Vocabulário expressivo e processamento auditivo em crianças com aquisição de fala desviante****

Expressive vocabulary and auditory processing in children with deviant speech acquisition

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****Trabalho Realizado no Departamento de Fonoaudiologia da UFSM-RS.

Artigo Original de Pesquisa

Artigo Submetido a Avaliação por Pares

Conflito de Interesse: não

Recebido em 06.09.2009.
Revisado em 21.02.2010; 29.04.2010; 24.07.2010; 30.07.2010.
Aceito para Publicação em 01.09.2010.

Abstract
Background: expressive vocabulary and auditory processing in children with phonological disorder. Aim: to compare the performance of children with phonological disorder in a vocabulary test with the parameters indicated by the same test and to verify a possible relationship between this performance and auditory processing deficits. Method: participants were 12 children diagnosed with phonological disorders, with ages ranging from 5 to 7 years, of both genders. Vocabulary was assessed using the ABFW language test and the simplified auditory processing evaluation (sorting), Alternate Dichotic Dissyllable - Staggered Spondaic Word (SSW), Pitch Pattern Sequence (PPS) and the Binaural Fusion Test (BF). Results: considering performance in the vocabulary test, all children obtained results with no significant statistical. As for the auditory processing assessment, all children presented better results than expected; the only exception was on the sorting process testing, where the mean accuracy score was of 8.25. Regarding the performance in the other auditory processing tests, the mean accuracy averages were 6.50 in the SSW, 10.74 in the PPS and 7.10 in the BF. When correlating the performance obtained in both assessments, considering $p>0.05$, the results indicated that, despite the normality, the lower the value obtained in the auditory processing assessment, the lower the accuracy presented in the vocabulary test. A trend was observed for the semantic fields of "means of transportation and professions". Considering the classification categories of the vocabulary test, the SP (substitution processes) were the categories that presented the higher significant increase in all semantic fields. Conclusion: there is a correlation between the auditory processing and the lexicon, where vocabulary can be influenced in children with deviant speech acquisition.
Key Words: Speech Disorders; Hearing Tests; Vocabulary.

Resumo
Tema: vocabulário expressivo e processamento auditivo em crianças com desvio fonológico. Objetivo: comparar o desempenho de crianças com desvio fonológico em teste de vocabulário com as normas apresentadas pelo mesmo e verificar a possível relação entre seus desempenhos nos testes de vocabulário e o déficit do processamento auditivo. Método: participaram da pesquisa 12 crianças com diagnóstico de desvio fonológico, com idades entre 5:0 anos e 7:0 anos e de ambos os sexos. Foi feita avaliação do vocabulário através do uso do ABFW, e avaliação simplificada do processamento auditivo (triagem), Dicótico de Dissílabos Alternados - *Staggered Spondaic Word* (SSW), Teste de Padrão de Frequência - *Pitch Pattern Sequence* (PPS) e o Teste de Fusão Binaural (FB). Resultados: quanto ao vocabulário, todas as crianças obtiveram resultados sem diferenças estatisticamente significantes. Quanto ao processamento auditivo, todas as crianças tiveram resultados aquém do esperado, com exceção da triagem com média de 8,25. Nos outros testes as médias de acerto foram, no SSW de 6,50, no PPS de 10,74 e no FB de 7,10. Ao relacionar as duas avaliações, considerando-se $p > 0,05$, os resultados mostraram que, apesar da normalidade, quanto menor o valor obtido no processamento, menor o número de acertos apresentados no teste de vocabulário, mostrando certa tendência, principalmente nos campos "meios de transporte e profissões". Das classes, o PS (processos de substituição), foi o que obteve maior aumento significativo, sendo em todos os campos semânticos. Conclusão: há uma correlação entre processamento auditivo e o léxico, onde o vocabulário pode ser influenciado em crianças com aquisição de fala desviante.
Palavras-Chave: Vocabulário; Testes Auditivos; Distúrbios da Fala.

Referenciar este material como:
Quintas VG, Mezzomo CL, Keske-Soares M, Dias RF. Expressive vocabulary and auditory processing in children with deviant speech acquisition (original title: Vocabulário expressivo e processamento auditivo em crianças com aquisição de fala desviante). Pró-Fono Revista de Atualização Científica. 2010 jul-set;22(3):263-8.

Introduction

Phonological disorders are speech disorders without apparent organic etiology in which there is disorder in the mental representation of linguistic sounds. This term refers to the distance towards typical acquisition instead of referring to it as simply a disturbance. Normal children start babbling around 6 to 9 months old and the first words come around 10 to 15 months old3.

It is very important to learn the vocabulary of the Native language, which allows the integration with the society4-5. However, the semantics implementation will be possible as the phonological inventory increases in relation to the number of phonemes6-9.

So, it can be concluded that the development of the lexicon and the phonology are interconnected, even though there are individual variations.

Besides this, it is believed that the difficulties in the speech, including vocabulary and phonology deficit, may be closely related to auditory processing disorders (APD) since hearing is the main route for language acquisition10-13.

Auditory processing (AP) comprehends all the mechanisms and processes of the auditory system, which are responsible for behavioral phenomena, such as acoustic location, auditory discrimination, auditory recognition, resolution and temporal ordering, auditory performance with competitive and / or damaged acoustic signals13-14.

Despite the importance of the theme presented and its noticeable clinical implications, there are few studies about it in the literature. Thus, this research aims to investigate the probable relationships between auditory processing and lexicon development in children with phonological disorders.

Method

This study is a quantitative, transversal, descriptive-exploratory research, which was based on clinical data provided by the children who participated in the research project "Study of contrastive approach in three models of speech therapy for phonological disorders ", approved by the Ethics Committee in Research, under number 108/05. The data were collected from September 2008 to June 2009.

The following criteria were considered for the children to be part of the study sample:

. The students´ parents or guardians should authorize them to participate in the research by signing the Consent Form;
. The students from both sexes but older than 5:0 years old should have a diagnosis of phonological disorder (PD), which should be checked during the speech sorting.

The following exclusion criteria were considered:

. Clear changes in the neurological, cognitive and / or psychological aspects of the child;
. Evidence of hearing loss;
. Alteration of the stomatognathic system that could be related to changes in speech;
. Having had speech therapy before;
. Difficulty concentrating.

For this study the children were selected during the sorting at a public speech therapy service. Through this procedure it could be realized if there were errors in the children's speech. The number of children who took part in the research was based on the demand for speech care in the institution.

Children who met the described criteria above were evaluated individually in the institution and all of them went through a new phonological sorting test in which an informal assessment of receptive and expressive language was held. There was also a complete phonological assessment for them with Diagnostic evaluation of Articulation and Phonology (DEAP)2 for children in which changes in the phonological inventory were observed. In addition to this, there were assessments of the stomatognathic and the hearing systems. Whenever it was necessary, there were complementary neurological, otorrinolaringological and psychological assessments (if the evaluator noticed changes in these levels).

Thirty children went through the sorting, but only 18 subjects with ages between 5:0 and 7:0 years and average age of 6:3 years met the inclusion criteria to compose the sample.

In this sample the ABFW Vocabulary Test - an infant language test15 - was applied to check the lexicon competence of each child. Through this test nine fields, such as semantic clothing, animals, food, means of transportation, furniture and utilities, professions, places, shapes and colors, toys and musical instruments were evaluated.

This test analyzed the designations by unusual names (DVU), the non designations (ND) and the replacement processes (RP) used by children to

reach the correct naming of words. For each of the semantic fields there is a normal reference (NR). It was not performed between the "Expected" and the "Obtained" because the only concern was to examine the auditory processing with the vocabulary.

After this, a simplified evaluation of the auditory processing and the Binaural Fusion Tests (BFT) and Alternate Dichotic Dissyllable (SSW) Test: application manual and the Frequency Pattern Test (FPT) with pure tone audiometry tests of Musiek. For the application of each test, we took into account the age pattern in which the hearing skills have been developed, as well as the literature guidance for the application of each test based on the age criterion. An overall average (in gross values) of the right and the wrong answers that could occur in the applied tests: sorting (11 responses) were performed; FBT (25 responses); SSW (40 responses) and FPT (30 responses) were performed.

The assessments of the subjects from the selected sample, from the sorting to the specific evaluations, were performed in two stages, on different days.

Initially, we performed the phonological sorting, the hearing evaluation and the phonological assessment for the selection of the sample. The children who were according to the inclusion criteria comprised the sample. At second, the assessments for data collection, including the performance on the vocabulary test and the AP evaluation were performed.

Statistical analysis was performed with SAS (Statistical Analysis System) software, version 8.02, with Pearson's Correlation Analysis Test, in which correlations above 50% and $p < 0.05$ were considered.

Results

Table 1 shows the results concerning vocabulary tests.

About the DVU, it has been noted that the overall average expected is 63.7, and the general average obtained was 61.0, which shows there was little difference between them. The semantic fields like food, professions, places, shapes and colors and toys and musical instruments obtained scores below the expected (Table 1).

As for the ND, the group obtained a general average of 3.66, and the expected result was 11.07. Only the semantic field means of transportation had a score above than the expected (Table 1).

Finally, in the case of the RP, the overall average obtained was 33.33, higher than the average expected result of 25.46. The semantic fields food, professions, places, shapes and colors and toys and musical instruments scored higher than expected (Table 1).

As for the AP, we have to consider the average right and wrong answers according to the possibility of each test. This way, for the test sorting the maximum value of each correct answer was 11; in the SSW it was 40, in the FPT it was 30, and in the FBT it was 25. The tests that showed the average of values of wrong answers close to the total possible value were considered abnormal (Table 2).

Table 3 shows the correlations that were significant between the performance in vocabulary tasks and in the AP tests.

By linking performance on vocabulary tasks and the AP tests, a positive correlation between the DUW and the result in auditory processing tests could be observed, i.e., the better the performance in the PA is, the better the designation by usual name is. It has been noted that the sorting had the highest correlation with the semantic fields, in the DVU group, since it presented significant values above or equal to 0.50 in five fields.

The SSW test had a correlation with just a single semantic field in the DVU; the FPT had correlation with both fields, and finally the BF test also had correlation with only a single semantic field in the DVU (Table 3). As for the ND group, it can be said that just the sorting and BF had correlation with some of the semantic fields. Such correlations were negative, which indicates that the worse the children performed in the processing tests, the fewer the non designations were in these semantic fields (Table 3.)

The same negative correlation was present in RP. The sorting and SSW tests had this correlation with two semantic fields and the FPT with four fields, which may have a greater influence in this group. The BF test showed no correlation. The negative correlation for this group shows that the worse the performance in the presented tests is, the more present the replacement processes will be (Table 3).

TABLE 1.Performance on the vocabulary tests.

Vocabulary Test		Expected Averange*	Obtained Averange*	Standard deviation of expected*	Standard deviation of obtained*
	clothing	70,00	71,67	11,68	19,46
	animals	61,67	77,83	11,15	26,41
	food	78,33	58,91	12,67	20,11
	means of transportation	65,00	65,16	10,87	24,45
DVU	furniture and utilities	60,42	64,75	8,38	18,37
	professions	40,42	40,41	13,22	23,78
	places	66,67	45,08	7,78	29,33
	shapes and colors	70,83	68,33	20,32	22,90
	toys and musical instruments	60,00	56,91	11,68	24,00
	NDU Averange	63,70	61,00	11,97	23,20
	clothing	3,33	0,00	3,89	0,00
	animals	18,33	2,83	2,46	7,87
	food	10,83	7,75	6,33	11,61
	means of transportation	3,33	4,50	2,46	9,00
ND	furniture and utilities	5,00	3,33	0	4,77
	professions	26,67	1,67	4,44	3,89
	places	10,00	2,08	7,38	5,23
	shapes and colors	10.83	3,33	12,58	4,92
	toys and musical instruments	17.67	7,50	20,62	12,03
	ND Average	11,07	3,66	6,68	6,59
	clothing	26,67	24,17	7,78	10,83
	animals	20,00	19,33	11,68	23,70
	food	10,83	29,08	6,34	7,92
	means of transportation	33,33	29,33	8,88	23,96
RP	furniture and utilities	30,00	29,41	8,26	17,81
	professions	35,00	56,67	5,22	22,69
	places	23,33	51,67	2,46	26,39
	shapes and colors	21,67	25,00	18,50	21,95
	toys and musical instruments	28,33	35,33	8,88	23,73
	RP Average	25,46	33,33	8,67	19,88

Legend: DVU - designation by usual names; ND – non designation; RP - replacement process * absolute values - depending on the patient's behavior and disposition, this assessment has been split between two running days.

TABLE 2. Performance in auditory processing tests.

Answers test	Average right*	Standard deviation of correct answers *	Average of Errors*	Standard deviation of Errors *
Sorting	8,25	2,90	3,00	3,16
SSW	6,50	7,15	33,50	7,14
FPT	10,74	6,54	19,25	6,56
Binaural fusion test	7,10	2,76	17,90	2,74

Legend: SSW - Alternate Dichotic dissyllable; FPT - Pattern Frequency; BF - Binaural Fusion. All the responses that were different from the standard patterns were considered to be wrong; * gross values.

TABLE 3. Correlation between auditory processing and vocabulary of children with phonological disorders.

Groups	Semantic Field	Sorting	SSW	FPT	BF
	animals	0,63	-	-	-
	food	0,64	-	-	-
	means of transportation	0,67	-	-	-
DVU	professions	0,58	0,54	0,64	-
	places	-	-	-	0,50
	shape and colors	0,52	-	-	-
	toys and musical instruments	-	-	0,52	-
ND	means of transportation	-0,66	-	-	-
	places	-	-	-	-0,84
	animals	-0,59	-	-	-
	food	-	-0,72	-0,56	-
RP	means of transportation	-	-	-0,50	-
	professions	-0,60	-0,50	-0,64	-
	toys and musical instruments	-	-	-0,57	-

Legend: DVU - designation by the usual name; ND - non designation; RP - replacement process. Only the values of correlation ? 0.50 and p <0.05 were tabulated. Pearson's correlation statistical test was used.

Discussion

The results of this research match the hypothesis that children with PD have APD. It also showed that the lexical level can not be changed. During the evolution of language, the lexical and the phonological development are interconnected, even though there are individual variations6. However, as seen in this study, one of these developments cannot influence the other.

The results presented on the performance in the vocabulary of children with PD are in agreement with part of the literature, which shows no significant difference between children with deviant speech acquisition and children with normal speech acquisition4,18-19. However, this study does not agree with other authors that suggest there is a lexical alteration in children with PD7,20.

Among all the semantic fields, the field means of transportation was the only one that presented statistically significant correlation in all the three groups, DVU, ND and RP. However, the field profession was the one that was more influenced by poor performance on tasks of AP (Table 3). It is noteworthy that all the subjects in this research presented PD.

Except for the sorting, it was noted that there was low performance in the AP tests performed by the children in this study, which matches the hypothesis of this research that say children with phonological disorder may present alterations in the AP.

When the acoustic signal is degraded or when it is competitive, the APD may affect the comprehension, the speech, the hearing and the learning21-22. Considering two studies23-24, as well as the results of this research, this fact can be demonstrated, since the results on the vocabulary, although are not significant, are consistent with the performance on the processing tests.

The overall vocabulary performance, especially in the DVU, shows that its good performance can be also linked to high scores in the simplified processing assessment. The BF test is the one with the worst result, which demonstrates that it is the most difficult test for the children.

Furthermore, based on the result of the AP in these children with phonological disorders we can say that both of them could be closely correlated. This finding is corroborated by some studies7,25-27. However, the analysis of this finding was not performed, since it was not the objective of this research.

The relationship between AP and the lexical acquisition is very little explored, even in children with normal speech development. Nonetheless, some studies on language acquisition deal with the vocabulary5 ,7,11-13 ,22-23 ,29-30.

It is important to highlight that, clinically speaking, the phonological deviation may be present in children with APD, but, according to new researches, the number of words in their vocabulary cannot be changed during the clinical procedures, although there is a greater range of words to be used in treatment of children with abnormal BP and DF.

The good development of hearing skills and related structures, is extremely important for the speech and lexical acquisition 5,10-12, 23,27,29.

Conclusion

This study showed that children with phonological disorders may have APD. On the other hand, it also pointed out that these children's vocabulary is not as bad as expected. However, language acquisition and AP are interrelated in this age group, suggesting that the better the result of auditory processing assessments is, the better the performance in expressive vocabulary will be.

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