

Sensory processing disorders in Indian children with Autism spectrum disorder

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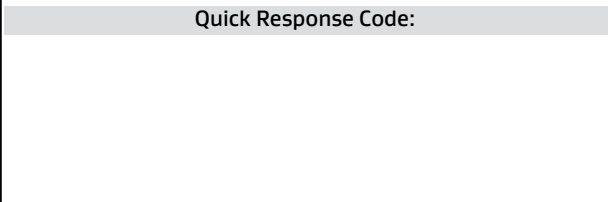
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Abstract

Sensory processing disorder (SPD) is common in children with autism spectrum disorder (ASD). The current cross-sectional study evaluated the prevalence of SPD in Indian children with ASD and its association with autism severity and sleep disturbances. Children who visited an inpatient residential facility attached to the Developmental Pediatrics Unit in a tertiary care center in south India from January 2016 to December 2016 with a diagnosis of ASD were included. The sample of 83 children comprised predominantly boys (83.1%). At least one sensory abnormality was found in 75 children (90%). Among sensory sections, auditory processing (62.7%) and oral sensory processing difficulties (45.8%) were reported maximum, while low registration (73.5%) and sensory avoidance (68.6%) were commonly reported among sensory quadrants. Children with severe autism had a higher proportion of auditory processing difficulty when compared to children with mild-moderate autism (80.8% vs 54.4% respectively; $p=0.028$). Children with sleep problems had also a higher proportion of auditory processing difficulty when

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compared with children having no sleep concerns (92.9% vs 7.1% respectively; $p=0.013$). The high prevalence of SPD and its association with autism severity and sleep disturbances in Indian children with ASD necessitate early screening for SPD for children with autism in low- and middle-income settings.

Keywords: autism spectrum disorder, sensory impairments

Introduction:

Children with Autism Spectrum Disorder (ASD), apart from having deficits in social communication and restricted repetitive behavior, show a wide range of abnormalities in their

sensory perception(Lord et al., 2020). As per the Diagnosis and Statistical Manual, 5th edition (DSM - V), diagnostic criteria of ASD include sensory processing disorder (SPD), defined as “Hyper- or hypo-reactivity to sensory input or unusual interest in sensory aspects of the environment”(American Psychiatric Association, 2013).

Incidence of SPD in children with ASD varies widely with some studies showing as high as 100%(Jorquera-Cabrera et al., 2017; Suarez, 2012).These abnormalities may involve auditory processing, vestibular processing, and processing of visual stimuli, tactile information, and olfactory sensory information. In addition, there can be inappropriate responses to multiple sensory stimuli processing, integration, and modulation as suggested in the quadrant model (Dunn, 1997).

Site-specific population-based prevalence of ASD in India ranged from 0.5 to 1.7% in 2-6 year-olds and 0.2-1.9% in 6-9 year-olds (Arora et al., 2018), and a systematic review showed a pooled prevalence of around 0.1%, while highlighting inadequate quality evidence (Chauhan et al., 2019). There is a dearth of SPD data in Indian children with ASD. A hospital-based prevalence study done in north India showed that all children with severe autism had SPD with the maximum number having auditory processing disorders(Kadwa et al., 2019). In this background, the current analysis was conducted to assess the incidence of various SPD in children with ASD in a tertiary care center in south India and their associations with autism severity and co-morbidities.

Materials and Methods:

All children welcomed to an inpatient residential facility attached to the Developmental Paediatrics Unit in a tertiary care center in south India

from January 2016 to December 2016 with a diagnosis of ASD were included in this cross-sectional analysis. Children were diagnosed by a multidisciplinary team of developmental pediatricians, psychologists, and therapists using DSM-V criteria(American Psychiatric Association, 2013). The current study was approved by the Institutional Review Board. All admitted families had given written consent for anonymized data to be used for audit and research activities.

Measures

Demographic information was collected from parents/caregivers. Co-morbidity information collected included the presence of seizures and sleep concerns.

The Childhood Autism Rating ScaleTM, Second Edition (CARSTM-2)

The Childhood Autism Rating ScaleTM – second edition (CARSTM-2)(Schopler, 2010) was used to analyze autism symptom severity in children and was scored by the psychologist with inputs from parent/s. This 15-item rating scale can be used from two years of age onwards and has good validity and reliability with raw scores ranging from 15-60 (Chlebowski et al., 2010).

The Sensory Profile

The Sensory Profile assesses the sensory difficulties of children using parent reports and has 125 items. The Likert scale responses are converted into a score with lower scores indicating greater symptoms and can be categorized under typical performance, probable difference, and definite difference. Items can be grouped under four principle quadrants as per Dunn’s model (viz low registration, sensory seeking, sensory sensitivity and sensory avoidance) and five sections (viz auditory processing, visual processing, vestibular

processing, tactile processing and oral sensory processing) (Dunn & Brown, 1997; Dunn & Westman, 1997).

Data entry and analysis:

Data entry and analysis were done using the SPSS package 16.0. Continuous and categorical variables were summarized using mean (SD) and count (proportion) respectively. Sensory performances under each domain and section were described using proportions. Probable and definite differences reported were considered together as atypical sensory performance or SPD (Dunn & Brown, 1997). Associations were evaluated between sensory abnormalities and demographic variables such as age, sex, and parent education; autism severity and presence of co-morbidities such as sleep disturbances, and seizures using chi-square tests. Severe autism was considered if CARSTM-2 score was (≥ 37) (Dunn & Westman, 1997).

Results:

The sample of 83 children had a median age of 47.92 months and comprised 69 boys (83.1%) (Table 1). The median CARSTM-2 score was 34.3 with 32.5% showing severe autism symptoms. Above 70% of parents were at least graduates.

At least one sensory abnormality was found in 75 children (90%). “Definite difference” in sensory processing was found in 65 out of 83 children (78.3%) while “probable difference” was present in the remaining 10 children. Auditory processing (62.7%) and oral sensory processing difficulties (45.8%) were reported maximum. Difficulties in visual processing, tactile processing, and vestibular processing were respectively 38.5%, 44.6%, and 30.1%. Quadrant analysis revealed that low registration (73.5%) and sensory avoidance (68.6%) were commonly reported. Sensory-seeking behavior and sensory sensitivity

were found in 22.9% and 51.8% respectively.

Children with severe autism had a higher proportion of auditory processing difficulty when compared to children with mild-moderate autism (80.8% vs 54.4% respectively; $p=0.028$) (Table 2). There was no significant difference in SPD in other sensory quadrants and sections between children with severe autism and those with mild-moderate autism. Children with sleep problems had a higher proportion of auditory processing difficulty when compared with children having no sleep concerns (92.9% vs 7.1% respectively; $p=0.013$). There was no statistically significant relationship between demographic factors such as sex and age of the child, and prevalence of seizures and other sensory abnormalities.

Discussion

The current analysis from a hospital-based sample has shown a high prevalence of 90% of at least one sensory abnormality in children with ASD. Auditory processing disorder was the most reported with its higher prevalence associated with severe autism symptomatology and sleep problems.

A close relationship has been reported between ASD and SPD in the literature including significant associations between SPD and core features of ASD, medical co-morbidities such as sleep and feeding concerns, and secondary behaviors including anxiety and problem behaviors (Ben-Sasson et al., 2009; Glod et al., 2015). It has been hypothesized that sensory behaviors as demonstrated in the SPD might affect the ‘piori’ brain constructs resulting in autistic behavior (Pellicano, 2013). It is also possible that this close association might be differing manifestations of aberrant brain connectivity with complex interlinkage (Posar & Visconti, 2018). However, there is a consensus that SPD

cause a significant impact on the quality of life of individuals with ASD (Ben-Sasson et al., 2009; Posar & Visconti, 2018; Suarez, 2012).

Early identification of SPD in children with ASD can help not only in specific sensory interventions and environmental modifications but also in planning and integrating the overall autism interventions with sensory needs (Ayres, 1979). A high prevalence of SPD in ASD as seen in the current study has been reported in the literature (Ben-Sasson et al., 2009; Glod et al., 2015; Jorquera-Cabrera et al., 2017; Suarez, 2012). A hospital-based study in north India reported that all children with severe autism had SPD while only 40% with mild-moderate ASD had SPD concerns (Kadwa et al., 2019), similar to our findings.

Sensory quadrant analysis in our study showed a high prevalence of low registration and sensory avoidance. Low registration is considered sensory hypo-responsiveness while sensory sensitivity is considered hyperresponsiveness (American Psychiatric Association, 2013). Sensory hyperresponsiveness and sensory seeking behaviors increase till the age of 6-9 years of age with a decrease in later years, but there is limited exploration of sensory hypo responsiveness including avoidance and low registration in individuals with ASD (Ben-Sasson et al., 2009; Glod et al., 2015; Posar & Visconti, 2018). Another quadrant dimension of 'enhanced sensory perception' has been added recently to address sensory experiences in individuals with ASD (Ausderau et al., 2014; Posar & Visconti, 2018).

The current analysis found a high prevalence of auditory processing disorder in children with severe autism similar to reports in systematic reviews (Ben-Sasson et al., 2009; Posar &

Visconti, 2018). Auditory processing difficulties can manifest as 'apparent deafness' where the child does not respond to name calls, increased sensitivity to high-pitched sounds, and repetitive verbal stereotypy, all among the core symptoms of ASD. In addition to uni-sensory auditory perception, integration of auditory to visual and other sensations can also be impaired, which can manifest as poor integrated social communication (Ben-Sasson et al., 2009; Posar & Visconti, 2018).

Children with sleep concerns had a high prevalence of auditory processing disorders in the present study consistent with other analyses (Ben-Sasson et al., 2009; Posar & Visconti, 2018). Hyperarousal associated with auditory sensitivity can impair sleep initiation and sleep depth (Posar & Visconti, 2018).

The current study had many limitations including hospital-based small sample size and parent report measures. Subjective parent reporting can be affected by the phase of parental understanding, engagement, and acceptance as well as culture-specific experiences (Desai et al., 2012). Nevertheless, the present analysis highlighted the high prevalence of SPD and its association with autism severity and sleep disturbances in Indian children with ASD necessitating early screening for SPD for children with autism in low-and-middle-income settings. Along with specific autism interventions, an intervention plan for SPD also should be included for such children. An integrated plan can help in improving adaptive behavior and quality of life in children with ASD.

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Conflicts of interest : There are no conflicts of interest

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Table 1: Demographic profile (n=83)

Factors	Range
Age in months- range (median)	24- 101 (47.92)
Sex	Female-14 (16.9%) Male- 69 (83.1%)
CARS™-2 score – range (median)	28-48 (34.3)
Father’s educational status	<12 th standard- 23 (27.7%) Graduate and above- 60 (72.3%)
Mother’s educational status	<12 th standard- 24 (28.9%) Graduate and above- 59 (71.1%)
Seizures	Present- 6 (7.2%) Absent- 77 (92.8%)
Sleep dysfunction	Present- 14 (16.9%) Absent- 69 (83.1%)

CARS™-2 - Childhood Autism Rating Scale™ – second edition

Table 2: Association between prevalence of sensory processing disorders and severity of autism

	Mild-moderate autism n=57	Severe autism n= 26	Statistical significance
Sensory sections			
Auditory processing	31 (54.4%)	21 (80.8%)	.028
Visual processing	22 (38.6%)	10 (38.5%)	1.000
Tactile processing	25 (43.9%)	12 (46.2%)	1.000
Vestibular processing	17 (29.8%)	8 (30.8%)	1.000
Oral sensory processing	23 (40.4%)	15 (57.7%)	.161
Sensory quadrants			
Low registration	41 (71.9 %)	20 (76.9 %)	.790
Sensory seeking	15 (26.3%)	4 (15.4%)	.399
Sensory avoidance	39 (68.4%)	18 (69.2%)	1.000
Sensory sensitivity	31 (54.4%)	12 (46.2%)	.636