

Abnormal Sensory Reactivity in the Child and Adolescent Psychiatry Clinic: Assessment, Management, and Treatment

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Phenomenology of Sensory Processing Disorder

Clinical interest in abnormal sensory processing has evolved since the mid-twentieth century from initial work by Anna Aryes,¹ a prominent occupational therapist, and Leo Kanner, known to many as the father of autism. Aryes, while observing children with learning disabilities, conceived of a field of sensory integration dysfunction, a disorder related to neurological impairment in “detecting, modulating, discriminating, and responding to sensory information.”¹ There is increasing recognition today that differences in sensory processing are transdiagnostic and encountered by a multitude of clinical practitioners, including psychiatrists, neurologists, occupational therapists, audiologists, and pediatricians, among others. It is thus of vital importance for child psychiatrists to recognize those differences, distinguish them from autism and other diagnostic categories, and conceptualize approaches to treatment.

Sensory Processing Disorder (SPD) describes impaired processing of, responses to, and organization of sensory information with a resulting impairment in social and occupational functions.¹ It is a diagnosis, however, that is not included in either the *DSM-5* or *International Classification of Diseases, 10th Revision* (ICD-10) classification systems. Research into this heterogeneous condition has suggested three subtypes, one of which is Sensory Modulation Disorder (SMD). SMD, referring to an inability to regulate one’s responses in an adaptive manner to sensory stimulation, has three further categories: sensory over-responsive (SOR), sensory under-responsive (SUR), and sensory seeking/craving.¹ A disorder highly related to SOR subtype is misophonia, which is a sound processing disorder characterized by

heightened and negative affective responses to specific, everyday sounds.² While SOR is only in response to loud or unexpected noises, misophonia describes aversive and angry feelings emoted in response to innocuous sounds, such as chewing, breathing, and pen clicking.

Research on the autonomic nervous system has demonstrated that increased reactivity (sympathetic nervous system) and less vagal variability (parasympathetic nervous system) contribute to a decreased ability to modulate responses to typical environmental stimuli.¹ Also, fMRI research into neural processes underlying SOR and misophonia has demonstrated that connections from the anterior insular cortex to regions responsible for processing and regulating emotions, such as the amygdala and ventromedial prefrontal cortex, display abnormal myelination patterns.² Taken together, this combination of increased salience attributed to harmless and irrelevant sounds with atypical interoception, leads to the anger, anxiety, and arousal experienced by individuals with misophonia.²

Differentiating Autism Spectrum Disorder and Sensory Processing Disorder

It is well established that there is a high incidence of sensory reactivity abnormalities in individuals with autism spectrum disorder (ASD), ranging from 33 to 96%,³ while the prevalence of SPD in Typically Developing (TD) children is cited at 5 to 16%.¹ However, it is important to recognize that several other conditions, such as intellectual developmental disorder, attention-deficit/hyperactivity disorder (ADHD) and obsessive-compulsive disorder (OCD), as well as non-psychiatric diagnoses, such as SPD, can have sensory modulation or processing difficulties be prominent.³ Thus, intolerance

to aversive sounds, visuals, textures, and other sensations does not appear to be a phenomenon unique to ASD or SPD, but instead likely represents an underlying aberration in neural connectivity that is transdiagnostic.

More recently, Tavassoli *et al.*³ published the largest study to date comparing children with ASD, SPD, and TD investigating the possibility of differentiating ASD and SPD children based off their sensory symptoms and cognitive styles. Pertaining solely to sensory symptoms, children with ASD scored highest on the SUR subscale, while on the SOR and sensory-seeking subscales, both the ASD and SPD children scored similarly higher compared to the TD children. With regards to cognitive styles, specifically Empathy Quotient (EQ) and Systemizing Quotient (SQ), children with ASD demonstrated lower EQ and higher SQ scores than both the SPD and TD children. Interestingly, children with SPD, who at baseline trended to higher scores (ie, more autistic) on the Autism Spectrum Quotient in this study, trended to lower EQ scores than TD children too. It is postulated that, in children with SPD, their overwhelming SOR symptoms might make it difficult to use empathy skills and respond to the emotions of others.³

It is recognized formally in Criterion B of autism spectrum disorder that autistic individuals often have hyper- or hypo-reactivity to sensory input or unusual interest in sensory aspects of the environment. Ultimately, however, while most children with ASD certainly demonstrate difficulties with sensory modulation similar to those with SPD, and many of the underlying neural features and resulting adaptive behaviors are likely to overlap, children with ASD can be differentiated based on the presence of core ASD features that impair social and emotional functioning.

Evaluation of Sensory Processing Difficulties

Practically, child psychiatrists and other practitioners clinically evaluating sensory processing difficulties are tasked with evaluating and documenting these deficits in an objective manner. Several different measures are used, and are broken down into parent/self-report and clinician observed assessments. Since several of

these measures were developed for the autistic population characterized by common language difficulties, parent-report is often the sole way to assess sensory reactivity abnormalities. Such measures include the Short Sensory Profile (SSP), Sensory Experiences Questionnaire (SEQ), and Sensory Processing Measure (SPM). Though no standardized diagnostic criteria for misophonia exist, several scales for assessing it are available, including the Amsterdam-Misophonia-Scale (A-MISO-S).

Of course, parent-report scales have inherent bias with retrospective recollection that can be inaccurate. As a result, some clinician-administered tools exist, including the Sensory Processing Scale Assessment (SPS), Sensory Integration and Praxis Tests (SIPT), and the Sensory Processing Assessment for Young Children (SPA). Tavassoli *et al.*⁴ set out to provide greater objectivity by validating the SPS, which consists of fifteen structured games to establish whether patients display sensory hyperreactivity, sensory hyporeactivity, or sensory seeking behaviors. Tasks include painting the patient's arm, the "goo game," among others, that allow the clinician to arrive at a global clinical impression of sensory symptoms. Tavassoli *et al.*⁴ found that when using the SPS, 65% of ASD children demonstrated clinically significant sensory processing difficulties versus just 4% of TD children. Compared to the SSP, the SPS was more specific, and item-reduction analysis found 5 critical items on the SPS. It is likely that using the parent- and clinician-administered measures in tandem would yield the most specific and clinically meaningful assessments in clinical practice.

Approach to Treatment of Sensory Processing Difficulties

In general, targeting the abnormal behaviors associated with sensory processing disorders is the main goal of treatment, and much of the research into treating these disorders has been done in the autistic population with comorbid sensory processing impairments. Necessarily, helping the individual achieve more adaptive emotional responses to sensory stimuli is an individualized process, and most of the current research focuses

on behavioral therapies. Schaaf *et al.*⁵ performed a randomized clinical trial on children with sensory integration difficulties, comparing Sensory Integration Therapy (SIT) to Usual Care. During the ten-week SIT, therapists used individualized assessment of maladaptive behaviors, creating a hypothesis of the sensory integration difficulties purportedly causing them, and enhanced the child's ability to utilize sensory-motor experiences in adaptive ways. For example, for a child with an aversion to touching his food, the therapist's goal might be to decrease tactile sensitivity and enable the child to eat with a fork and spoon for 50% of the meal as appropriate. As measured on the Goal Attainment Scaling, which measures functional outcomes as chosen by parents, those with SIT demonstrated significantly greater improvement with a large effect size of 1.2.⁵ The authors concluded that, as a child's ability to modulate sensation improved, so too did their behavioral regulation and ability to interact in self-care and social activities.

More recent literature in treating sensory processing disorders in individuals without autism has focused on treating misophonia. For example, Schroeder *et al.*⁶ assessed the efficacy of a modified cognitive-behavioral therapy (CBT) in improving misophonic emotions in individuals with misophonia and without other psychopathology. The treatment protocol targeted the hyper-focus on human sounds with resulting negative affective reaction by utilizing task concentration exercises, counterconditioning, stimulus manipulation, and relaxation.⁶ A majority of the individuals (58%) demonstrated improvement.

Finally, no standardized trials exist to date of non-behavioral treatments of SPD. There is some speculation that, since misophonia and sensory processing difficulties may share neurocircuitry with OCD and Tourette's syndrome,⁷ serotonergic medications such as clomipramine could theoretically reduce the negative emotional and physical sensations associated with SPD. Alternatively, one could envision using repetitive transcranial magnetic stimulation (rTMS) to augment response to SIT or other behavioral-based therapies.

Conclusion

Sensory processing difficulties, though not unique to ASD, are highly prevalent in this population. Atypical sensory reactivity can take many forms, including sensory hyporesponsiveness, sensory hyperresponsiveness, and sensory seeking behavior. Understanding of these difficulties has been slightly hampered by a lack of a unified classification system. There is solid evidence, however, that there are sympathetic and parasympathetic impairments, as well as fMRI evidence of altered activation responses in various neural networks. The clinical evaluation of these individuals with atypical sensory reactivity requires a thorough evaluation for autism, as well as characterization of sensory impairment via parent-reported and ideally clinician-administered assessments. Current research indicates that the most effective treatments are sensory integration therapies that individualize adaptive responses to sensory experiences.

Take Home Summary

Sensory processing difficulties are highly prevalent in children with ASD, though can occur in TD children too. It is important for child psychiatrists to understand the neural and etiological bases for atypical sensory reactivity and its variants; to evaluate it and other psychiatric comorbidities; and to help formulate a multi-modal treatment plan.

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