

Original Research Article

Visual perception skill profile pattern in children with learning disorder

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ABSTRACT

Background: Visual perception skill related problems are important in poor academic performance in learning disability (LD) children. Visual perception skill often not tested in LD children. The objective of the study is to explore visual perception skill pattern among children with learning disorder.

Methods: Retrospective observational study was conducted at LD clinic of tertiary hospital. Children diagnosed with learning disorder were included. Visual perception data were collected using predefined standard questionnaire of third edition total visual perception score (TVPS-3). Trained medical professional collected the details.

Results: Total 103 children diagnosed with LD were evaluated for TVPS-3. Majority of the children had all three learning disorders-dyslexia, dysgraphia and dyscalculia. 58.42% children had co-morbid attention deficit hyperactivity disorder. From the 7 subtests of the TVPS visual discrimination, visual memory, form constancy and visual figure - ground affected more in boys and also in lower age children.

Conclusions: Assessment of visual perception skill in children with learning disorder is crucial. Visual perception rehabilitation with other management of LD can benefit the overall functionality of these children.

Keywords: Attention deficit hyperactivity disorder, Dyscalculia, Dysgraphia, Dyslexia, Specific learning disorder

INTRODUCTION

Learning disabilities (LD) are neurodevelopment disorders. LD impedes the ability to learn or use specific academic skills like reading, writing or arithmetic. These further results to notably reduced level of productivity, output in school and, at home. LD types mainly include Dyslexia, Dysgraphia and Dyscalculia which involve problems with reading writing and mathematics respectively.¹⁻³

Visual perception is the process responsible for the reception (sensory functions) and cognition (specific mental functions) of visual stimuli.⁴ Visual – receptive component is the process of taking and organizing

information from the environment, and the specific mental functions that constitute the visual-cognitive component provide the capacity to organize, structure, and interpret visual stimuli.⁵ These two components help a person to understand what he or she sees, and both are necessary for functional vision. The visual-cognitive components are visual attention, visual memory, visual discrimination, and visual imagery.^{6,7} The visual-receptive components include visual fixation, pursuit and saccadic eye movements, accommodation, binocular fusion and stereopsis, and convergence and divergence.⁶

Visual-perceptual skills include the recognition and identification of shapes, objects, colours, and other qualities. Visual perception helps a person to make

accurate judgments on the size, configuration, and spatial relationships of objects.^{5,8} Children who have difficulty interpreting and using visual information effectively are described as having visual-perceptual problems because they have not acquired adequate visual-perceptual skills despite having normal vision.⁹ Visual perception deficits also can affect gross and fine motor skills, reading, writing, mathematic, and social participation of the children.

METHODS

This is the retrospective observational study conducted at neurodevelopment clinic (LD clinic) of Lokmanya Tilak Municipal Medical College and General Hospital. The main objective of the study is to assess visual perception skill in children who diagnosed with learning disorder. Children with learning disorder and aged 8 to 18 years satisfying inclusion-exclusion criteria were selected for study. In our study, children diagnosed with LD in past 3 years were included. Detailed history were taken by trained medical professionals mainly includes, general and neurological examination with specific standards psycho educational test used for diagnosis of learning disorder.

Test for visual perception skill third edition (TVPS-3) were used to evaluate the visual perception ability children satisfying inclusion-exclusion criteria.¹⁰ TVPS-3 is the revision of family of visual perception tests initially authored by Dr Morrison F. Gardner.¹¹ This test assess visual perception skills in seven subtests which are visual discrimination (ability to differences details such shape, colour, size), visual memory (ability to remember the images, sequence of the images and quickly recognised them when seen again), spatial relationships (ability to recognise position of the image from the rest), form constancy (ability to interpret positional differences), sequential memory (ability to remember sequence of the images or objects), visual figures-ground (ability to give visual attention at an object or image of regard in background), visual closure (ability to covert incomplete image to correctly complete image by filling the missing part). Visual-motor skill of these children was assessed by Berry VMI test (5th edition).¹² This test assess the extent to which individual can integrate their visual and motor abilities.

Study was approved by institutional ethics committee of study hospital wide their letter no IEC/61/19 dated 16-10-2019.

Statistical analysis

Collected details using predefined standard questionnaire were documented. Tabulation was done in Microsoft Office Excel 16.0 (Microsoft Corp.) for windows. Statistical analysis was performed SPSS 22.0 (IBM Inc., Chicago, US). Data was represented across group as in terms of absolute numbers with standard deviation in

respective categories. Independent sample t test was used to check significance across study variables. While, one-way ANOVA was used for birth weight wise visual perception comparison. P value less than 0.05 considered statistically significant different.

RESULTS

Total 103 children with learning disorder were included in this study. Their age range was 8–18 years with mean age is 10.73 (SD 2.19) years. Boys were predominance to the girl with ratio of 3.3:1. In this study a diagnosis of dyslexia in 103/103 (100%), dysgraphia in 101/103 (97%) and dyscalculia in 98/103 (94%) were made in these children. However most of the children in the study group had all three type of specific learning disorder 97/103 (93.3%).

Table 1: Demographic details and clinical profile of the children with LD.

Narration	Boys (n=78)	Girls (n=25)	Total (n=103)	P value
Mean age	11.06 (2.16)	9.68 (1.97)	10.73 (2.19)	
Age group				
≤12 years	53	23	76	0.017
>13 years	25	2	27	
Birth weight				
<2.5 kg	68	20	88	0.376
≥2.5 kg	10	5	15	
ADHD				
Yes	45	14	59	0.882
No	33	11	44	
Speech				
Normal	49	18	67	0.411
Delayed	28	6	34	
Missing	1	1	2	
Soft neurological sign				
Yes	20	7	27	0.941
No	18	5	23	
Missing	40	13	53	

Table 1 shows demographic and clinical profile, there were 88 (85.6%) children with the history of low birth weight, history of speech delay was present in 34 (33.66%), 27 (54%) children had soft neurological sign and 59/103 (57.28%) children had comorbid attention deficit hyperactivity disorder (ADHD). In this study TVPS score of its 7 subtests compare in 103 children with learning disorder according to the gender, age and comorbid ADHD.

Table 2 shows the mean and standard deviation of the visual perception skills subtest of the children with learning disorders in gender, age and comorbid ADHD wise comparison. For studied all the seven domains of TVPS there was no statistically significant (p value

>0.05) difference was observed in boys and girls. However, higher average score values were seen in boys than that of girls. According age wise evaluation statistically significant difference (p value <0.05) was noticed in all 7 subtests. Children in higher age perform better than that of children in lower age. In performance

of TVPS subtests there was no statistically significant (p value >0.05) difference was observed in children with and without ADHD. However, higher average score values were seen in children without ADHD than children with ADHD except Spatial relationship and sequential memory.

Table 2: Sex, age and comorbid ADHD wise TVPS score distribution [mean (SD)].

Area of visual perception skill assessed	Sex of children		P value	Age group		P value	ADHD status		P value
	Boys	Girls		8-12 years	13-18 years		With ADHD	Without ADHD	
Number of Children (n)	78	25		76	27		59	44	
Visual discrimination	11.03 (4.61)	9.66 (3.83)	0.184	10.04 (4.19)	12.54 (4.72)	0.01	10.42 (4.12)	11.07 (4.88)	0.471
Visual memory	9.77 (3.52)	8.53 (3.04)	0.118	8.92 (3.43)	11.03 (3)	0.01	8.91 (3.1)	10.21 (3.75)	0.057
Spatial relationships	11.23 (3.51)	9.96 (3.93)	0.132	10.24 (3.68)	12.84 (2.79)	0.00	11.13 (3.59)	10.64 (3.73)	0.508
Form constancy	9.64 (3.88)	9.37 (3.24)	0.753	8.82 (3.66)	11.7 (3.05)	0.00	9.23 (3.57)	10.04 (3.9)	0.272
Sequential memory	10.15 (3.33)	9.43 (2.83)	0.335	9.02 (2.9)	12.65 (2.51)	0.00	10.02 (2.9)	9.91 (3.64)	0.869
Visual figure-Ground	10.8 (4.26)	10.63 (3.56)	0.859	9.74 (4.13)	13.63 (2.18)	0.00	10.19 (4.07)	11.53 (4.03)	0.101
Visual closure	10.41 (3.27)	9.98 (3.09)	0.566	9.48 (3.11)	12.66 (2.24)	0.00	10.09 (3.22)	10.58 (3.24)	0.447

In this study VMI (visual motor integration) data of total 87 children with learning disorder was available in which VMI scores of 33 (37.4%) children were below average, 44 (55.5%) children’s average and 8 children was above average.

DISCUSSION

This study evaluates the visual perception skill profile in the children with learning disorder who were referred to tertiary care hospital of Mumbai for poor academic performance. Majority of the student in our study had all three learning disorders-dyslexia, dysgraphia, dyscalculia. Karande et al found similar observation.³ In our study, mean age was 11.06 (2.10) for boys and 9.68 (1.97) for girls which suggest the late referral of these children to assess for LD which is quite late compare to the onset of the disorder. Shipra et al found the similar observation.²

Visual perception ability is one of the basic cognitive ability for learning, behavior and academic success. Visual perception problem in children leads to poor academic performance. In our study, we evaluated performance of the children with learning disorder in the TVPS subtests. Earlier studies found that poor visual perception skill present in children with learning disorder.

In the present study, boys with LD presented better performance in all subtests of visual perception to the girls with LD. This study is one of a few cases that focus on a comparative analysis of the visual perception in boys and girls with LD.

Visual perception develops as the child matures, with most developmental changes taking place by 9 years of age. Children vary in acquiring and use of these abilities (case-smith O’Brien). In age wise comparison in our study we found that lower age group (8-12 years) students obtained low score in all subtest of TVPS compare to higher age group (13-18 years).

The children with LD who were co-morbid with ADHD presented lower-level performances in all subtest except spatial relationship and sequential memory compared to without ADHD. Earlier studies have found varies result.⁷

It seems that lower age children with learning disorder have lowered of visual perception skill. However, the girls and the children with ADHD had also performed poor to compare group. Visual perception problem affect the educational performance as well as their daily activities.

Visual discrimination deficits may interfere child's ability to recognize symbols, alphabets and numbers. These children found difficulty in reorganization in visually similar symbols and causes confusion between the letter such as b-d, a-o, p-q which make reading difficult and also affect the child's writing. Visual memory is important for remembering visual shape of letters, words and numbers. Children with Visual memory deficit may demonstrate problem in association of these shapes with letter, sound and words which causes problems in reading, writing and mathematics skills. Children with visual spatial problem have difficulties in writing like reversing the letters and also have a lack of uniformity in orientation and letter size (case-smith O'Brien). Children with form constancy problems may have difficulty recognizing form and object when presented with different sizes, spaces and orientation. If the child's sequential memory affected then he or she may face problem in remembering the sequences which presented with poor spellings and mathematical skill. This may result in difficulty recognizing letters or words in different styles of print which affects child reading and writing ability. Child with visual figure-ground problems may over attend to details and miss the big picture or may overlook details and miss the important information. These children may have difficulties in attending word in printed page or copying the written work.

The main aim of study is to assess the visual perception skill in learning disability children. Also, to study the improvement in management of disability by remediation and occupation therapy.

CONCLUSION

Considering the result of this study, early identification of the LD and visual perception problems which can cause severe impact on child's learning and behaviour is important. Rehabilitation program for visual perception problems should also needs to include alongside with remedial education and occupation therapy for these students.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee of LTMMC and G Hospital By letter ref no IEC/62/19 dated October 16, 2019

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