

Sensory Processing Disorder in Individuals with Autism Spectrum Disorder

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Abstract:- Autism Spectrum Disorder is a neurological developmental disorder that affect individual's communication abilities, behavior and social skills. Individuals with the condition also portray restrictive interests and repetitive behaviors. Majority of individuals with ASD have a comorbid disorder known as Sensory Processing Disorder. Over 90% of them typically exhibit unusual sensory behaviors. The disorder entails a dysfunction of one or more of the eight sensory modalities. The modalities include, auditory, visual, gustatory, olfactory, tactile, proprioception, interception and vestibular. It appears in three forms including the Sensory modulation disorder, Sensory discrimination disorder and Sensory-based motor disorders. The disorder has severe and critical implications in education and general quality of life of individuals with ASD. It is important for therapists, teachers and caregivers to understand the nature and implication of the disorder to affected individuals. Stake holders should work consultatively and collaboratively for timely identification and intervention. Early intervention leads to a more productive outcome. In order to intervene effectively, it is important to understand the entire disorder and its implications. This paper highlights the key features of the disorder including causes, characteristic, intervention strategies and implication to live and education of Individuals with ASD. It is a product of lengthy and in depth review of research findings and scholars' work in the field of sensory processing disorder and ASD. Its intended audience include caretakers, families of individuals with SPD, teachers, educationists, speech and occupational therapist.

Keywords: sensory processing disorder, autism spectrum disorder, interventions, collaboration, sensory modalities, sensory diets, special gyms

I. INTRODUCTION

Autism Spectrum Disorder is a neurological developmental disorder affecting individual's communication abilities, behavior and social skills. Individuals with ASD also exhibit restrictive or repetitive interests (Suarez, 2012). Individuals also have phenotypic differences including pace of language development, presence or absence of epilepsy and cognitive abilities. It is referred to as a spectrum because of the wide range of symptoms and severity in the affected individuals. Diagnostic and Statistical Manual of Mental Disorders, 5th Edition (DSM-5), also notes that individuals with ASD have difficulties interacting with others. Currently, Autism spectrum disorder includes conditions that were previously considered as separate disabilities. They include childhood disintegrative disorder, Asperger's syndrome, autism, and unspecified form of pervasive developmental disorder. Asperger's syndrome

referred to what was thought to be the mild end of autism spectrum disorder. Some people still use the term but the current world order is moving away from the practice. ASD is a lifelong disability and has a prevalence rate of 1 in every 69 children (Christensen, et al., 2018). Diagnosing ASD is difficult since there is no medical test to be conducted in order to identify the disorder. Practitioners rely on observation of the child's behavior and the development history in collaboration with parents who respond to interview questions on the child's social, behavioral, communication and medical history. While early identification and corresponding intervention may lead to improved quality of life, most children are diagnosed late. In the United States for example, the average age of diagnoses is 4.4 years. This complicates research on ASD phenotypes in early childhood (Wiggins, et al., 2015). The global prevalence of ASD has increased by between twenty and thirty times since the first ever epidemiologic studies in the area were conducted in late 1960s and early 1970s. By then prevalence estimates from European studies were one in every 2,500 children in the population. On the other hand, by the 2000s, prevalence estimates from large surveys were 1%–2% of all children (CDC, 2014). Research indicates that early intervention improves a child's development. Initial signs and symptoms are apparent by age 2. On the other hand, behavior and social skill deficits take time to be recognized usually until a child is unable to meet social, occupational, educational, or other important life stage demands. Functional limitations also vary across the spectrum and might develop over time (CDC, 2014). This works against effective identification and interventions. Majority individuals with ASD exhibit an atypical response to sensory information reaching their bodies (Marco, et al., 2012). The disorder is frequent with severe symptoms and implication across the Autism Spectrum (McCormic, et al., 2016). It is known as Sensory processing disorder.

Causes of Autism Spectrum Disorder

It is not very clear what causes ASD but research indicates that etiopathogenesis of ASD is multifactorial. There is a rare and complex interplay between Environmental and genetic factors (Parmeggiani, Corinaldesi & Posar). While Researchers worldwide agree that both genetic and non-genetic factors contribute to a child having ASD, it is unfortunate that distinct genetic mechanisms have been found in only 10–25 % of all individuals with ASD. A breakthrough in identifying the causes of ASD would help work on preventive and control measures to curb the unprecedented increase in prevalence of

the disorder. A major barrier to ASD etiologic research is the substantial variability in ASD symptoms, severity and presentation. Complicating the matter further is the co-occurrence of medical, psychiatric and behavioral conditions in individuals with ASD (Wiggins, et al., 2015).

Nature and Aspects of Sensory Processing Disorder

Sensory processing Disorder is a critical heterogeneous neurophysiologic condition (Miller, et al., 2009). Its theory is accredited to Dr. Jean Ayres, a pioneering Occupational therapist and a researcher who identified children with problems of integrating multiple sensory stimuli. She compared it to a 'traffic jam' in the neurological path. The jam hinders parts of the brain from receiving information necessary for effective response (Critz, et al., 2015). Integration difficulties may affect a child's physical enactment of activities. Their feelings of competency in the context of social participation is also affected. Generally, Sensory processing difficulties lead to problems of under- or over-arousal in typical environments. This in turn contributes to affect dysregulation in individuals with ASD (Cheng & Boggett-Carsjens, 2005).

There are three categories of sensory processing disorder. They include Sensory modulation, Sensory discrimination and Sensory-based motor disorders. Implication of the three is equally critical in education and quality of live. Sensory modulation refers to difficulty in regulating responses to the bodies sensory stimulation. In this category are three finer subcategories. There is the Sensory over-responsive subcategory in which response to stimulus is un-proportionally too much or for untypically too long. Individuals also respond to 'too weak' intensity stimuli that typical individuals may not even notice. The next subcategory is the Sensory under- responsive ones. Individuals respond too little to a stimulus or need extremely strong stimulation in order to respond. The third subcategory are the sensory cravers. They intensively seek for stronger stimulation in typical real life situations (Miller, et al., 2009). They may commonly non-functionally and aggressively run, jump, and touch people or objects with a tight grip in typical situations. Some make unwarranted and unusual noise in typical environments (Critz, et al., 2015). The three sub categories have challenges grading or regulating responses.

Within sensory-based motor disorder is Postural disorder in which individuals have problems in balance and core stability. Dyspraxia, which involves difficulties in motor planning and sequencing movements is also included in this category. Finally, Sensory discrimination disorder refers to difficulty interpreting the refined differentiated characteristics of sensory stimuli. This includes the intensity, the duration, the spatial, and the temporal elements of sensations. It can be present in any of the sensory systems (Miller, et al., 2009).

SPD is not unique to Autism Spectrum Disorder but is more prevalent in the population (Marco, et al., 2011). It significantly affects learning and participation of individuals

in meaningful functional activities (Miller, et al., 2009). It is important to detect and identify the disorder as early as possible in order to promptly begin targeted interventions (Parmeggiani, Corinaldesi & Posa, 2019). When the disorder is not identified on time, mislabeling takes place and interventions are delayed (Crietz, et al., 2015). On the other hand, timely identification and intervention lead to increased participation in meaningful activities (Suarez, 2012). This enhances learning and improves the individual's quality of live.

Causes of Sensory Processing Disorder in Autism Spectrum Disorder

The causes of sensory processing disorder are not clearly known. Preliminary research indicates that most cases are inherited. Environment also plays a significant role in increasing vulnerability. It is suspected that prenatal and birth complications make individuals vulnerable to sensory processing disorder. Distressed expectant mothers, maternal illness and corresponding medication, are also considered contributory risk factors. On the same note, Premature births of less than 36 weeks, prenatal complications and assisted delivery could also lead to increased vulnerability.

Other documented risk factors include complications during delivery and poor economic background. Further, from Brain structural MR imaging, children with sensory processing disorder exhibit noticeably and critically decreased white matter microstructural integrity especially in the posterior regions even though they do not exhibit comparative morphologic abnormalities (Chang, et al., 2014).

Prevalence of Sensory Processing Disorder in ASD

Addressing and responding to a challenge in any community is usually informed and motivated by its prevalence and implication. The higher the prevalence rate of a disorder, the more governments and stakeholders invest on research and intervention. Information on the prevalence of SPD in children with ASD vary with authorities. Suarez (2012), opines that the rates of impaired response to sensory information in children with ASD may be as high as 90%. Piller and Bariom (2019), on the other hand estimates that 70–96% of children with ASD exhibit some difficulties with sensory processing. Further, a research conducted by Jussilla et al., (2019) in Oulu Finland (n = 28), found that 53.6%, of the participants with ASD had sensory processing disorders. The figure could be higher considering the small number of participants who were only twenty-eight.

Other literature indicates that Over 96% of children with ASD report hypersensitive or hyposensitive sensory behavior differences ranging from mild to severe (Marco, et al., 2011). Further, Marcomick, et al., (2016), estimates that between 69% to 93% of children with ASD have the disorder. Finally, Shah, Joshi and Kulkani (2015), reported 98% prevalence of the disorder in children with ASD in urban India. Based on the above literature, prevalence of the disorder is evidently

(and significantly) high in ASD and cannot be taken for granted by caregivers, family, therapists and other stakeholders in Education.

The Eight Sensory Modalities and the Sensory Processing Disorder

As noted earlier, sensory processing disorder occurs when there is a failure or a dysfunction of one or more of the eight sensory modalities. Sensory modulation is the body's potential to regulate the intensity, degree and nature of its response to a sensory input (Critz, et al., (2015). Visual Modality detects stimulus through the eye. Its dysfunction has pervasive and severe symptoms on the individual (Coulter, 2009). Individuals with the dysfunction in this modality seek visual stimulation by for example staring and getting fascinated with moving and shiny objects. Some others are sensitive to bright lights and struggle reading high contrast materials like black on white.

Auditory System is another modality that detects stimulus through the ear. Studies have documented a generally delayed auditory processing in learners with ASD (Ocak. et al., 2018). Sensory failure in this modality leads to individuals being overly sensitive to noise. Some cover their ears in crowded places or make own noise to mask out other sounds in public. They are oversensitive to sounds that would not even be noticed by others.

Another sensory modality is the Gustatory System. It detects flavor or taste in the mouth. Its malfunction leads to heightened response to taste and texture of food (Avery, 2018). Selective eating habits are common in Individuals with (ASD) and is associated to failure of Gustatory system. Some Kids could also be overly sensitive to tooth brushing. Others seek out oral stimulation by yearning for strong tastes as well as chewing and sucking objects like pens for compensatory reasons.

Interception sensory modality enables the body to experience, and respond to its physiological state. Its main functions include both body and emotional state (cscadmin, 2018). It helps individuals understand physiological variables such as need to use the restroom. It plays a significant role in emotions identification. Its Dysfunction leads to self-adjustment problems.

There is also the Olfactory System modality that detects smell through the nose. Disorder in the sense of smell significantly impact quality of life, safety, and nutrition (Goncalves, & Goldstein, 2017). Individuals get easily distressed or nauseated by smells that others may not typically notice. Some seek out for smells from even distasteful sources such as dirty socks, excrete and sweat.

Another sensory modality is Proprioception which is the sense of muscle and joint movement. It helps detect joint and limb positioning in the human body. It is very crucial and its dysfunction leads to Bumping or crashing into objects or people as individuals move around. Individuals

characteristically kick, or stomp while seated or walking. Some have difficulty climbing stairs and locating their body parts (Porter, 2017).

Vestibular System on the other hand is a modality involved in the bodies' motor functions. It allows bodies to remain in balance during movement. It feeds the brain on head movement and its position relative to the body. Semicircular canals of the inner ear sense rotational head movement while other parts known as utricle and saccule detect and respond to linear acceleration and gravity (Thompson & Amedee, 2009). Its Dysfunction leads to a child being overly sensitive to Movement. Children avoid swings and fast movement equipment and activities. Others enjoy rough-and-tumble activities and may also seek fast movement activities for compensation.

Finally, the Tactile modality detects and responds to touch pressure and temperature. In situations where there is dysfunctional, individuals avoid light touch to the head and body during grooming and clothing. Others seek sensation through deep pressure like squeezing into pillows or deep hugs. (Marco. et al., 2011). Dysfunction can be dangerous because a child will not automatically respond to weather changes like excess heat or excessively low temperature.

Characteristics of children with sensory processing disorder

Children with SPD are easy to identify through their externalized unusual behaviors in typical environments. They exhibit both Lower-order and high order repetitive behaviors. Lower order repetitive behaviors include stereotypy, like hand flapping or self-injurious behaviors. (Suarez, 2012). Many Children with SPD but not necessarily those with ASD exhibit the characteristics. (PSD is also common in individuals with other developmental disabilities). Higher order repetitive behaviors on the other hand are exclusively found in children with ASD. They include compulsions and insistence on sameness over and over again. Others include restricted interests, being unusually attracted and preoccupied with particular objects and having a narrow range of interests. These behaviors affect learning and participation level of individuals in meaningful day to day activities (Suarez, 2012). In the long run, both high order and low order repetitive behaviors affect learning and the quality of life of affected individuals.

Some children with SPD get distressed by activities of daily living such as brushing of teeth and combing of hair. Others are sensitive to very light touch even by the clothes they wear. On the same note, some take time to respond to touch and may have unusually high pain threshold. Many parents and caregivers report that by the time a child complains of pain, it is usually too late. They are usually already very sick as they are taken for treatment.

Some children with the disorder typically exhibit high energy in ordinary situations. They are hyper active and usually in nonfunctional fast and constant movement. It is therefore hard

to sit still for classroom instruction or for a therapy session. Others exhibit low energy and are usually described as being sedentary or lethargic. They want to be isolated and prefer being by themselves most of the times. Some children also easily lose balance, fall while moving and at times while standing. They also portray immature motor coordination in ordinary life situations. Some caregivers report that their Children are extra selective to taste, texture of food and flavor. They are picky eaters. Others seek intense pressure by (for example) spinning or swinging often. On the same note, others are scared of using lift, swings slide and movement equipment. While some of them avoid hugs at all, others insist on tight hugs and crash onto objects. Precisely, characteristics exhibited by individuals with ASD vary with the sensory modality that is dysfunctional.

Addressing Sensory Processing Disorders in Autism Spectrum Disorder

Sensory integration therapy has been used to address SPD for decades of years. The strategy is based on neural plasticity and making environmental situations more enriched. It provides individualized but environmentally controlled rich experiences for individuals with SPD. The strategy helps develop and boost coping and problem-solving abilities as well as acquisition of self-regulation skills in individuals with SPD (Crietz, et al., 2015). In 1982, American Occupational Therapy Association produced a guiding position paper supporting a full spectrum approach. Practitioners were advised to use existing evidence and outcome to device client specific interventions.

Diverse intervention strategies have been used to address effects of SPD. They vary and depend with the affected modality. Example, to address Vestibular input, occupation therapists apply coordinated vertical movement. Children may jump swing or use rocking chairs. On the other hand, for Proprioceptive input, children indulge in weight-bearing and climbing activities. For deep pressure tactile input, touch techniques are recommended. They include massage, ball “squishes” or weighted lap pads (Piller & Barimo, 2019).

Sensory rooms and specialized gyms have also been used to mitigate effects of SPD. In the gyms, children are exposed to calming light, music and also sit on or jump into pit of balls. They also crash into pillows, roll and bounce on huge round balls. This is done with or without assistance of occupational therapists in those gymns. Collaborating with occupational therapist is however more productive and is therefore encouraged. Therapeutic listening is another research based intervention. Electronically altered sound stimulations that go hand in hand with varied sensory activities is used as an intervention (Chiu, & Li, 2017).

Another strategy that has been successfully used by families is known as Sensory diet. The programs target specific sensory needs of the individual. Gradual increase in levels of exposure to distressing sensations is done. Families and caregivers may do this by themselves or work in consultation

and collaboration with Occupation therapists. The latter is more productive and equally encouraged. It enhances a more targeted treatment.

II. IMPLICATION AND DISCUSSION

Autism Spectrum Disorder is a lifelong disability usually occurring comorbid with Sensory Processing Disorder. It is referred to as a spectrum because individuals with the disability phenotypically vary. Sensory Processing Disorder is characterized by externalized and internalized behaviors that negatively affect ability to participate in learning and meaningful day to day activities. It eventually affects the entire quality of life of the individual. Prevalence late of SPD in individuals with ASD exceeds ninety percent going by statistics presented by majority researchers. On the same note, SPD is not currently recognized as an independent diagnosis by itself and hence its intervention should take place intermittent with that of ASD. The disorder is quite critical and has far reaching implications to families, schools and the community.

Sensory Processing disorder affects an individual’s ability to learn, socialize and participate in day today activities. It critically lowers the general quality of life of the affected individuals. Research further indicates that there is a strong correlation between sensory processing disorders and symptoms of Autism Spectrum Disorder. The more severe the former the equally severe the ASD symptoms. The repetitive behaviors and restrictive interests make it hard for learners to stay calm in order for teachers to teach or therapists to conduct sessions.

ASD learners desire for sameness and constant routines is not realistically possible in real life. Naturally, routines change unpredictably. A good example is weather. Schools get occasionally ‘called off’ especially in winter seasons owing to severe weather changes. This does not auger very well with children with ASD. Abrupt change occasionally triggers discomfort and could lead to aggression in some individuals with SPD. As well, due to compromised attention it is difficult for the individuals with SPD to participate in meaningful learning activities (Suarez, 2012).

Research indicates that Children with SPD are either hypoactive or hyperactive in typical environments. Some individuals also get distressed by activities of daily living with parents complaining that their children are uncomfortable having their hair or teeth brushed. Others are extra sensitive to touch especially during grooming. A good number of ASD learners are also picky eaters being oversensitive to taste, smell and flavor of food. Some children also lose balance and repeatedly fall, bump onto people and objects as they walk which could lead to occasional injuries and hospitalization. Implications of the above to families is significantly critical. Families have to cope with all the above challenges which is time consuming and expensive. Further, SPD and ASD in general have stigma and psychological implications. Some

members of the society look down upon families and individuals with the disorders.

While craving for sensation some children hug with grip, could be aggressive, or exhibit nonfunctional hyper-activities like running aimlessly. Some also characteristically jump up and down in typical environments. All the above are quite disruptive and very inconsistent with appropriate learning environment. Further, some individuals have *pica* tendencies. They eat non palatable material such as buttons and coins. Others have self-injurious behaviors. All the above again could raise health concerns and may lead to legal issues too. Parents of injured children could take teachers, therapists or school authorities to courts of law seeking damages and compensation. This in turn lowers teachers and therapists' morale.

Children with SPD are mostly less interactive and participate less in academic activities (Piller & Barimo, 2019). Managing disruptive behavior in class and during therapy session is also time consuming. Quality learning time is lost as therapists and teachers attempt to manage the disruptive and repetitive behaviors. Parents of children with SPD do not therefore get value for their money. Teachers and therapists too could be injured by children seeking sensation or reacting to harsh environmental demands aggressively. In this era of inclusion, children with ASD (with or without SPD) are entitled to Free appropriate education. The new world order advocates that no child is left behind in provision of education. Children need to be educated in the least restrictive environment. Children with SPD however could be a source of disruption in regular classrooms affecting learning of typical students whose parents may not readily understand. This could lead to legal suits as some parents of typical children may argue that their children are getting low quality education when taught amongst individuals with SPD.

Occupational therapists, special gyms, and Sensory diet are some of the common interventions families and schools use to manage SPD. Further, special diet is sometimes given to children with ASD to minimize digestive implications on SPD. This is expensive to families. Environmental modifications are also key in management of sensory processing disorder. This could be expensive to do and maintain in schools and community. It is even more challenging given that environmental needs of individuals with SPD significantly vary. Importantly, Symptoms of dysfunctional sensory systems fluctuate across different environmental demands, evolve over time and vary considerably (Critz, et al., 2015). This makes intervention difficult in learning institutions, home and community.

Ability to effectively address implications of sensory processing disorders requires more education and skills than teachers, occupational and speech therapists independently get during their training. More so, care givers are worse prepared because naturally no parent plans to sire a child with disability. It all happens by accident and unexpectedly. It is therefore

imperative that a team approach is used to address challenges arising from SPD. Precisely, Collaboration, team work and consultation are key to effective intervention in individuals with SPD.

III. CONCLUSION

Autism Spectrum Disorder is a neurological developmental disorder that affect individual's communication abilities, behavior and social skills. Individuals with ASD also exhibit restrictive interests and repetitive behaviors. More than 90% of Children with Autism Spectrum Disorder have a secondary neurophysiologic condition known as Sensory Processing Disorder. It entails the dysfunction of one or more of the eight sensory modalities. They include, auditory, visual, gustatory, olfactory, tactile, proprioception, interception and vestibular modalities.

Sensory Processing Disorder compromises attention and ability of individuals to participate actively in learning and meaningful activities of day to day living. Its etiology is not clear but preliminary research indicates that there is an interaction between genetics and environment making individuals potentially vulnerable to the disorder. It is important for care givers, teachers and therapists to work collaboratively for effective mitigation of its effects in education and quality of life of individuals with ASD. The first step towards effective intervention is to precisely understand what the disorder entails from cause, implication to appropriate interventions. This paper cuts across the causes, nature, characteristics and implications of SPD to individuals, families, schools and community. Its targeted audience is Parents/caregivers teachers and related therapists.

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