Original article:

Study of visual perceptual problems in children with learning disability

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Abstract:

Introduction: Our aim was to study the visual perception and visual motor integration in children diagnosed as specific learning disability (LD) referred for poor scholastic performance at a tertiary care hospital and to identify the different types of visual perceptual errors in the children with different subgroups of spLD with to study the effect of co-existent attention disorders (ADHD/ADD) on visual perception and visual motor integration.

Study design : It was a observational prospective study in a tertiary care hospital for a duration of 1 year 6 months with 100 children, aged 8 to 14, diagnosed with specific learning disability with coexistent conditions were enrolled as participants. The diagnosis of sp LD was achieved using the discrepancy criteria by performing a battery of psycho-educational tests. The Test Of Visual Perceptual Skills – 3RD Edition (TVPS), visual motor integration tests (developmental test of visual motor integration, Berry and Buktenica, 1967) and DSM 4 TR criteria for ADHD/ADD was done

Results: 78% of children had an average IQ (90-110),of these 27% had a discrepant Full Scale IQ of >15 points. Only 16% had co-existent ADHD.30% SpLD cases had only one type of learning disorder(12 dyslexics,9dysgraphics and 9 dyscalculics) whereas 71% children had an overlap type i.e. combination of dyslexia with dysgraphia or dyscalculia.In dyslexics visual memory, visual spatial relationships, sequential memory, were affected significantly(p= 0.04). In dysgraphics visual memory, spatial relationships (p= 0.05) and in dyscalculics visual discrimination,visual memory, visual closure was affected significantly(p=0.02). VMI was unaffected in dyslexics whereas 22% of dyscalculics and dysgraphics had a low score.

Conclusion : Poor visual perceptual aspects contribute to classroom challenges influencing the academic proficiency. Early vision therapy can provide long term relief to affected children. This study highlights the need for acceptance and awareness of perceptual abilities and their important role in learning process and hence academic success.

Introduction

Specific learning disability (SpLD) refers to a group of disorders manifested by difficulties in the acquisition and use of listening, speaking, reading, writing, reasoning or mathematical abilities.[1]There are 3 types of SpLD: dyslexia, dysgraphia and dyscalculia. Affected children have deficits in perception (visual, auditory, kinesthetic, tactile) or motor abilities leading to affection in performance areas.

Neurophysiology of visual perception

Visual perception is the process of reception (sensory functions) and cognition of visual stimuli. The visual-cognitive components are visual attention, memory, discrimination, and imagery. Visual discrimination consists of object perception (form constancy, closure ,figure-ground recognition) and spatial perception.

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Visual-motor disorders is due to either visual-cognitive deficits, fine motor issues or poor integration.[2]

Perceptual problems manifest as difficulties in reading, copying, writing and mathematics.[3]

Methods

The main objective of the study was to assess the visual perceptual, visuomotor integrative abilities in diagnosed learning disabled children and identification ofvarious perceptual components affected.780 consecutive children with poor scholastic performance (PSP) were screened,100children aged8 - 14 diagnosed with specific learning disability were enrolled. Children with neurodevelopmental conditions such as intellectual disabilities, autistic spectrum disorders, significant sensory or physical handicaps were excluded. The diagnosis of spLD was established using the ability achievement discrepancy criteria by psychoeducational tests. For visuoperceptual abilities ,test of visual perceptual skills– 3rd edn(TVPS)[4],developmental test of visual motor integration tests (VMI, Berry and Buktenica,1989)[5]and checklists for AD/HD was performed..

TVPS is a standardized ,validated tool for children aged four to 18years and consists of seven subtests: visual discrimination(differentiate one object from other),memory (visual immediate recall), form constancy(recognise the size, colour, shading, textures),sequential memory(recall in the exact order),visual figure ground(read at a specific place on a particular page without losing track),visual closure(identify an object in absence of a total stimulus) and spatial relationships(analyse forms in relation to one's body and space).

Statistical analysis- The data obtained was categorical variation, mean and standard deviation (SD) for linear variable. Proportion between evaluated group compared by chi –square test or Fishers exact test for low expected cell counts. A "p"value <0.05 was consider statistically significant. Then the difference in the means was compared using a t-test.

Results

The mean (SD) age was 12.2 ± (2.0) for males and 11.8 ± (2.5) for females, M: F ratio was 3.1:1.A majority 58(58.5%) had difficulty in all academic domains,30(30.3%)had both reading and writing issues,8(8.0%) had difficulty only in mathematics,2 (2.0%) cases had isolated reading difficulties and 1(1.0%)had both reading and mathematics concerns.8(8.0%) had a significant antenatal history and 15(15.1%) were preterms,20(20.2%) had delayed speech. A definite history of parental academic underachievement was present in 22.22% and presence of soft neurological signs was seen in 44.44% of spLD.(Table 1)

Of 99 spLD children,29(29.3%) had only one type of learning disorder(11 had dyslexia, 9 had dysgraphia, 9 had dyscalculia) whereas 70(70.7%)children had combinations of dyslexia with dysgraphia or dyscalculia.In 99 children, the below average scores of different components of the TVPS scale according to type of SpLD was compared (Table 2).

In only dyslexics (n=11) a statistical significance for visual discrimination($p \leq 0.05$),visual spatial relationship($p \leq 0.01$),form consistency ($p \leq 0.05$) and sequential memory($p=0.06$) was obtained versus a mixed or combination type of SpLD (Table 2).In only dysgraphics (n=9) a statistical significance for visual discrimination($p \leq 0.01$),spatial relationship($p \leq 0.05$), visual form consistency ($p \leq 0.05$) and figure ground ($p \leq 0.01$)was obtained versus a mixed or combination type of SpLD (Table 2).In children with

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dyscalculia(n=9) when compared witha mixed or combination type of SpLD, spatial relations($p \leq 0.05$) and form consistency($p=0.07$) had a statistical significance (Table 2).

VMI was unaffected in dyslexics whereas (22%)of dyscalculics and dysgraphicshad significantly below age scores.

Discussion

Visual perception develops as the child matures and by9 years most developmental changes are completed.[2]Visual cognitive abilities are fundamental to read, spell, write and perform numeric tasks.In our study the mean age was 12.2 ± (2.0) for males and 11.8 ± (2.5) for females. Although specific ,persistent academic difficulties manifest within 2 to 3 years of formal school based instruction the older age of diagnosis of learning disability is known in Indian scenario due late referrals,Karande et al [6] also had similar observations. Males were affected in all academic domains($p=0.03$) suggesting a more generalized learning difficulty affecting overall academic under achievement,Smith etal[7] had similar findings.

8 (8.0%) had a significant antenatal historyColletti[8] et al found significant academic delay in children born of mothers with leaking PV, PIH and PPH.15 (15.1%) were preterms similar to Grunau et al[9].A definite history of parental academic underachievement was present in 22.22%similar toVogler et al[10]wherein 4 fold increased risk was present. Presence of soft neurological signs was seen in 44.44% similar to Peters et al[11] (Table 1).

In dyslexics significantly low scores were present in visual discrimination(both object and spatial perception).A significant association between reading and visual discrimination($p<0.01$) has been described previously by Kavale et al.[13]In dysgraphics below age average scores were obtained in discrimination, spatial perception but not on visual memory this finding was contradictory to previous studies [13].Mathematics necessitatesa good spatial sense, dyscalculics had a significant association with visual discrimination, spatial relationship as described by Groffman et al[14]. Poor visual motor integration (weak visuo motor skills)was seen in22% dysgraphics anddys calculics,Mati-zissi had observed a correlation between written skills and visuomotor abilities.[15]

The ultimate goal of assessing visual perceptual and motor skills is its role in remediation .In addition to compensatory approaches a robust occupational therapy program(for visuomotor skills) and vision therapy (for perceptual skills) is integral in definitive management .Studies have undisputedly shown that these when incorporated in the developmental therapies of learning disabled children are often valuable.

Conclusions

Poor visual perceptual aspects contribute to perceptual challenges in the classroom influencing the child's academic proficiency. Diagnosis of perceptual lproblems facilitates appropriate referrals, recommendations and interventions. This study highlights the need for awareness of visuoperceptual disorders and their important role in learning.

What This Study Adds

Assessment of perceptual and visuomotor skills is essential in evaluation of sp LD.

Occupational therapy, vision therapy would be beneficial in affected children.

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Table 1: Table showing the demographic profile and clinical history in 99 children with learning disabilities, Mumbai, India

	Males	Females	p value
	n (%)	n (%)	
All	24 (100)	75 (100)	
Age			
Mean (SD)	12.2 (2.0)	11.8 (2.5)	0.52
Significant antenatal history			
Yes	7 (9)	1 (4)	0.68
No	68 (91)	23 (96)	
History of prematurity			
Yes	13 (18)	2 (8)	0.35
No	62 (83)	22 (92)	
Family history			
Yes	15 (20)	7 (29)	0.40
No	60 (60)	17 (71)	
Presence of soft neurological signs			
Yes	34 (45)	10 (42)	0.82
No	41 (55)	14 (58)	

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Table 2: Table showing the below average scores for different subtests of the Test of Visual Perceptual Skills (TVPS) scale in children according to type of learning disabled children(n= 99).

	Type of LD		Type of LD		Type of LD	
	Only Dyslexia	Mixed†	Only Dysgraphia	Mixed†	Only Dyscalculia	Mixed†
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
All	**11 (100)**	**88 (100)**	**9 (100)**	**90 (100)**	**9 (100)**	**90 (100)**
Visual Discrimination	10 (91)	45 (51)*	9(100)	46(51)**	2(22)	53(59)
Visual Memory	11(100)	62(70)	9(100)	64(71)	9(100)	64(71)
Spatial Relationships	1(9)	48(55)**	8(89)	41(46)*	8(89)	41(46)*
Form Constancy	3(27)	54(61)*	8(89)	49(54)*	2(22)	55(61)[b]
Sequential Memory	11(100)	57(65)[a]	9(100)	59(66)	9(100)	59(66)
Visual Figure Ground	8(73)	37(42)	0(0)	45(50)**	1(11)	44(49)
Visual Closure	2(18)	33(38)	2(22)	33(37)	3(33)	32(36)

† = May include a combination of either (dyslexia, dysgraphia, dyscalculia)

* $p \leq 0.05$; ** $p \leq 0.01$; [a] p=0.06; [b] p=0.07

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