Memória de curto-prazo visual em crianças com distúrbio específico de linguagem****

Visual short-term memory in children with specific language impairment

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****Pesquisa Realizada na Universidade de São Paulo. Premiada no XII Congresso Brasileiro e II Congresso Sulbrasileiro de Fonoaudiologia.

Abstract
Background: relationship between Specific Language Impairment (SLI) and visual short-term memory. Aim: to compare the performance of children with SLI to a control group of children with normal language development in tasks involving visual short-term memory. Method: subjects were 20 SLI children (ages 3;0 to 5;11), and 29 children with normal language development (ages 2;0 to 4;11), assessed in tasks of visual short-term memory involving picture recognition and localization recall of objects previously manipulated by the examiner. As the diagnosis of SLI implies in the linguistic age being at least one year below the expected for the chronological age, the control group was also constituted by younger children with normal language development. Results: SLI children presented an inferior performance when compared to their pairs of the same age, similar to the younger children or below the younger age group. Conclusion: SLI children presented deficits in tasks involving visual short-term memory, which must be discussed in order to understand the nature of the disorder and also in terms of speech-language intervention.
Key Words: Specific Language Impairment; Visual Short-Term Memory; Language.

Resumo
Tema: relação entre o Distúrbio Específico de Linguagem (DEL) e a memória de curto-prazo visual. Objetivo: comparar o desempenho de crianças com DEL e de crianças em desenvolvimento normal de linguagem em tarefas envolvendo a memória de curto-prazo visual. Método: foram avaliadas 20 crianças com DEL (faixa etária de 3:0 a 5:11), e 29 crianças em desenvolvimento normal (faixa etária 2:0 a 4:11) por meio de tarefas de memória de curto-prazo visual envolvendo a identificação através de fotos e a evocação da localização de objetos previamente manipulados pelo examinador. Como o diagnóstico de DEL implica em idade lingüística pelo menos um ano inferior ao esperado para a idade cronológica, o grupo controle foi constituído por crianças em desenvolvimento normal de linguagem também mais novas. Resultados: as crianças com DEL apresentaram desempenho inferior quando comparadas a seus pares de mesma idade, semelhante ao de crianças mais novas ou ainda inferior ao do grupo mais jovem. Conclusão: as crianças com DEL apresentaram déficits em tarefas envolvendo memória de curto-prazo visual, os quais devem ser discutidos tanto para a compreensão da natureza do quadro, como para os processos de intervenção fonoaudiológica.
Palavras-Chave: Distúrbio Específico de Linguagem; Memória de Curto-Prazo Visual, Linguagem.

Artigo Original de Pesquisa

Artigo Submetido a Avaliação por Pares

Conflito de Interesse: não

Recebido em 15.05.2007.
Revisado em 30.08.2007; 27.09.2007.
Aceito para Publicação em 29.10.2007.

Referenciar este material como:
Menezes CGL, Takiuchi N, Befi-Lopes DM. Visual short-term memory in children with specific language impairment (original title: Memória de curto-prazo visual em crianças com distúrbio específico de linguagem). Pró-Fono Revista de Atualização Científica. 2007 out-dez;19(4):363-9.

Introduction

Specific Language Impairment (SLI) is characterized by important language deficits in the absence of any pathology that generates the impairment. The performance of these children in many tasks is inferior to that of the peers in normal development (14).

The disorder may include extensive and broad cortex dysfunctions or genetic alterations (5 - 8). Considering the great heterogeneity observed in SLI a single deficit hardly would explain all the features (9).

Reports that children with SLI present some kind of memory disorder that could increase the linguistic impairment are present in the literature for over 20 years (1). In this study attention will be directed toward short-term visual memory, which seems to influence learning and retrieving long term memory information, and a series of complex cognitive tasks.(10-13)

Since a lesser importance is attributed to the visual system in the language acquisition process, few studies investigated visual memory of children with SLI. The research involving this ability state that the limited processing capacity is the cause of the poor performance as well as by the linguistic disorders.(14)

The purpose of this study was to compare children with SLI with a control group of the same age in a short term visual memory task.

Method

Research approved by the institution's committee of ethics and research (289/03). Assessing procedures started after the consent term was signed.

Subjects

The study compared a group of 20 children with SLI (Research Group - RG) and 29 children with typical development (Control Group - CG). Once the SLI diagnosis demands that the linguistic age is at least one year under the chronological age, the subjects of CG were younger children with normal language development.

Research group - RGI (3:0-3:11): 5 boys and 5 girls, RGII (4:0-4:11): 6 boys; RGIII (5:0-5:11): 5 boys and 3 girls - 16 male subjects (80%) and 4 female subjects (20%).

Control group - CGI (2:0 - 2:11): 5 boys and 5 girls; CGII (3:0 - 3:11): 5 boys and 5 girls; CGIII (4:0 - 4:11): 4 boys and 5 girls - 14 male subjects (48,3%) and 15 female subjects (51,7%).

The language assessment of children with SLI was conducted in the Language Development and Disorders Research Laboratory of the School of Medicine - University of Sao Paulo (FMUSP). It used standard language tests and informal assessment, considering the inclusion criteria determined by the literature.

The CG attended a day-care center and subjects could not present speech, language or hearing complaints by the parents or teachers and should understand the pre-test (described in procedures).

Material

Miniatures of objects of different categories and its corresponding pictures; a transparent box and two identical opaque boxes and the Answering Recording Protocol (appendix) were used.

Procedure

A pre-test was conducted to guarantee the tasks were understood: a ball was placed inside the transparent box while the child watched; it was asked to the child what is inside the box. All the miniatures were presented to identification by the child after the nomination by examiner (Ex: "show the dog"). If the child didn't choose the correct target it was pointed by the examiner.

Test situation consisted of two Tasks: identification and retrieving. The two opaque boxes were placed in front of the child. The examiner, showed, labeled and placed three objects (target-objects) in box 1 and latter did the same with the second box. Four starting events were conducted with objects of the same category and four with different categories (animal, food, household items and transport items).

Task 1 - Identification

The child was asked to point on the board to the objects of each box. For each box there was a board with the three target-objects and three distracters.

Task 2 - Retrieving

The boards were taken off and the child was asked to point in which box was the target-object, with the prompting question: "where is the…?".

The tasks were individually applied by two examiners for approximately 20 minutes. The

answers were recorded on the Answering Recording Protocol during the realization of tasks according to the view of both examiners consensus.

Results

The results obtained were evaluated for each task and statistically analyzed (ANOVA and the Test for two equal proportions) with significance level of 0.05.

A child of the CGII was excluded form analysis by parent's request. In the RG the proportion of boys was statistically larger than that of the girls (p<0.001*). In the RGI three children didn't recognize all the objects used on the tests. They were then showed and labeled by the examiner. The test was understood by 90% of the RG and 100% of the CG.

The Board 1 shows the scores for Task 1. Scores were attributed for all the possibilities of answers. Pointing to the three target-pictures among the six pictures presented (expected answer) received the largest number of points (15 points) and the indication of target objects as well as of distracters (all pictures) the smallest number (1 point).

In Task 2 the subjects should show the box with the requested object (box 1 or 2). Each correct answer received 1 point and wrong answers received zero points. The maximum of points possible was 24.

CHART 1. Scores in Task 1.

Pointed pictures *	Correct answers **	Number of mistakes ***	Scores
3	3	0	15
2	2	0	14
3	2	1	13
4	3	1	12
4	2	2	11
3	1	2	10
2	1	1	9
1	1	0	8
3	0	3	7
2	0	2	6
1	0	1	5
4	1	3	4
5	3	2	3
5	2	3	2
6	3	3	1

* Number of pictures pointed by each child in each answering trial
** Target pictures that the child should point to (three among six)
*** Distractive pictures that the child shouldn't point (three among six).

Within-group analysis

In Task 1 the CG presented statistically significant difference among the three age-groups for the same category (p<0.001*) and for different categories (p<0.001*). Comparing the age groups significant differences between CGI and CGII (p=0.002*/ same category; p<0.001*/ different categories), CGII and CGIII (p=0.009*/ same category; p=0.048* different categories) and CGI and CGIII (p<0.001*/ same category and different categories) were also observed.

Also in Task 1, the RG presented statistically significant difference among the three age groups for the same and for different categories (p<0,001*). Comparing the age groups significant differences were observed between RGI and RGII (p=0,002*/ same category; p=0,001*/different categories), RGII and RGIII (p<0,001*/same category and different categories) and, RGI and RGIII (p<0,001*/ same category and different categories).

In respect to Task 2, in the CG, in the same category part, there was significant difference between ages (p=0.006*) and just in the comparison of CGI and CGIII (p=0.001*). With different categories the difference was significant among ages (p=0.002*) and in the comparison of CGI and CGII (p=0.010*) and CGI and CGIII (p=0.001*).

In Task 2, with the same category, RG presented significant difference between ages (p=0.020*) and in the comparison of RGI and RGIII (p=0.006*). With different categories there was no statistically significant difference between age groups.

Generally there was a statistically significant evolution in age groups.

Between group analysis

Tables 1 and 2 show the comparison of CG and RG performances, combining the age groups in Task one, with the same category and different categories, respectively. With the same category no significant difference was found in all age groups. With different categories only the comparison of CGIII and RGIII didn't present average significant difference in relation to the average of scored points.

Comparing CG and RG by the combination of age groups in Task 2, it was observed a statistically significant difference of CGIII and RGII with the same category (p=0.042*) and with different categories (p=0.049*).

In respect to the performance of both groups in Tasks 1 and 2, the average score in Task 2 was always higher (significant difference/ p<0.001*). Besides, in Task 1 both groups showed larger performance variation in lower ages and this variation was also larger in the RG. In Task 2 this variation was smaller and groups were more similar.

Discussion

From the results obtained some questions about short term memory in children with SLI could be addressed.

It is estimated that 5% to 10% of school-age children present SLI as the basic language disorder, with impairments in the areas of memory, learning and language processing (1-2,15).

The study by Dapretto and Bjork (2000), in which this study was based, was conducted with children in typical development in different stages of vocabulary development in the end of the second year. Young children mentally represent persons, objects and events even before the onset of expressive language because it is easier to retrieve the meaning of a word (comprehension) than the sound patterns related to a given meaning (expression).

Children with SLI take longer to recognize, retrieve, formulate and produce words, due to the slowing of the information processing. It can be related to failures in semantic representation and in cognitive organization. Besides, they present a lower performance in fast visual discrimination tasks when compared to normal peers (1,3,17,19).

In this study children with and without language impairment were assessed with tasks that didn't demand speech, to avoid absence of answers due to expressive language impairments (20).

From a general analysis it was observed that both groups increased their differences with increasing age in Tasks 1 and 2 (same category and different categories).

According to Gathercole and Hitch (21) this improvement in performance happens during development and two year old children are already able to use primitive memory strategies that became similar to the adults' during adolescence(3).

The comparison of both groups in Task 1 showed statistically significant differences with the same category and with different categories except between CGIII and RGIII. This way, children with SLI present lower performance than younger peers in normal development.

TABLE 1. Comparison of the performance of control and research groups in Task 1 - same category.

Groups	Score average	Standard Deviation	p-value
GCI (2 anos)	10,55	4,53	<0, 001*
GPI (3 anos)	4,60	5,85	
GCII (3 anos)	12,71	4,15	<0, 001*
GPI (3 anos)	4,60	5,85	
GCII (3 anos)	12,71	4,15	<0, 001*
GPII (4 anos)	8,60	6,53	
GCIII (4 anos)	14,19	2,50	<0, 001*
GPII (4 anos)	8,60	6,53	
GCIII (4 anos)	14,19	2,50	<0, 008*
GPIII (5 anos)	12,52	4,56	

*p-value: 0,05%.

TABLE 2. Comparison of the performance of control and research groups in Task 1 - different categories.

Groups	Score Average	Standard Deviation	p-value
GCI (2 anos)	10,43	4,72	<0, 001*
GPI (3 anos)	5,04	5,89	
GCII (3 anos)	13,08	3,32	<0, 001*
GPI (3 anos)	5,04	5,89	
GCII (3 anos)	13,08	3,32	<0, 001*
GPII (4 anos)	9,15	6,20	
GCIII (4 anos)	13,93	1,57	<0, 001*
GPII (4 anos)	9,15	6,20	
GCIII (4 anos)	13,93	1,57	0, 73
GPIII (5 anos)	13,13	3,39	

*p-value: 0,05%.

In Task 2, with the same category and with different categories significant differences were observed only between CGIII and RGII (both with four years), when it was expected that older children had better performance, thus showing the disorders of children with SLI.

As stated by Van Der Lely and Howard (22) these findings show the failures in different functions of short term memory as well as the several aspects of language disorders present in children with SLI.

Hick et al (23) compared short term memory abilities and vocabulary development in children with Down syndrome, SLI and normal development in tasks of short-term visual-spatial memory. They observed that the SLI group presented the worst performance, significantly different from the group in normal development.

The same authors assessed the short-term verbal and visual-spatial memory and the visual-spatial processing of children with SLI and controls of the same age. The results indicated deficits in verbal and visual-spatial short-term memory in children with SLI in relation to controls, indicating cognitive deficits despite the non-verbal abilities are generally preserved (24).

Archilbald and Gathercole (25) observed deficits in the performance of children with SLI in short-term and verbal working memory tasks but not in visual-spatial memory.

These discrepancies with our findings can be due to the fact that in our study the tasks proposed involved, besides the visual-spatial aspects, information of long-term memory (vocabulary) and of the phonological loop, and attention and coordination aspects of the proposed activities.

No differences were found for both groups in the same category or in the different categories stages. This finding disagree with the study by Baddeley (12) that described that semantically similar words are less remembered than non-related words in the immediate retrieving. It may have occurred because in our study visual clues that worked as facilitators were provided.

In respect to the performance in the tasks the results point out to statistically significant differences in favor to Task 2. The study described by Dapretto e Bjork (16) leaded to similar results.

In the present study no strategies demanding oral responses were used, as in the study by Dapretto and Bjork (16). But the findings of this study about Task 2 show that, as suggested by the authors, this activity is little dependent on the lexical development because it is essentially a comprehension task.

Other finding about both groups in Task 1, the performance variation was larger in younger subjects especially in the RG. It indicates an evolution through development and shows the heterogeneity of children with SLI. In Task 2 the performance of both groups were better and lessened the variation between them and in general.

Conclusion

The results of this study indicate a deficit in short-term memory in children with SLI. In general their performance is equivalent or worse than of their peers of the same age or younger.

This way, despite children with SLI frequently present good non-verbal abilities, the deficits observed in short-term visual memory must be taken into account for the intervention because it seams that these children do not benefit from visual clues in the verbal development as normal children do.

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Appendix

Answering Recording Protocol

Name: Gender:
Date of Birth: Current Age:
Control Group: CG I ( ) Research Group: RG I ( )
CG II ( ) RG II ( )
CG III ( )

Understood pre-test: Yes ( ) No ( )

TASK 1. Identification: Mark the pictures the child points

Same Category

Box 1		*Box 2*	
cat	fish	**dog**	monkey
cow	lion	**chicken**	elephant
rabbit	bear	**horse**	duck
table	plate	**chair**	stove
bed	refrigerator	**glass**	spoon
knife	pan	**telephone**	sofa
korn	cheese	**grape**	chocolate
orange	vegetable	**banana**	apple
egg	cake	**carrot**	bread
bus	tractor	**bicycle**	helicopter
car	rocket	**truck**	train
airplane	cart	**motorcycle**	ship

Different Categories

Box 1		*Box 2*	
dog	bear	**cat**	lion
table	plate	**glass**	pan
korn	cheese	**bicycle**	rocket
car	tractor	**chicken**	monkey
telephone	sofa	**orange**	chocolate
cow	fish	**chair**	stove
banana	vegetable	knife	spoon
bed	refrigerator	**carrot**	apple
airplane	train	**truck**	cart
bus	helicopter	**motorcycle**	ship
egg	cake	**grape**	bread
rabbit	elephant	**horse**	plate

TASK 2. Retrieving: Mark in which box (1 ou 2) the child shows the object requested.

Same Category

dog (1) **(2)** cat **(1)** (2) chicken (1) **(2)** cow **(1)** (2) rabbit **(1)** (2) horse (1) **(2)**

table **(1)** (2) glass (1) **(2)** *bed* **(1)** (2) knife **(1)** (2) *chair* (1) **(2)** *telephone* (1) **(2)**

korn **(1)** (2) orange **(1)** (2) *banana* (1) **(2)** *carrot* (1) **(2)** egg **(1)** (2) grape (1) **(2)**

bus**(1)** (2) *truck* (1) **(2)** car **(1)** (2) airplane **(1)** (2) *bicycle* (1) **(2)** *motorcycle* (1) **(2)**

Different Categories

dog **(1)** (2) table **(1)** (2) cat (1) **(2)** korn **(1)** (2) *glass* (1) **(2)** *bicycle* (1) **(2)**

chicken (1) **(2)** *orange* (1) **(2)** car **(1)** (2) *chair* (1) **(2)** telephone **(1)** (2) cow **(1)** (2)

banana **(1)** (2) bed **(1)** (2) knife (1) **(2)** airplane **(1)** (2) *carrot* (1) **(2)** *truck* (1) **(2)**

motorcycle (1) **(2)** *grape* (1) **(2)** bus **(1)** (2) egg **(1)** (2) horse (1) **(2)** rabbit **(1)** (2)