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Perceptual Visual Skills in Delayed Language Developed Children

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ABSTRACT

Aim: To evaluate Perceptual visual skills in delayed language developed children.
Material and methods: The relation between visual skills and language has not been rigorously examined in previous investigations. This is a case-control study which comprised of 25 preschool children with Delayed Language Development (DLD) (cases) and 25 typically developed children (control). Exclusion criteria: any neurological or visual impaired disorder. All children had undergone Intelligent Quotient (I.Q) using Stanford Binet (IV edition), Attention Deficit Hyperactivity disorder Test (ADHDT) and Illinois Test of Psycholinguistic Abilities (ITPA). The performance of cases was surprisingly superior to the performance of controls in all visual skills. Moreover, it was significantly different in visual closure (P value = 0.027) and visual memory (P value = 0.005).
Conclusion: Reading disorders that may develop in children with DLD are more related to language than to visual skills. DLD has some strong perceptual skills such as visual closure and visual memory. This should be taken in consideration while planning a strategy for language therapy.

1. Introduction

Perception operates on an immense amount of incoming information that greatly exceeds the brain's processing capacity. Because of this fundamental limitation, the ability to suppress irrelevant information is a key determinant of perceptual efficiency.[17] Visual perception refers to the process of organizing and interpreting visual sensory stimuli.[14] Visual perception, as a hypothetical construct, is best known through the field of learning disabilities. A simplistic explanation expressed through education is that visual perception occurs within the brain, and the process of attributing meaning to visual stimuli.[15] The assumption of a series of levels leading from perceptual to semantic was subsequently abandoned.[3]

Language is critical for human communication and central to social interactions. Specific language impairment (SLI) commonly experience learning difficulties of a comparable magnitude across all scholastic domains.[2] Feldman and Messick 7 noted that children with SLI are at high risk for reading disorders, emphasizing that reading disorders are more related to language than to visual skills. Some children whose early delays in language and speech apparently resolve during the preschool years have reading disorders at school age, indicating that the initial delay was indicative of a fundamental, although subtle long-standing disorder.

The relation between perceptual visual skills and learning disabilities has been thoroughly investigated. Yet, the relation between visual skills and language has not been rigorously examined in previous investigations. Hence, the purpose of the present study was to evaluate visual skills such as visual reception, visual association, visual closure and visual memory in delayed language developed children.

2. Methods and patients

This is a case-control study which consists of 25 children with delayed language development (Expressive Language Impairment) (cases) and 25 typically developed children with normal receptive and expressive language abilities (control). Inclusion criteria: Age of the children ranged between 2.5 and 6 yrs (preschool) and normal receptive language abilities Exclusion criteria: any neurological disorder, visually impairment and mental retardation. All children had undergone

- Arabic Preschool Language Scale-4 (PLS-4).[6] The cases of this study will include only Expressive Language Impairment (ELI), who showed impaired expressive language abilities and fulfilled normal receptive language abilities. Children were

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diagnosed as ELI if they had expressive language abilities one year less than their chronological age, while their receptive quotients were within normal range. This is done to in order for children to understand the instructions of the Arabic version of the Illinois Test of Psycholinguistic Abilities (ITPA).[1]

- Intelligent Quotient (I.Q) using Stanford Binet (IV edition)[12] to exclude mental retardation.
- Attention Deficit Hyperactivity disorder Test (ADHDT).[10] Parents completed the ADHD test. ADHDT was based on DSM-IV diagnostic criteria; comprised of 36 questions in three subtests related to the three core symptoms of ADHD: hyperactivity, impulsivity and inattention.
- Four subtests assessing visual perception skills of the Arabic version of the Illinois Test of Psycholinguistic Abilities (ITPA)[1] was administrated to both groups. Those subtests are visual Reception, Visual Association, visual closure and visual memory. The raw scores for each subtest were used to drive scaled scores for each task.
- **Visual Reception** (VR) is the ability to "remember" by matching a current visual input against an internal image reconstructed from a similar past input. It is the ability to know that what one is looking at is either the same or different than what it was previously.
- **Visual Association (VA)** is the ability to conceptually relate visually presented stimuli.
- **The visual closure (VC)** is a complex perceptual task that provides the ability to recognize an object from a partial or limited stimulus or to form a "gestalt." The patient with a difficulty in this area is unable to perceive the "whole-part" relationship in partially-visible stimuli.
- **Visual Sequential Memory** is utilized to test the ability to reproduce meteorically a series of stimuli presented visually. The child is shown a card with a series of geometric figures on it and is then given several chips, each containing one of these figures. The child is required to reproduce the sequence on the card from memory, using the chips. It entails an active inner search of past visual experience in the absence of a stimulus.

Statistical methods: Statistical package for social Sciences version 16 (SPSS, INC, Chicago, IL) under windows was used for data entry and data analysis. Descriptive statistics were done for continuous variables by mean, standard deviation (±SD). Student '*t*' test were used to compare continuous variables in various groups. Pearson's correlation used to assess the association between the different parametric data. For all tests a probability (P) value less than 0.05 was considered significant.

Approval of the ethics committee of Sohag University was obtained. A written consent to participate and to publish was taken from all patients or participants before our study procedures. None of the authors have any competing interests.

3. Results

Both patients' group and control group were matched as regards sex distribution and age Table 1.

Table 1
Characteristics of the study group.

	Case No (%)	Control No (%)
Sex		
Female	8(32%)	10(40%)
Male	17 (68%)	15 (60%)
Age (mean ± SD)	(48.52 ± 9.9)	(49.2 ± 8.9)

The performance of cases was surprisingly superior to the performance of controls in all visual skills. Moreover, it was significantly different in visual closure (P value = 0.027) and visual memory (P value = 0.005) Table 2.

Using Pearson correlation coefficient to investigate the correlation between the visual perceptual skills and ADHDT scores, results showed no correlation. Moreover, no correlation was found between visual perceptual skills and IQ (Table 3).

No correlation was noticed between perceptual visual skills and age except visual memory which showed significant strong positive correlation (r = 0.7) (see Table 4).

4. Discussion

In this study, both groups had comparable results in VR and VA. However, DLD children performed significantly better in VM and VC than typically developed children with normal language abilities. One difficulty with the Visual Sequential Memory subtest is that its administration is somewhat complicated. Since tachistoscopic presentation of stimuli with supposedly 6 s exposure time, the stimuli were accurately perceived by DLD children when the duration of exposure is increased. Consequently, the superiority of DLD children in visual memory may be attributable to lengthy duration of exposure. On the other hand, visual sequential memory subtest also appears to engender low child interest and enthusiasm as well as low tester enthusiasm.[16] This may explain low performance of control than cases.

DLD children performed better in Visual closure (VC) than typically developed children. VC helps us quickly to process information in our environment because our visual system does not have to analyze every detail. This skill requires an abstract problem solving and t is closely linked with thinking and development of concepts and develops later than some of the other perceptual skills. Also, Visual closure influences learning especially reading. The

Table 2
Difference of different subtests between cases and controls.

	Case	Control	P value
Visual Reception (VR)	38.44	36.16	0.188
Visual Association (VA)	33.86	30	0.121
Visual closure (VC)	34.78	25	0.03*
Visual Memory (VM)	30.34	23.33	0.005*

* Statistically significant.

Table 3
Correlation between visual perceptual skills and ADHDT scores.

	VR	VA	VC	VM
ADHD Q	−0.312	0.152	0.345	0.31
Hyperactivity	−0.262	0.258	0.354	0.389
Impulsivity	−0.23	0.157	0.326	0.371
Inattention	−0.385	−0.0802	0.194	0

VR = Visual Reception, VA = Visual Association, VC = Visual Closure, VM = Visual Memory.

Table 4
Correlation between age and perceptual visual skills.

	VR	VA	VC	VM
Age case group	−0.0577	−0.488	−0.34	−0.70*
Age control group	−0.341	0.0558	0.03	0.32

VR = Visual Reception, VA = Visual Association, VC = Visual Closure, VM = Visual Memory.
* Statistically significant.

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superior performance of DLD children in VC in comparison to typically developed children cannot be explained except for the association between DLD and good visual closure skills. Further research is needed to investigate this point.

Although most professionals would agree that accurate perception requires some level of attention, they don't know how much attention is required.[15] Also, Groffman 11 stated that Visual Sequential Processing requires visual vigilance which examines the attentiveness of the subject and his/her capacity for selectively detecting and appropriately responding to changes in stimulus events over relatively long periods of time. Moreover, the key to perceptual learning is the education of attention—learning which variables to attend to and which to ignore. Through practice and experience, attention becomes fine-tuned toward the relevant information.[9] In this study, there was no relation between the visual perceptual abilities and attention. This was a surprising result but possibly it could attributable to ADHDT, used in this study, which provides the likelihood and the probability of inattention depending on the interpretation of the rater. Hence, it does not examine the child directly or evaluate the selective or sustained attention. Further research is needed using larger number of children and using tests to evaluate their attention.

Moreover, there was no correlation between visual perceptual skills and IQ. This was consistent with the results of Kavale 14. Also, Deary 5 and Jensen 13 noted that most perceptual tasks only weakly correlate with IQ (usually between 0.2 and 0.4). Many studies focused on processing speed measures (e.g. reaction times) in order to link between intelligence and perception explaining that faster neural processing is important for perception and intelligence.[4] On the contrary, knowledge of language has been considered as the principle basis of intelligence.

In this study, there is strong positive correlation between visual memory and age which indicate that whenever children get older, the better the visual memory skill. Williams 18 noted that visual memory skills continue development until 12 years. On the other hand, in this study, No correlation was noticed between other perceptual visual skills and age. This is not consistent with other research that investigated for example visual closure skills and noted they develop and continue development until five years of age.[8]

5. Conclusion

Reading disorders that may develop in children with DLD are more related to language than to visual skills. DLD has some strong perceptual skills such as visual closure and visual memory. This should be taken in consideration while planning a strategy for language therapy. A larger study should be designed to explicitly test the link between visual perceptual skills to language.

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