

Original Research Article

Sensory processing issues in children with cerebral palsy: a pilot study in tertiary care institute

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ABSTRACT

Background: Understanding of sensory processing disorder in children with cerebral palsy is paramount to implement holistic rehabilitation and it would help in achieving highest level of function and independence. The purpose of the study was to detect sensory processing disorder in children with cerebral palsy in east zone of India. This study may help to formulate the implementation of effective therapy protocol in east zone.

Methods: The study was a prospective cross-sectional study. 30 children with cerebral palsy were enrolled in our study. All 30 children were spastic diplegic. Children were assessed with short sensory profile. All caretakers were given questionnaire of SSP (short sensory profile).

Results: Short sensory profile can help find out the sensory processing disorder in cerebral palsy. All 30 participants showed sensory processing difficulties in at least one of the sensory processing sections. In our study, 19 children with cerebral palsy out of 30 showed sensory processing disorder. 22 children with cerebral palsy have reported sensory seeking issue and same number of kids has reported weak muscles and low endurance. Moreover, 18 of the children with cerebral palsy have reported movement sensitivity issue and 6 children reported visual auditory issues. On top of that 15 children with CP have reported auditory filtering issues, 9 children showed tactile sensitivity issues and 11 children showed taste and smell sensitivity.

Conclusions: Children with spastic diplegic cerebral palsy showed difficulty in sensory processing especially in sensory seeking domain. Sensory processing disorder is present in children with cerebral palsy

Keywords: Cerebralpalsy, CP, Sensoryprocessingdisorder, Occupationaltherapy, Sensoryintegration, Rehabilitation, SPD

INTRODUCTION

Cerebral palsy (CP) is a group of disorders that affect the muscle's posture, movement and tone. It is the most common motor disability in childhood, which is caused by abnormal brain development or damage to the developing brain during the prenatal, anti-natal or postnatal phase. It affects a person's ability to control their muscles.

Therefore, it is also known for affecting physical abilities due to altered muscle tone, muscle power, and an improper execution of fine and gross motor functions as well.¹ In addition to that, motor problems are frequently accompanied by the issues in perceptual, cognitive and emotional abilities. So, CP hinders occupational performance and participation of the kids in the home, school, or social environment while performing activities of daily living (ADL) and instrumental activities of daily

living (IADL) due to various sensory processing and motor issues. The symptoms of CP vary from kid to kid. It depends upon the cause and type. The types of CP are spastic, dyskinetic, ataxic, hypotonic, and mixed.

The most common type of cerebral palsy is spastic, which accounts for 2/3rd of all cases. In spastic CP, the most common type is Diplegia, followed by Quadriplegia, hemiplegia, Triplegia and monoplegia. Preliminary research suggests that CP may have sensory processing disorder difficulties. Sensory processing issues may cause difficulty in understanding and interpreting what they see, hear, taste, smell, feel and experience.^{2,3} It could hamper social interaction, leisure, and play activities.

These sensory processing difficulties may be distressing to the child and prevent them from participating in everyday interactions and activities. The senses play a very important role in how people perceive the world. The sights, smells and tactile experiences control a child's impressions and daily regulation from early life till adulthood. Sensory processing disorders (SPDs) are classified into three broad patterns.³⁻⁹

Pattern 1: Sensory modulation disorder- The affected child has difficulty responding to sensory stimuli. They may be over-responsive, under-responsive, or crave stimuli (Sensory seekers).^{3,6} Pattern 2: Sensory-based motor disorder- The affected child has difficulty with balance, motor coordination and habitual motor tasks.^{5,6} Pattern 3: Sensory discrimination disorder (SDD) - The affected person may have trouble understanding the different kinds of stimuli. For example, if the kid has auditory discrimination disorder, then he or she might not be able to differentiate between cat, cap or pack.^{7,8}

In this study, we aim to find out sensory processing issue patterns in children with spastic diplegic cerebral palsy (DCP). The short sensory profile (SSP) is being used to measure children's sensory processing ability having the age group 3 to 14 years. There are 7 sections of sensory processing issues listed in this profile. Each item is measured on a five-point Likert scale method. The items measured were tactile sensitivity, taste/smell sensitivity, movement sensitivity, under-responsive/seekers sensations, auditory filtering, low energy/weak and visual/auditory sensation.¹⁵ These items include functional behaviour in daily activities that are symptoms of sensory processing disorders. The classification system labels the child's sensory processing abilities for each section and factors them as Typical Performance having a score of 155-190, Probable Difference with a score of 142-154, or Definite Difference, having a score of 38-141. Higher scores indicate better sensory processing abilities.¹⁴ So, It helps the professionals to determine whether a child's performance on any section or factor groupings is of concern.¹⁶

The normal level corresponds to typical sensory processing abilities, while the probable difference and

definite difference levels correspond to atypical sensory processing abilities.

METHODS

It is a prospective observational cross-sectional study. This study was conducted on patients attending the CP clinic in the Physical Medicine and Rehabilitation Department (PMR) of Indira Gandhi institute of medical sciences, Patna. This study has got ethical clearance, and informed consent was taken from patients/parents in this study. A CP Proforma was filled. It included detailed history (pre-natal, antenatal, post-natal), paediatric assessment, and neuro-musculoskeletal examination. Investigation such as complete blood count, thyroid profile, calcium, phosphorus, and alkaline phosphate was done in all patients. Other investigations, such as MRI brain, EEG, and BERA, were done as required.

Sampling techniques and sampling

Consecutive sampling was used. A previous study which was done on 20 patients, 14 showed sensory abnormalities in more than one section.² Taking the proportion of sensory abnormalities from the above-mentioned study. We calculated the need for 323 participants to get the prevalence of sensory abnormalities in diagnosed Spastic CP. Cerebral palsy of all categories of patients (5% error & 95% confidence interval). The target sample size for our study would have been 193 -210 spastic diplegics CP. However, in our study duration of 1 year (February 2021 to January 2022), 134 patients enrolled in the CP clinic (age group 1 to 16) and 82 Spastic CP patients of all categories between the age of 3 to 14 years attended our department. We took all consecutive cases in one study. Out of them, 42 patients were diplegic CP, and 12 patients were excluded owing to exclusion criteria. Therefore, in one year, we got 30 consecutive patients of diplegic CP of 3- 14 years of age. The study is being continued with more patients of different CP types. However, in this study, we intend to report the result of only the diplegic category in one year.

Inclusion and exclusion criteria

DCP Children in age group 3-14 years and gross motor function classification system (GMFCS) II-IV were included. Children having other associated chronic medical conditions (hypothyroidism and metabolic disorder), the Children taking psychostimulant medication, and Children having epilepsy. All patients have undergone sensory processing assessment by SSP by an Occupation therapist having more than 10 years of experience.

Statistical analysis

Information collected and converted into a computer-based spreadsheet using data visualization and analysis software Microsoft Excel.

RESULTS

Out of 30 children with spastic diplegic CP (DCP). 20 children were in GMFCS level III, 5 children each in levels IV and II. The gender distribution (number of males=21 and number of females=09) is depicted in (Figure 1).

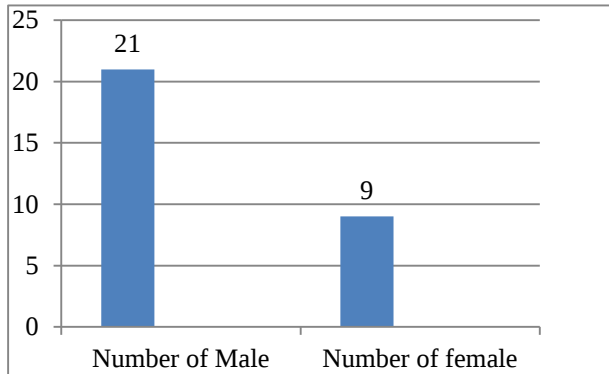


Figure 1: Gender distribution.

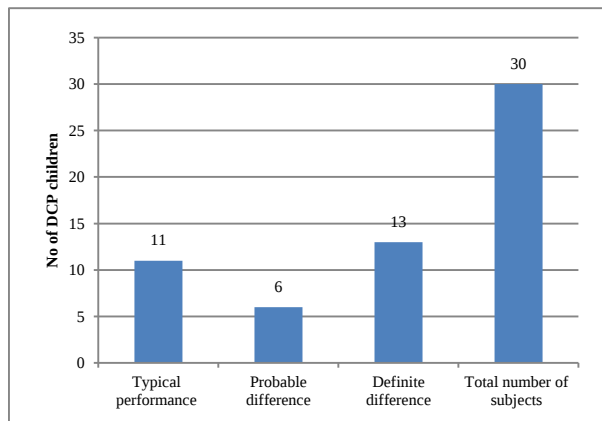


Figure 2: Distribution of sensory processing disorders.

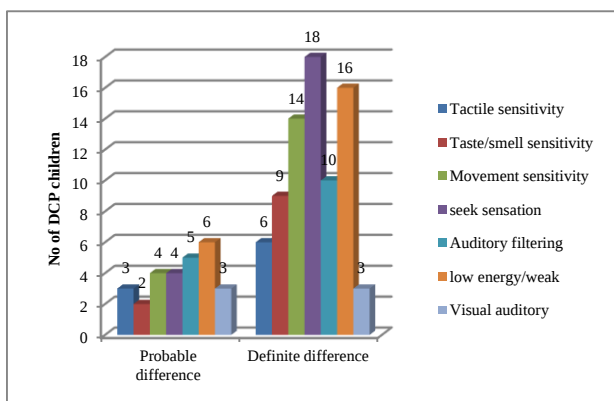


Figure 3: Number of children with sensory processing issues.

The distribution of sensory processing disorders in children with Diplegic Cerebral palsy in our study is shown in (Figure 2). The number of subjects with sensory processing issues which fall under the probable difference

and definite difference category among all groups is shown in (Figure 3).

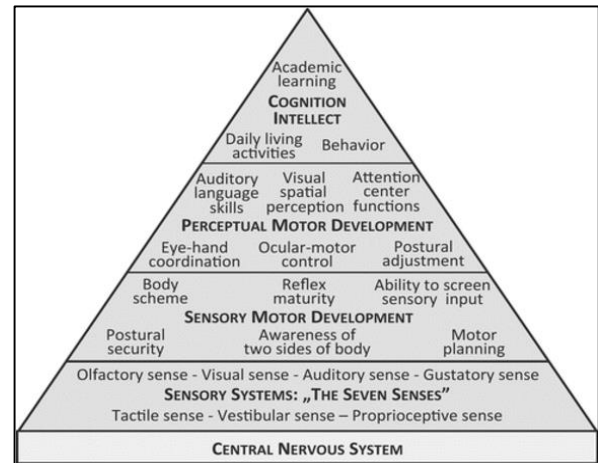


Figure 4: The pyramid of human development Williams and Shellenberger.²²

Table 1: Age at presentation.

Age (years)	N (%)
3 to 6	21 (70)
7 to 14	9 (30)
Mean age	5.03
Total	30

DISCUSSION

This study tried to assess the sensory processing issue patterns in children with spastic diplegic CP by using SSP with a mean age of 5.03 years (3-14 years). However, the single study by Mennatallah et al which was a pilot study with only 20 patients, including all spastic CP types (diplegic, hemiplegic), had a mean age of 7.25 years.² Reduction of the mean age in our study might be due to the early detection of cerebral palsy by our multidisciplinary clinic. Also, in our study, the majority (70%) of the children with spastic diplegic CP fall under the age group of 3-6 years. It indicates that the majority of sensory processing issues are under the age group of 3-6 years. Bahareh et al. also found that sensory processing issues were present in 80% of children between the age of 3 and 7 years.²³ Furthermore, in our study, a sensory-seeking issue (a kind of sensory modulation disorder) was seen most in children with cerebral palsy. It was prevalent in 73.33% (22 children with 18 definite and 4 probable) with DCP.

Weak muscles and low energy were the second sensory issue that was seen in the same 73.3% of children (16 definite and 6 probable). This is in line with the findings of the study done by Tomchuck and Dunn; sensory seeking is the dominant sensory processing style in children with autism.¹⁸ Similarly, Mennatallah et al did a study in which 20 out of 20 children with spastic CP showed sensory processing difficulties.² In our study, 19 (63.3%) children

out of 30 showed sensory processing difficulties in the environment. Similarly, Patricia et al also found out that hemiplegic CP children have greater difficulty in sensory processing than typical development children.³

Furthermore, Gupta et al did a study (40 patients) in Mumbai in which she found out that 67.5% of children with CP had an issue with seek sensation issue and 72.5% of children had issues with weak muscles in probable and different groups.⁴ Moreover, 65 % of children with CP had an issue with movement sensitivity (60% in our study), 60% had an issue with auditory filtering (50% in our study), and 55% had an issue with visual and auditory sensitivity. Finally, 57.5% were under the issue of tactile sensitivity.

So, there is a great difference from our study (that is 20% for visual and auditory sensitivity, whereas 30% for tactile sensitivity). We had 36% with an issue of taste & smell sensitivity, whereas Gupta et al published only 10% in her study. So, it's nearly similar finding for movement sensitivity and auditory filtering but visual and auditory sensitivity, tactile sensitivity, and taste & smell sensitivity are not correlating to our study. That means sensory modulation disorder (taste, smell, tactile and visual sensitivity) is a dominant kind of sensory processing disorder affecting children with cerebral palsy, followed by sensory-based motor disorder (weak muscle, low energy), which is again followed by movement sensitivity issues (60%).

This small difference can occur due to many factors. First, it could be due to different cultures. The perspective of caregivers could change in different cultures and regions. Moreover, Mumbai is a metropolitan city and mostly an industry-based city in comparison to the east zone. East zone is still an agriculture-based society. The population of Mumbai is also much more than cities like Patna. So there could be more children in metropolitan cities with autism or cerebral palsy. They could be exposed to much more screen time or exposure to screen in those areas.

Another point which should be noted is that the east zone of India, such as Bihar, is still an agricultural zone, and this zone is less industrialized in comparison to the Mumbai zone. So, kids in the east zone have less screen time, and they have more opportunities to interact with nature. Similarly, it could be assumed that diet, food and socio-cultural factors might also play a role in various sensory modulation disorders. These factors along with screen time may account for differences in sensory processing patterns.²⁴ Recent estimates of the prevalence of sensory symptoms in people with autism spectrum disorder (ASD) in children and adults are from 69% to 93%.¹⁹ we are also seeing a similar trend in CP. The majority of the children with CP. is showing sensory processing issues. The dominance of sensory processing issues in children with CP and Autism is evident now. A new study from USC-UNC study suggests sensory issues in early infancy may be the first sign of autism diagnosis.²⁰

These criteria could also be applied during the diagnosis of CP because a majority of children with CP show a prevalence of sensory processing issues in our study. Also, according to the pyramid of learning, the sensory system is the foundation skill in children. The pyramid shows how using the sensory systems is essential to support the early development of the child. So, diagnosing sensory processing issues in children with cerebral palsy is paramount for the development of sensory-motor development, perceptual motor development and cognition intellect. Furthermore, the presence of Sensory processing disorder in children with DCP can significantly affect the learning ability of children with cerebral palsy. It could affect their academic skills and integration in school. A study conducted by Stephanie et al. points out that the Children with learning disorder group showed significant differences in 10 out of 13 sensory profile scores.²¹ Sensory processing issues detection and management in the early stage can help them better integrate into school, home and community, and it may play a major role in the prevention of the development of Cerebral palsy sequelae in a later stage. It may also prevent the development of learning disorders later in life.

Limitations

Limitation of current study was this study has used a small sample size, and it does not represent the entire DCP or CP population. This study has only used SSP (short sensory profile). Many different varieties of sensory processing assessment tools may also be used.

CONCLUSION

About two-thirds of DCP children have Sensory processing issues, which affects the ability of the children to interact with the environment. Sensory-seeking processing issues (73.3%) and sensory-based motor disorder (73.3%) were present significantly, followed by movement sensitivity (60%). Visual and auditory sensitivity was found to be the least (20%) in children with DCP. Addressing sensory processing issues in the early stage can help children with CP better integrate into school, home and community, and it may play a major role in the prevention of the development of Cerebral palsy sequelae in a later stage. Moreover, it can prevent the development of learning disorders later in life.

Recommendations

Study with a large sample size for future studies. Cerebral palsy of different types (such as mixed CP, athetoid CP, and Ataxic CP) also should be studied. Studies can be done to investigate interrater reliability and validity studies of SSP in children with CP. Treatment protocol should include attention to fine and gross motor skills along with sensory processing disorders in children with cerebral palsy. To formulate framework policy, early detection, policy planning and implementation of effective therapy protocol in early intervention in every district.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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