipronged comprehensive approach, which includes play-based therapy and use of specialized equipment to create specific, measurable goals, is used in assisting the child to organize sensory input. Therapy supports the child in developing coping and problem-solving abilities to replace "fight-and-flight" reactions with self-regulation skills and promote intact self-esteem.

Treatment for sensory challenges generally takes place in private practices, OT departments, schools, and clinics. Typically, OT intervention in the school is geared toward identifying sensory strategies, accommodations that focus on a child managing the demands related to the school day, and may, for example, include the development of a "sensory diet" or "regulation plan." It will also likely include remediation of specific skills impacting school performance such as fine-motor, postural, and handwriting skills. Intervention focused on remediation and parent education is typically provided in an outpatient setting and considered central to a comprehensive treatment approach.

SIT is a specialized area of pediatric work that is typically carried out by OTs and sometimes by trained physical and speech therapists. SIT may also be referred to as OT-SI (occupational therapy–sensory integration). OT-SI qualifications include certifications in postprofessional training, mentorship, and clinical experience.[29] OTs, using a sensory integration frame of reference and specialized equipment, work on increasing a child's ability to tolerate and integrate sensory input in order to adapt to daily environments and events. Equally important is caregiver education regarding how to interpret their child's signals and how to use specific parenting strategies to support the development of self-regulation skills. Intervention is highly individualized to the parent and child and thus children with similar profiles may have differing courses of intervention depending on the child's age, severity of the processing constrictions, follow through of therapy strategies, and the parents' ability to support the child's regulation around stressful events. Models of

intervention that target consistency in approach to addressing the complexity of clinical reasoning around all of these factors are emerging, such as the STEP-SI Clinical Reasoning Model.[3] The Ayres Sensory Integration Fidelity Measure is a tool to measure structural components as well as SI principles of intervention.[30] Such models and measures that support both complexity and fidelity of intervention are critical to both therapy outcomes and SIT research.

A review of studies of SIT effectiveness concluded that, "positive outcomes have been found in the areas of sensorimotor skills and motor planning, attention and behavioral regulation, academics, participation in active play, and achievement of individualized goals."[27(p412)] Preliminary results of a study including 98 children with SPD treated using the STAR treatment model for SPD children showed significant improvements in adaptive behavior and emotional functioning after intensive, short term, occupational therapy for children with SPD.[31]

The outcome of effective intervention enables the child with sensory challenges to better regulate and improve adaptive functioning in order to take part in the normal occupations of childhood, such as playing with friends, enjoying school, eating, dressing, sleeping, and learning. Treatment addressing sensory processing challenges is multifaceted and includes parent education, compensatory sensory strategies, skills building, and remedial work focused on helping the body better register, process, and integrate sensory input. Therapeutic strategies and accommodations can be carried out by parents and school staff to enhance the child's function at home, school, and in the community.

CONCLUSIONS

Sensory processing challenges should be considered in children who present with symptoms suggestive of sensory and motor processing irregularities as well as difficulties with self-regulation. A thorough history, physical examination, and developmental assessment is necessary to determine whether the sensory issues stand alone or are embedded in other disorders such as autism spectrum disorders, attention deficit/hyperactivity disorder, mental health disorders, behavioral disorders, and disorders of learning. Whether sensory deficits are conceptualized as a symptom complex embedded within a larger picture of a neurodevelopmental disorder or as a distinct disorder, an essential role of the NP is to minimize the impact these differences on the child's social, emotional, and behavioral development through early identification and referral for treatment. JNP

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