

Prevalence of sensory processing dysfunction in children with difficulties in learning

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Abstract

Introduction: Sensory Processing Dysfunction (SPD) is the impaired ability to receive, process and react to sensory information in an adaptive way. It has been associated with conditions like Learning Disabilities, Autism etc. Affection of the sensory systems may result in difficulties in learning and cause the child to fall behind in class.

Aim: To find the prevalence and types of SPD in children with difficulties in learning.

Materials and Methods: This study was a cross sectional analytical study conducted in the community. The sample size was calculated as 286, based on prevalence from a pilot study, acceptable error 6%, confidence interval 95% and non response 10%. Convenient sampling technique was used. The Short Sensory Profile (SSP) was used as an outcome measure.

Statistical Analysis: SSP was scored as per the manual provided. Descriptive analysis was done using excel.

Results: 53.46% of the sample considered had definite SPD, 25% probable SPD and 21.54% showed typical performance. Maximum affection was found to be in the order of auditory filtering, low energy/ weak section and under-responsive/ seeks sensation sections of SSP.

Conclusion: In this study, prevalence of SPD with difficulties in learning in children was determined as 53.46%.

Keywords: Sensory processing disorder, Difficulties in learning, Sensory integration, School children.

Introduction

Sensory integration has been defined as the 'neurological process that organizes sensation from one's own body and environment and makes it possible to use the body effectively within the environment.'¹ It develops the most during an adaptive response that is purposeful, goal directed response to a sensory stimulus from the environment. It results in learning something new. According to Ayres, taking in and processing sensations from the environment forms the core of learning. Impairment in this would result in difficulties in adapting and learning. Such problems lead to slow learning and poor behavior although it may not be apparent to untrained individuals. School going children not only have to learn many new things but they also have to be socially competent within their environment. These complex activities require large amount of sensory integration.

Sensory processing is the way in which central and peripheral nervous system manage incoming sensory input from the seven sensory systems- vestibular, proprioceptive, tactile, auditory, visual, taste and olfactory. Accurate perception of sensation and its modulation are the keystones of sensory integration that in turn result in learning. As SPD is the impaired ability to receive, modulate, interpret and react to sensory information in an adaptive way, a child with processing disabilities may interpret information insufficiently as he may receive inadequate, excessive or inaccurate feedback from the mentioned sensory systems. This could impair the child's performance and refinement of skilled activity.³ The learning pattern of a child with SPD would be disorganized and inefficient. Children with SPD have already been shown to have affected motor control and planning. This could result in poor postural control, clumsy movements or avoidance of or excess motor activity. Processing of each system individually and in combination

with each other will affect learning and thus performance in academics and school.

A study conducted in the USA, 13.7% children enrolled in kindergarten were found to have SPD.⁴ Failure of integration in these children may result in them growing up to fall back in class. Literature shows that without intervention, children with SPD could not cope with demands on them and thus may fail to excel.⁵ At the same time, there has been evidence about the efficacy of physical therapy interventions in improving academic performance in children with SPD.⁶⁻⁹ The government of India has recently announced that instead of just spreading education they want to focus on improving learning.¹⁰ With physical therapy intervention showing positive results, improved sensory processing ability would help these children achieve their abilities and boost their self-esteem and confidence. Therefore the need of this study was to find out the prevalence of SPD amongst these academically low achieving children.

Materials and Methods

The study conducted was a cross-section analytical study in the local schools of Pune, Maharashtra. The study population was school going children with difficulties in learning.

The inclusion criteria were boys and girls, age 6 to 15 years with reported difficulties in learning, and whose academic performance was repeatedly below 50% or grade C. The exclusion criteria was children with mental retardation (I.Q. below 70), on the age appropriate Colored Progressive Matrices and Standard Progressive matrices, as checked by trained psychologists, were excluded from the study. Children with known neuro-motor disorders, children with known orthopedic conditions and children with known

but uncorrected visual or auditory impairments were also excluded. Sampling technique used was convenient sampling.

Sample size was estimated based on a pilot study conducted on 36 children who had difficulties in learning as reported by the teachers. A prevalence of 41.7% of SPD was found in these children. Taking this prevalence into consideration, with an acceptable error of 6% on either side at a confidence level of 95%, the sample size was calculated as 260. Assuming a non-response of 10%, the final sample size was considered as 286. The acceptable error of 6% was considered instead of 5% to make the calculated sample size feasible.

The instrument used was the 'short sensory profile' (SSP) by Winnie Dunn to screen the children.¹¹ The short sensory profile is a caregiver questionnaire that consists of 38 items grouped into 7 sections for the purpose of easy interpretation. As per the manual provided with the questionnaire, the results are interpreted as typical performance, probable difference and definite difference based on cut off scores provided in the manual. The total score is to be interpreted as well as the individual score on each subscale can be interpreted. It is valid, reliable and has been used in the Indian population.^{12,13}

Ethics clearance was obtained from D. E. Society's Brijlal Jindal College of Physiotherapy institutional Ethics Committee. The principals of various local schools were approached for the study. A meeting was conducted for the teachers to instruct them to screen the children with difficulties in learning. Children who were achieving 50% or less (C grade) in the past 3 semester exams were picked up by teachers. They were the children reported by teachers and parents as those finding it difficult to cope with the class. The children were then screened as per the inclusion and exclusion criteria and the sample was chosen. A meeting with the parents of the children who met the inclusion criteria was conducted. The need, purpose and nature of the study were explained to them. Written consent about their willingness to participate was taken. The parents were interviewed in groups of 10-15. The questionnaire was handed out to the parents. The parents were asked to fill in the initial details: name, age and class of the child. The parents were asked to write their own name and their relation to the child as well. The importance of completing each item was emphasized upon to the parents. The nature of picking the most appropriate option for each component of the SSP was explained.

Each component of the SSP was elaborated upon and personal queries were taken up. The questionnaires were collected and checked if each component was filled, as failure to do this would mean that raw score for that section would not be computed.

Once the questionnaires were collected from the parents, the scoring was done on the questionnaire itself as per the manual. The results were interpreted as typical performance, probable difference and definite difference.

Each one of the seven components on the Short Sensory Profile was computed separately as well as the total score on

the profile was computed at the end of each child's data entered.

Percentages were calculated and children were divided into groups of children showing typical performance, probable SPD and definite SPD.

Descriptive analysis of the data was done.

Results

This study was conducted to find out the prevalence of SPD in children in age group 6 to 15 years, with difficulties in learning. Total sample collected and analyzed at the end of the study was 260. Table 1 shows that 75.77% of the sample were in the age group of 6-10 years while 24.23% were 11-15 years of age.

Table 2 shows that 67.31% of the sample were males while 32.69% were females.

Table 3 provides the percentage distribution of children in each group as per the total scores achieved on the SSP; 53.46% children had definite SPD, 25% had probable SPD and 21.40% showed typical performance.

Table 4 shows that out of the 53.46% children who had definite SPD, maximum children had affected auditory filtering followed by under-responsive and seek sensations and then low energy or are weak sections of the SSP. Least affection was found in movement sensitivity issues and taste or smell sensitivity.

Discussion

This study was conducted to establish the prevalence of SPDs in children with difficulties in learning.

76% of children with difficulties in learning were in the age group of 6 to 10 while 24% were from 10 to 15 years. Less percentage in the latter group could either be due to high dropout rates in India after the 5th standard¹⁴ or maybe, with increasing age, the children learned to cope with the academic demands as they got more fluent with language and exam patterns. 67% of children with difficulties in learning were boys while the rest were girls. This educational gender gap despite high enrollment ratio could be attributed to differences in brain structures and function between the two genders.¹⁵

53.4% children had definite SPD based on their total scores on SSP. Their SSP scores were further assessed and it was found in the order of hierarchy that highest affection was in the auditory filtering section (91.7%), then responsive or seeks sensation section (79.86%) followed by the low energy and weak sections (76%).

The auditory filtering section of the SSP reflects sensory integration of the sensations processed by the auditory system. The under responsive or seeks sensation section as well as the low energy weak sections represent the vestibular and the proprioceptive systems.

The reason behind these three subsections being maximally affected could be due to anatomical and physiological proximity of the auditory and vestibular systems.^{16,17}

Affection of the auditory filtering section reflects the inability of the child to differentiate and organize various

sounds from the surrounding. This may result in the child not being able to correctly register and modulate what the teacher is teaching in class resulting in poor understanding and grasping.

With a high pupil teacher ratio in India,¹⁸ the children with auditory filtering section affected who are sitting at the back of the class or close to windows might not be able to register and process what is being taught in class further affecting their learning. Environmental modifications should be suggested for these children.

Children with bilateral vestibular integration issues may appear lost in space, having trouble with spatial interpretation resulting in difficulties in reading and writing. They may have trouble performing smooth and rhythmical movements, difficulty with gaze stabilisation and tracking thus making reading a sentence from the black board or in the book difficult. These children also have poorly established 'handedness'.

Affection of the proprioceptive system¹⁹ will result in impairments in motor planning resulting in the child being clumsy or awkward, preferring known play patterns and activities to new ones, have trouble organizing his surroundings etc. This will result in these children learning to write numbers or letters later than normal, having slower speeds of writing or applying too much or too little pressure on the pencil making their handwriting illegible.

Affection of the tactile²⁰ and proprioceptive systems together may result in excess or too little grip strength and pressure while writing resulting in illegible handwriting or too slow a writing speed.

The 25% children who had probable SPD need to be looked into in more detail for assessing their sensory processing abilities.

With such a high prevalence of SPD, these children must be given a fair chance to compete with their batch mates by their timely identification, provision of necessary environmental modifications and treatment so that they could achieve their true potential.

Awareness regarding SPD in children with difficulties in learning must thus be spread amongst physiotherapists, parents and teachers of school going children. Basic screening techniques like use of the SSP should be done by therapists on a regular basis. With many studies indicating academic gains in children with learning difficulties, developmental coordination disorder, sensory integrative dysfunction therapy in various forms should be implemented in who have SPD as well. Therapists should be included in the school staff for timely inhouse (within school campus) assessment and treatment.

Given that the sample considered in this study were not already diagnosed cases of learning disability, the children who had definite SPD could be further referred for learning disability screening and then given the necessary aid if found to have it.

The same project could be taken up at a national level in order to further emphasize the prevalence of SPD in children with difficulties in learning. Gender differences in sensory processing of children with difficulties in learning

who had SPDs could be studied in details and comparative cohort studies can be done on children with difficulties in learning that have SPD to check the effect of intervention on self-esteem and potential achieved in future life.

Along with SPDs, influence of socio-economic factors, behavioral issues, social and environmental issues on learning, as confounding factors were not considered in the study as it was conducted in a stipulated period of 6 months. Further studies should be conducted keeping in consideration these factors as well.

Table 1: Percentage wise distribution of subjects according to age

Age (in Years Completed)	Percentage of Subjects
6-10 years	75.77%
11-15 years	24.23%

Table 2: Percentage wise distribution of sample according to gender

Gender	Percentage of Subjects
Males	67%
Females	33%

Table 3: Percentage of children in each group as per the total scores achieved on SSP

Percentage of children showing typical performance	Percentage of children showing probable SPD	Percentage of children showing definite SPD
21.40%	25%	53.46%

Table 4: Performance of children with definite SPD on individual sections of SSP

	Definite Affection	Probable SPD	Typical Performance
Auditory filtering	91.37%	5.04%	3.60%
Under responsive/ seeks sensation	79.86%	12.95%	7.19%
Low energy/ Weak	76.26%	14.39%	9.35%
Tactile sensitivity	65.47%	18.71%	15.30%
Visual/ auditory sensitivity	32.37%	23.74%	43.88%
Movement sensitivity	31.65%	16.55%	51.80%
Taste/ smell sensitivity	30.94%	18%	51.08%

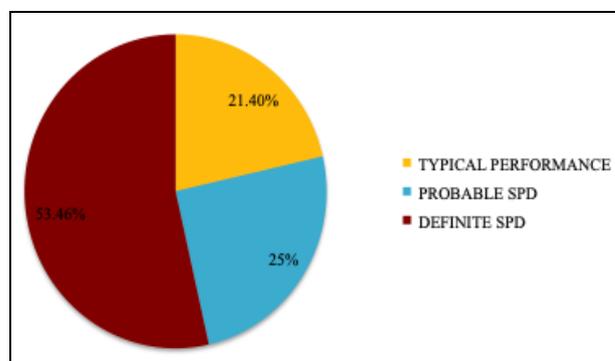


Fig. 1: Diagrammatic representation of sensory processing abilities of children based on total scores achieved on SSP into definite SPD, probable difference and typical performance.

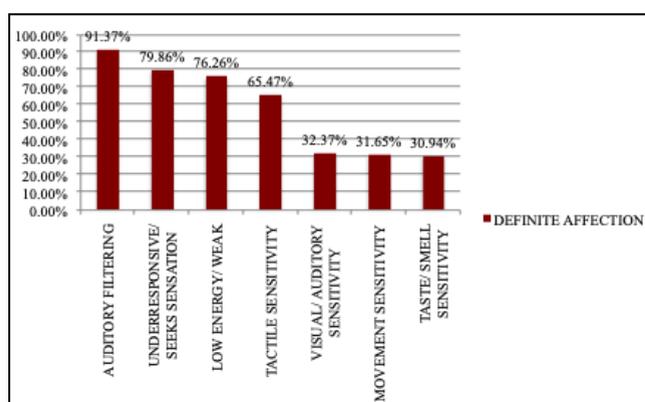


Fig. 2: Graphical representation of definite affection in individual sections of SSP of those children who had definite SPD on their total scores.

Conclusion

The study concluded that 53.4% children with difficulties in learning had definite SPD while 25% had probable SPD and needed more detailed evaluation. Highest affection in the children identified to have SPD was in the Auditory Filtering section of the SSP followed by Under-responsive and then the Low Energy and Weak sections of the SSP.

A high prevalence of SPD in children with difficulties in learning warrants the need to look more deeply into the matter and to have these children screened, identified and timely treated by physiotherapists.

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