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Effects of Sensory-Motor Issues on The Performance of Activities of Daily Livings in Autism Spectrum Disorder

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A B S T R A C T

Background: Abnormal sensory integration is an important feature of Autism. Due to sensory motor difficulties most of the children with Autism cannot perform their functions independently.

Objective: The objective of this study was to determine the impact of sensory-motor issues on the performance of activities of daily living skills in Autism spectrum disorder.

Methodology: This study was conducted in The Children's Hospital Lahore and Rising Sun Institute. Data was collected using purposive non random sampling technique in three months duration from 15th October 2014 to 15th January 2015. Observational and Cross sectional study design was used. 35 patients of both genders were included. Sample selection criteria included the patients affected with Autism of age range 3-15 years. Standardized Barthel index scale and Sensory profile questionnaire based on Ayers sensory integration theory were used to determine the sensory motor issues impact on performance of Activities of daily livings.

Results: Results showed that visual processing disorders were highly correlated with Activities of daily livings ($r = 0.436$, $p = 0.009$).

Conclusion: It was concluded that children with Autism on average, showed atypical sensory-motor responses. The poor functional independence in Activities of daily livings was related to and caused in part by their abnormal sensory motor responses, especially their visual processing. Visual processing problems show that children may have difficulties in tasks such as dressing, grooming, bathing etc.

Introduction

Autism spectrum disorder is a disorder of neuro development, with characteristic impairments in social interactions, verbal and non-verbal communication and range of repetitive and restrictive behaviors.[1]

According to recent estimates, sensory difficulties are seen in about 96% of children with Autism.[2] For the incidence of Autism, the estimated range is about 2.1 to 8.3/1000. Since early 1990s prevalence of Autism has increased. Changing of diagnostic practices is one of the major causes in boys.[3] 52 million estimated cases of ASD were reported in 2010, with 7.6/1000 prevalence rate in 132 persons. Autistic children usually show following symptoms e.g. avoids eye contact, language delays, (echolalia), restrictive and repetitive routines and rituals, obsessive interests, hypo or hypersensitive characteristics to sensory stimuli, short attention span, aggression and self-injurious behavior.[4] Sensory integration is a neurological process in which sensations from the environment and *body are organized and processed. Children who

have sensory integration dysfunction can't process the sensory information and exhibit abnormal sensory and motor symptoms. Delay in fine and gross motor skills, poor motor coordination, motor planning, postural control, perceptual motor integration and poor body movements imitation are some of the main features of children with Autism.[5] Over 90% of ASD's children have abnormalities of the sensory system and exhibit many symptoms in multiple sensory domains.[6] Total score of 95 children with ASD on short sensory profile shows that a definite difference is shown by 65% children (3 to 10 years of age), and a probable difference in processing of sensory integration is shown in 21% children.[7] Definite movement impairments are seen in 79%, children, with ASDs on the M-ABC.[8] Those tasks which a person does every day are called Activities of daily livings. These are of two types; Basic Activities of daily livings include activities directed towards taking care of one's own body.[9] Those activities which are directed towards interacting with the environment are called Instrumental Activities of daily livings.[10] ADLS performance is also influenced by atypical sensory responses. Due to impairments in fine motor skills buttoning a sweater becomes a challenge for them; they also dislike the feel of certain woolen garments. Social, motor and sensory issues collide.[11] Mastering in ADLS & self-care is difficult for some Autistic children. Preschool Autistic children's Performance is very poor on WeeFIM (below -2 SD) which indicate a significant delay in daily living skills. 2 SD below mean sample score accounted for 49%.[12] Not only the life of the individual with ASD is affected by these daily life skills challenges but it also affects his or her family and couples relationship. This study describes whether there is a relationship between sensory-motor development and activities of daily livings. One of the main concerns of parents and therapist is level of independence in activities of daily livings because of its importance for child's integration in school and daycare.

Batool et al., (2017) conducted a study to show why the ASDs reports having varied sensory profiles? For the study, they selected 13 children of ASD in middle and late childhood (5 years to 13 years), (Male = 9; female = 4). For the observation and record of sensory perceptual behavior in 3 modalities (hearing, vision, and propioception), of ASD children, SPCR (sensory Profile Checklist-Revised) was administered. Cognitive linguistics offered an embodiment thesis "human beings are embodied beings." Their findings were consistent with these results. According to cognitive linguistics thesis "variable, embodiment" is due to different experiences, where each and every person constructs, construes and conceptualize their own meaning.[13]

Cermak et al., (2013) conducted a study on sensory sensitivity and food selectivity in ASD children. For the selectivity of food, they discussed the contribution of the sensory factor like sensory sensitivity. The electronic database of Cinahl, Medline, psychoInfo, and the web of science was used by the researcher to locate the pertinent published literature during last 25 years. They concluded that food selectivity may occur due to many reasons, sensory sensitivity suggested as the main cause of it.[14]

Smith et al., (2012) conducted the study over a period of 10 years in a large community-based sample of ASD adolescents to investigate the longitudinal course of daily living skills. For longitudinal and ongoing study 397 individuals of ASD were drawn. They concluded that during the adolescent and early 20's, improvements were seen in skills of daily livings. There was an association between intellectual disability and low initial levels of skills of daily livings and over time a slower change observed.[15]

Jasmin et al., (2009) conducted research on the daily living skills and problems of the motor and sensory system in preschooler children of Autism. They recruited 35 children of age 3 to 4 years, by using the diagnostic and clinical test battery, they assessed the children. Poor DLS, poor motor skills and atypical responses of sensory system were shown by children. Researchers concluded even by taking into account the cognitive performance the sensory seeking, sensory avoiding fine motor skills and visual processing were correlated with ADLS significantly. They concluded that the autonomy of ASD children was impacted by the sensory and motor deficits and for the improving and supporting the sensory-motor skills development interventions should be planned.[12]

Mechling et al., (2009) conducted a study on the students of Autism in which for the portable self-prompting device (PDA) personal digital assistant with auditory, video prompts with voice over and picture was evaluated. Across the 3 cooking recipes multiple prob design was used and with 3 students of Autism it was replicated. According to their results students adjusted on the prompt levels of PDA and they also maintained their ability for the independent usage of the device and complete recipes over the time.[17]

Hume et al., (2009) conducted research on three focused interventions review in ASD for increasing of independence. They concluded through their research that due to executive function and disability deficits independent performance is difficult for Autistic individuals, combined with those intervention strategies which encourages the dependency on the support of adults to get cheap but long-term results for them such as housing, employments, self-monitoring, and relationship development and video modeling each emphasis shift of stimulus control from continuous adult management to the alternative stimuli, for addressing increase independency and other deficits in executive function it has proven successful.[18]

Cicero and Pfadt, (2002) conducted study on the toilet training interventions based on the reinforcement and its effectiveness in three Autistic children. Procedures include positive reinforcement, graduated guidance, scheduled practice trials, and forward prompting. It was concluded through this study that as a response to urination all procedures were implemented. According to their findings for the toilet training proposed procedure was the effective method, in structured settings of schools this method can be implemented and can also be generalized to their home environment.[19]

Methodology

It is an Observational cross-sectional Study, carried in Department of Developmental Pediatrics, CH & ICH Lahore and Rising Sun Institute for special children D.H.A Lahore. For Activities of daily living assessment a valid and reliable tool, Barthel Index was used. Inter-rater reliability of Barthel index is 0.95 and its test-retest reliability is 0.89, as well as it has high correlations (0.74 – 0.8) with other measures of physical disabilities.[20] Sensory profile questionnaire developed from the literature review and derived from Ayers sensory integration theory was used for the sensory-motor assessment. Duration of study was three months from 15th October 2014 to 15th January 2015. Total 35 children were selected for the study who were diagnosed with ASD, whose age range was from 3 years to 15 years and they were diagnosed with ASD. ASD's with other co morbid congenital and acquired conditions were excluded. All the patients fulfilling the inclusion criteria were evaluated by an Occupational therapist, Pediatricians, and Psychologist for the sensory-motor and ADLS during the period. Initially, formal permission was taken from the authorities of department then the parents of Autism were approached. Data was collected by interviewing the parents of Autism Spectrum Disorder who came to Children hospital and Rising Sun Institute. Appropriate statistical data analysis technique by using SPSS (Statistical packages social science) 21 version was applied. Age ranges and gender distribution were represented by a pie chart; the frequency of sensory-motor problems and frequency of ADLS were represented by bar charts. Pearson correlation was used to find the relationship between sensory- motor issues and ADLS. Statistically, the significant P value was considered less than 0.05.

Results

In a total of 35 children of Autism, 14.29% were among the age range of 3-5 years, and 60.00% were among the age range of 6-10 years and 25.71% were among the age ranges of 11-15 years. (Figure 1)

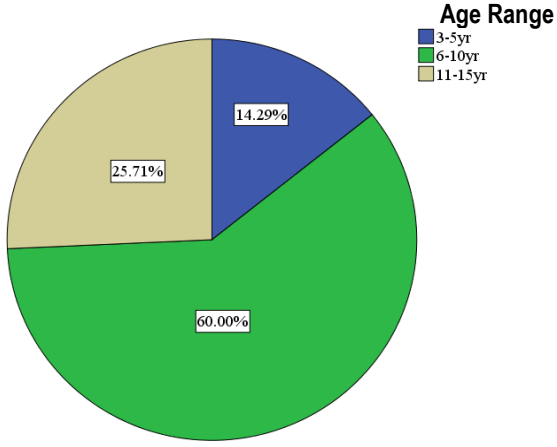

Figure 1: Pie Chart for Ages of Children with ASD

Among both genders, 5.71% were females and 94.29% were males.(Figure 2)

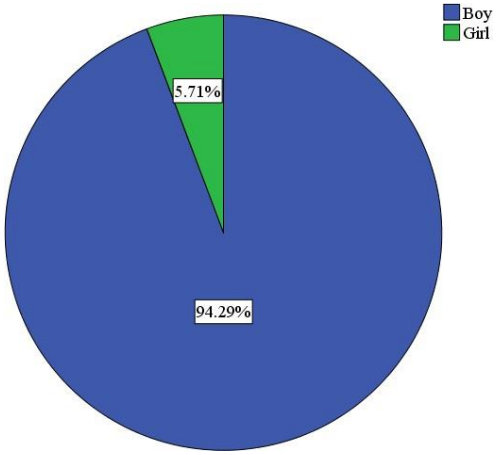

Figure 2: Pie Chart for Gender of Children with ASD

Table 1: Frequency of Sensory-Motor Issues in Children with ASD

Variable	Sub variable	Yes (%)	No (%)
Vestibular system	Dislikes plays	4(11.4%)	31(88.6%)
	Clumsy stumbles	7(20.0%)	28(80.0%)
	Jumps on swings	31(88.6%)	4(11.4%)
	Spins constantly	23(65.7%)	12(34.3%)
Propioceptive problems	Stiff movements	14(40.0%)	21(60.0%)
	Difficulty in and out chair	5(14.3%)	30(85.7%)
	Pencil grasp	25(71.4%)	10(28.6%)
Tactile problems	Dislikes textures	16(45.7%)	19(54.3%)
	Dislike brushing , combing	16(45.7%)	19(54.3%)
	Craves touch	14(40.0%)	21(60.0%)
	React to painful stimuli	25(71.4%)	10(28.6%)
Visual processing	Avoid eye contact	24(68.6%)	11(31.4%)
	Avoid reading-writing	21(60.0%)	14(40.0%)
Auditory processing	Responds to name	29(82.9%)	6(17.1%)
	Loves noise	15(42.9%)	20(57.1%)
	Irritate by sounds	20(57.1%)	15(42.9%)

Above table shows the sensory-motor problems in children with ASD. In case of analysis of vestibular problems 4(11.4%) disliked play, 7(20.0%) were clumsy, and least children 4(11.4%) did not like jumping on swings and most of the children 23(65.7%) spins constantly. Analysis of propioceptive problems showed that only 14(40.0%) children had stiff and uncoordinated movements, only5(14.3%) had difficulty in getting out of chair and 10(28.6%) were unable to grasp pencil. Tactile problems showed that most children 16(45.7%) disliked textures, 16(45.7%) disliked brushing, combing, 10 (28.6%) showed no reaction to stimuli and 14(40.0%) craves touch. Visual processing disorder showed that most of the children, 24(68.6%) avoid eye contact, and most of the children 21(60.0%) avoid reading and writing. Auditory processing disorder analysis showed that minimum children 6(17.1%) did not respond to name, 15(42.9%) loved noises, most of the children 20(57.1%) irritate by sounds and most children 20(57.1%) cover ears.

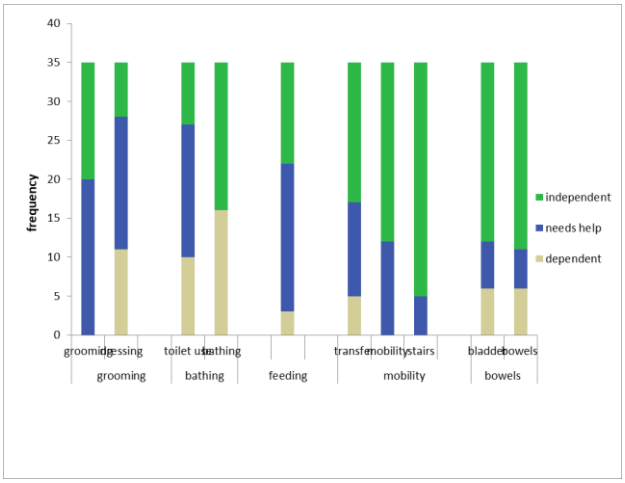

Figure 3: Bar Chart of Frequency of Activities of Daily Livings in Children with ASD

Statistical Analysis of Activities of Daily Living showed that in case of analysis of Bowels/Bladder 6(17.1%) children had Bowel incontinence, 5(14.3%) occasional accident and maximum 24(68.6%) children had Bowel continence, most of the children 23(65.7%) had bladder continence,6(17.1%) occasional accident and 6(17.1%) were incontinent. Analysis of Grooming showed that in case of dressing 11(31.4%) were dependent, 17(48.6%) children needed help in dressing and 7(20.0%)) were

independent in dressing. In case of grooming, most of the children 20(57.1%) needed help in grooming and 15(42.9%) were independent. Analysis of Bathing showed that in Toilet use 10(28.6%) were dependent, 17(48.6%) needed help and 8(22.9%) were independent, In case of Bathing 16(45.7%) were dependent, 19(54.3%) were independent. Feeding analysis showed that minimum children 3(8.6%) were unable, mostly children 19(54.3%) needed help and 13(37.1%) were independent. In Mobility 5(14.3%) needed major help in transferring, 12(34.3%) needed minor help, most of the children 18(51.4%) were independent in the transfer. In case of Mobility 12(34.3%) walk with help and most of the children 23(65.7%) were independent in walking. In using stairs 5(14.3%) needed help and a maximum number of children 30(85.75%) were independent in using stairs.

Table 2: Relationship between Sensory-Motor problems and Activities of Daily Livings in children with ASD

	Mean	St. Deviation	r	p
Total score of vestibular problems	2.1429	0.49366	0.304	0.076
Total score of propioceptive problems	1.7429	0.61083	-0.169	0.330
Total score of tactile problems	1.9714	0.95442	0.256	0.138
Total score of visual processing	0.7143	0.78857	0.436	0.009
Total score of auditory processing	1.6000	0.49705	-0.142	0.416

ADLS (**Mean**=13.9714, **St. Deviation**=4.33512)

Discussion

Children with ASD have sensory - motor impairments which affect the performance of ADLS like grooming, bathing, toileting, hygiene, feeding dressing, etc. In the domain of self-care of this vulnerable population, its sensory-motor aspect remains to be characterized.

The present study explains poorest expected ADLS of ASD's group. The result of the research shows the calculated correlations between sensory-motor performance and ADLS. These results illustrated that vestibular system, Propioceptive system, Tactile system and Auditory system processing were not correlated significantly with ADLS. While Visual processing was significantly correlated with ADLS (r=0.436, p=0.009). According to these correlations children having difficulties in the visual motor, integration found it difficult to perform the tasks which involve fine motor skills for example toileting, grooming, bathing, and dressing. Another study was conducted by Lloyd et al, (2013), they described the fine motor and gross motor skills of a cross-sectional group having 162 ASD children of the age range 12-36 months, and following longitudinally had a subset of 58 children. For each child's fine and gross motor skills, a "motor difference variable" was calculated. Results indicate that between second and first measurement fine and gross motor difference scores increase significantly.[21] In another study by Ayers et al., (2013) emphasis was put on awareness of available technologies and how it can support day to day activities. Participation in the essential day to day activities becomes challenging due to fine and gross motor difficulties and sensory sensitivities. 97% of the individuals with ASD can't live independently and for daily assistance, they require a caregiver. They concluded that by proliferating technologies and by giving proper instructions on the usage of advanced technologies, individuals with ASD may achieve a greater level of independence, approaching ultimate functioning criteria.[22] Similarly, Lucker, (2009) conducted a study on self-help skills review for Autistic people: A systematic teaching approach. They concluded, for the production of lasting functional improvements in ASD, considerable empirical evidence exists about the applied behavioral analysis used as teaching methodology for a variety of skills.[16] Cermak et al., (2013) conducted a study on sensory sensitivity and food selectivity in ASD children. For the selectivity of food, they discussed the contribution of the sensory factor like sensory sensitivity. The electronic database of Cinahl , Medline, psychoInfo and web of science was used by the researcher to locate the pertinent published literature during last 25 years. They concluded, food selectivity may occur due to many reasons, sensory sensitivity suggested as the main cause of it.[14] A similar study was conducted by Nadon et al., (2011) in which they found the

relationship between a number of eating problems and sensory processing in ASD children. By using short sensory profile, Of 95 children, ages were between 3 years to 10 years, the definite difference was shown by 65% and other 21% showed a difference in sensory processing on total score. By using eating profile increased number of eating problems was measured and these were related to the results significantly.[7] Our results are also in agreement with the study of Jasmin et al., (2009) who conducted research on the sensory-motor & DLS of preschooler children diagnosed with ASD. 35 children, of age, (3y to 4y), assessed and recruited with the battery of diagnostic and clinical tests. These children exhibit a poor motor and DLS, and atypical sensory responses. When we even take into account the cognitive performance, sensory seeking, sensory avoiding fine motor skills and visual processing were correlated with ADLS significantly (12). Kern et al., (2006) conducted a cross-sectional study to check the sensory processing of the oral, visual, touch and auditory systems in 104 Autistic individuals, 3-56 years of age by using sensory profile. Their findings match our results that person with ASD has abnormal processing of visual, auditory, touch and oral systems, those abnormalities are global in nature while with increasing age they have a tendency to improve.[23]

Conclusion

It is concluded that atypical motor and sensory responses are shown by Autistic children, and they have difficulties in performing their ADLS. Abnormal sensory motor responses especially visual processing disorder, are the cause of poor performance and independence in ADLs. Problems in visual processing indicate children may have difficulties in tasks such as dressing, grooming, bathing toileting, etc. In order to validate caregiver's responses, needs which assist in the planning of intervention should be confirmed and the addition of observational testing of ADLS and sensory-motor responses is suggested.

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