Eficácia da terapia para desvios fonológicos com diferentes modelos terapêuticos*****

Therapy effectiveness for phonological disorders with different therapeutic approaches

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*****Trabalho Realizado no Centro de Estudos de Linguagem e Fala (CELF) da UFSM.

Artigo Original de Pesquisa

Artigo Submetido a Avaliação por Pares

Conflito de Interesse: não

Recebido em 19.12.2007.
Revisado em 28.04.2008; 13.06.2008.
Aceito para Publicação em 28.07.2008.

Abstract
Background: phonological therapy. Aim: to evaluate the effectiveness of three different therapy models regarding changes in the phonological system of subjects with different phonological disorder (PD) severity levels. Method: the research group was composed by 66 subjects, 43 males and 23 females, with ages between 4:4 and 8:2 years, who were part of a school clinic database. All subjects were evaluated, before and after a period of 15 to 25 sessions of phonological therapy, using the Child's Phonological Assessment. Based on this assessment, the severity level of the PD was determined using the Percentage Consonants Correct - PCC, and by calculating the number of Non-Acquired Segments -NAS and the percentage of Acquired Segments (AS) after treatment. The subjects were treated using the following approaches: ABAB-Withdrawal and Multiple Probes, Modified Maximum Opposition and Modified Cycles Models. For the statistical analysis the T-Test was used with a significance level of 5%. Results: the statistical analysis indicated an increase in the PCC and in the percentage of AS, as well as a reduction in the number of NAS for all groups. These results were statistically significant for the majority of the groups. Conclusion: the results indicate that the three therapy approaches were effective in the treatment of children with PD, and were effective in treating different severity levels. Besides that, most of the changes occurred in the phonological system of the groups with more severe PD.
Key Words: Phonological Disorders; Speech; Speech Therapy; Speech Disorder.

Resumo
Tema: terapia fonológica. Objetivo: avaliar a eficácia do tratamento em três diferentes modelos de terapia quanto às mudanças no sistema fonológico de sujeitos com diferentes gravidades do Desvio Fonológico (DF). Método: a amostra constituiu-se de 66 sujeitos, com idades entre 4:4 e 8:2, sendo 43 do sexo masculino e 23 do feminino, integrantes do banco de dados de uma clínica escola. Todos foram avaliados, antes e após um período de 15 a 25 sessões de terapia fonológica, utilizando-se a Avaliação Fonológica da Criança, a partir da qual foi determinada a gravidade do DF conforme o Percentual de Consoantes Corretas - PCC, o número de Segmentos Não Adquiridos - SNA , e o percentual de Segmentos Adquiridos (SA) após o período de tratamento. Os sujeitos foram tratados pelos modelos ABAB-Retirada e Provas Múltiplas, Oposições Máximas Modificado e Ciclos Modificado. Posteriormente, realizou-se análise estatística dos dados, utilizando o Teste T para amostras iguais, considerando-se $p < 0,05$. Resultados: verificou-se um aumento do PCC e do percentual de SA, bem como redução do número de SNA em todos os grupos tratados pelos diferentes modelos de terapia. Estes resultados foram estatisticamente significativos para a maioria dos grupos. Conclusão: os resultados permitem afirmar que os três modelos de terapia aplicados foram eficazes no tratamento de crianças com DF, para as diferentes gravidades do desvio. Além disso, as maiores mudanças no sistema fonológico ocorreram para os grupos com DF de grau mais acentuado.
Palavras-Chave: Desvio Fonológico; Fala; Fonoterapia; Desordem de Fala.

Referenciar este material como:
Keske-Soares M, Brancalioni AR, Marini C, Pagliarin KC, Ceron MI. Therapy effectiveness for phonological disorders with different therapeutic approaches (original title: Eficácia da terapia para desvios fonológicos com diferentes modelos terapêuticos). Pró-Fono Revista de Atualização Científica. 2008 jul-set;20(3):153-8.

Introduction

The high incidence of phonological disorders (PD) contributed to the elaboration and application of different therapeutic models based on the linguistic theories. The applicability of these models and its effectiveness in the treatment of disorders in the development of the speech has been the subject of many studies. (Gierut, 1998; Almost and Rosenbaum, 1998; Keske-Soares, 2001; Mota et al., 2002; Pagan and Wertzner 2002; Silva et al., 2002; Garrett and Nye, 2004; Bagetti et al., 2005; Crosbie, Holm and Dodd, 2005; Williams, 2006; Mota et al., 2007).

The models ABAB - Withdrawal and Multiple Probes (Tyler and Figurski, 1994), Maximal Oppositions (Gierut, 1992; Bagetti, Mota and Keske-Soares, 2005), and the Modified Cycles Model (Tyler, Edwards and Saxman, 1987; Hodson, 2006) were applied to Brazilian Portuguese speakers, which could verify its applicability and effectiveness (Keske-Soares, 1996; Pereira, 1999; Keske-Soares, 2001; Mota and Pereira, 2001; Mota et al., 2002; Silva et al., 2002; Blanco, 2003; Barberena et al., 2004; Mota et al., 2005).

Williams (2000a) refers that the phonological system of a child, the number of missing sounds in the phonetic and phonological inventory and the incidence of the PD can contribute to choosing a more adequate therapeutic model and also it can contribute to the effectiveness of the treatment.

From this, the current work has as its objective to compare the effectiveness of the treatment in three different therapy models taking into consideration the phonological changes in different incidences of the PD when making reference to the Percentage of Consonants Correct (PCC) and the non-acquired segments (NAS) at the beginning and in the end, and the Percentage of Acquired Segments (AS).

Method

This study was carried out through the database of a Center of Studies about the Language and Speech (CSLS), of one Federal Institution of Superior Teaching, with the project approved by the Committee of Ethics in Institutional Research (CEIR) on the number 046/02. The free and clarified term of consent signed by the parents or by the tutors giving the permission to use the data in the evaluation of future researches.

The sample was constituted of 66 subjects, 43 males and 23 females with ages between 4:4 and 8:2. These subjects were submitted to the phonological evaluations before the treatment such as comprehensive and expressive language; repetitive-articulator test; stomatognatic system evaluation; psychomotor evaluation; listening discrimination, and the phonological evaluation of the child - (PEC) (Yavas, Hernandorena e Lamprecht, 1991). Besides this, they were submitted to Otorhinolaryngologic, audiological and neurological evaluations.

In the phonological evaluation it was carried out the collection, transcription and analysis of the speech data and later, it was determined the severity of PD which was calculated from the Percentage of consonants correct- PCC (Shriberg e Kwiatkowski, 1982).

The severity of the PD is classified by the PCC as: Moderate Disorder (MD), PCC of 86 to 100%; Mild-Moderate (MMD), PCC between 66 to 85%; Moderate-Severe Disorder (MSD), PCC of 51 to 65%; and Severe Disorder (SD), PCC smaller than 50%.

It was also verified the number of Non-Acquired Segments (NAS) in the phonological system. It was considered the absent segment the one whose percentage of correct production was inferior to 40%. Partially acquired segment, the one with percentage values between 40% and 79 % (Bernhardt, 1992), and both classified as Non-Acquired Segment (NAS). The Acquired Segments, according to Lamprecht (2004) are the ones that show percentage superior to 80%.

As discretion of inclusion, the subjects should present: alterations only in the phonological aspect; have received phonological treatment in a period of 15 to 25 sessions in one of the studied models (ABAB- Withdrawal and Multiple Probes; Modified Cycles Model and Modified Maximal Opposition). The same subjects didn't present auditive alterations, phonetic distortions, complaints about school, or other problems that could interfere in the treatment for the phonological disorders.

Each subject received phonological treatment from a therapist-trainee from the Phonological Course during all the therapeutic process.

In the model ABAB- Withdrawal and Multiple Probes it was treated 36 subjects, being 4 with SD, 7 with MSD, 17 with MMD and 8 with MD. In the Modified Maximal Opposition Model, 17 subject were treated, 1 with DS, 4 with DMS, 9 with DMM and 3 with DM. In the Modified Cycles Model it was treated 13 subjects, being 3 with MSD, 9 with MMD and 1 with MD. In this model there wasn't a subject with SD.

The ABAB- Withdrawal and Multiple Probes Model (Tyler and Figursky, 1994), it is based on the implicational hierarchy of distinctive traces, using the Implicational Model of Complexity of Traces (Mota, 1996) to the selection of the treatment targets. The therapy starts with the collection of speech data (A1), followed by the cycles of treatment (B1) with the duration of 9 sessions and, in the sequence occurs the Withdrawal Period (A2) without direct treatment on the target-sound, with the duration of 5 sessions. This way, the treatment successively goes, with another cycle of treatment (B2), followed by another Withdrawal Period (A3). This model still has the Multiple Probes that includes the Generalization Probe (GP) and the Basic-Target Probe (BTP). The first one has as its objective to verify the generalization of the worked traces to the sounds not trained and it is carried out during the Withdrawal Period. The second is used to evaluate the progress of the target-sound during the cycle of the treatment. In this model all the subjects were submitted to 2 cycles of treatment (18 sessions), being worked no more than two sounds.

The Modified Maximal Opposition Model (Bagetti, Mota and Keske-Soares, 2005) contrasts words with just one phoneme however they are different in one or more distinctive trace. In the beginning and in the end of each session, it is done the auditory bombardment. Initially, the minimal pairs are worked by the imitation of the therapist production. When the child gets 80% or more of correct production, it is started the phase of spontaneous production that continues until the end of the considered therapeutic process. After 5 sessions of therapy, it is carried out a survey to verify the generalizations. After a period of 20 to 25 sessions of therapy (without counting the survey ones), the phonological system of the child is evaluated again through PEC, with the purpose of verifying if there was progress in the treatment. In this model the subjects were submitted to 3 to 5 cycles of treatment, with variations of 15 to 25 sessions, being worked 2 to 10 target-sounds.

The Modified Cycles Model (Tyler, Edwards and Saxman, 1987) when there are many phonological processes in the speech. Each cycle has the duration of three weeks and in each week; it is approached one phonological process. In each process, one or two target-sounds are focused on and each one is worked during one session of therapy, working with the other sound in the following session. If the child got only 20% of correction or less on the stimulus words of that session, the target is repeated. In the end of three weeks, it is carried out a survey, with the purpose of verifying the generalizations got. The child has to reach a percentage bigger than 50% of correct production, so, the second cycle starts, using the same phonological processes of the first, however with the level of sentences. In the beginning and in the end of each session it is done the auditory bombardment. In this model the subjects were submitted from 2 to 3 cycles of treatment, with variations of 15 to 23 sessions, being worked 6 to 18 target-sounds.

Having as an exception, in the ABAB-Withdrawal and Multiple Probes Model the target is stimulated in nine sessions, the others permit that each session can be repeated more than one time when there was no success in the previous session. After a period of 15 to 25 sessions of therapy, the subjects were evaluated again with the applying of the instrument PEC (Yavas, Hernandorena and Lamprecht, 1991). It was calculated again the PCC (Shriberg and Kwiatkowski, 1982), determining the NAS number of the phonological system and the percentage of Acquired Segments (SA).

It was compared the initial and final number of PCC and NAS, as well the percentage of AS after a period of phonological therapy, in the three different models of therapy. The data collected were tabulated and submitted to statistic analysis, using the Test T to equal samples, taking into consideration $p < 0,05$.

Results

In the Table 1 it is presented the description of the comparison between the initial and final PCC, the number of NAS and the percentage of AS after the period of studied treatment in the different models of therapy considering the PD severity. It was noticed an increasing of final PCC in all groups with different severities of PD treated by different models, being statistically significant. However, this was not verified to the MD treated by the Modified Maximal Opposition Model, and to the MSD submitted to the Modified Cycles Model.

In relation to the number of NAS, it happen a reduction of this value, because the subjects added segments to their phonological systems. In all the groups treated with different therapeutic models. It was not verified a statically and significant difference between the SD and MSD submitted, respectively, to the Models ABAB-Withdrawal and Multiple Probes and Modified Cycles.

Besides this, the acquisition of segments in the phonological system of the subjects was more representative when the severity of PD was bigger, presented by the groups treated with the Models ABAB- Withdrawal and Multiple Probes and Modified Cycles, according to the number of absent sounds. In the group submitted to the Modified Maximal Opposition Model, it was verified a bigger acquisition of segments in the MMD. The results did not differ statistically between the severities in all the models researched due to its quantity of acquired sounds among the different severities of PD being similar.

The Table 2 presents the description of the comparison of the severity of PD in the different models considering the initial and final PCC. It is verified an inversely proportional relation between the severity and the PCC. It is possible to observe that existed, in the groups treated by the Models ABAB-Withdrawal and Multiple Probes and Maximal Oppositions, a more expressive increase in the final PCC of the SD in relation to the other degrees.

In the Modified Cycles Model, the increase of the PCC was bigger for the MMD. The difference between the initial and final PCC in all the models researched was smaller for the MD, because, in this group, it was observed a smaller quantity of segment to be acquired. The contrary is observed in the SD, where this difference is bigger than in the other degrees, because there is a bigger number of segments to be acquired in the phonological system.

The Table 3 presents the description of the comparison of the PD severity as for the initial and final NAS in each therapeutic model researched. It is observed the directly proportional relation between the severity and the number of NAS in the phonological system of the children, because if the severity of the PD is bigger, bigger is the quantity of NAS in the phonological system for the three studied therapeutic models. In the group treated by the ABAB-Withdrawal and Multiple Probes, the subjects with SD presented a bigger acquisition of segments than the other groups and in the Modified Maximal Opposition it was verified this in the MMD. In the group treated by the Modified Cycles, it was observed this improvement in the subjects with MSD, being the results statistically significant.

TABLE 1. Percentage of Consonants Correct, number of non-acquired segments and percentage of acquired segments in three models of phonological therapy.

	ABAB – Withdrawal and Multiple Probes (n=36)				**Modified Maximal Opposition (n = 17)**				**Modified Cycles (n=13)**		
	SD (n=4)	MSD (n=7)	MMD (n=17)	MD (n=8)	SD (n=1)	MSD (n=4)	MMD (n=9)	MD (n=3)	MSD (n=3)	MMD (n=9)	MD (n=1)
PCCi	29,0 (4,2)	60,1 (3,2)	74,5 (5,2)	87,1 (1,8)	48,4 *	59,6 (4,0)	74,6 (6,3)	92,4 (1,8)	62,7 (4,4)	79,5 (6,6)	94,0 *
PCCf	63,9 (14,4)	75,5 (8,8)	84,6 (6,5)	96,1 (1,6)	74,1 *	78,4 (11,5)	92,1 (10,3)	95,4 (2,5)	76,1 (13,5)	97,7 (7,4)	97,9 *
P	**0,01**	**0,00**	**0,00**	**0,00**	*****	**0,01**	**0,00**	**0,05**	**0,09**	**0,00**	*****
NASi	15,5 (4,2)	10,7 (1,6)	6,8 (2,2)	2,7 (1,5)	13,0 *	9,2 (1,2)	6,7 (2,3)	3,7 (1,1)	10,7 (1,5)	4,4 (2,6)	3,0 *
NASf	9,7 (3,6)	7,3 (4,0)	3,5 (2,4)	0,6 (0,9)	10,0 *	5,7 (2,9)	2,0 (2,6)	1,7 (0,6)	5,0 (3,6)	2,4 (3,2)	1,0 *
P	**0,08**	**0,04**	**0,00**	**0,00**	*****	**0,01**	**0,00**	**0,04**	**0,06**	**0,04**	*****
	5,7 (6,4)	3,4 (4,5)	3,2 (3,1)	2,4 (1,5)	3,0 *	3,7 (1,9)	4,7 (1,7)	2,0 (1,0)	5,7 (3,8)	2,1 (2,8)	2,0 *
P			**0,59**				**0,14**			**0,25**	

Subtitle: PCC: percentage of consonants correct; PCCi: initial percentage of consonants correct; PCCf: final percentage of consonants correct; NAS: non-acquired segments; NASi: initial non-acquired segments; NASf: final non-acquired segments; AS: acquired segments. * Non-representative number of subjects for the statistics analysis.

TABLE 2. Severity of phonological disorder in each therapeutic model considering the Initial and Final Percentage of Consonants Correct

	Therapeutic Models					
	ABAB-Withdrawal and Multiple Probes		Maximal Opposition		Modified Cycles	
Severity	**PCC_i**	**PCC_f**	**PCC_i**	**PCC_f**	**PCC_i**	**PCC_f**
Severe	29,0 (4,2)[a]	63,9 (14,4)[a]	48,4 (*)[a]	74,1 (*)[a]	**	**
Moderate-Severe	60,1 (3,2)[b]	75,5 (8,8)[a]	59,6 (4,0)[a]	78,4 (11,5)[a]	62,7 (4,4)[a]	76,1 (13,5)[a]
Mild-Moderate	74,5 (5,2)[c]	84,6 (6,5)[b]	74,6 (6,3)[b]	92,1(10,3)[a]	79,5 (6,6)[b]	97,7 (7,4)[a]
Mild	87,1 (1,9)[d]	96,1 (1,6)[c]	92,4 (1,8)[c]	95,4 (2,5)[a]	94,0 (*)[b]	97,9 (*)[a]
P	**0,00**	**0,00**	**0,00**	**0,07**	**0,00**	**0,05**

Subtitle: PCC: percentage of consonants correct; PCCi: initial percentage of consonants correct; PCCf: final percentage of consonants correct; # Equal Letters don't differ statistically; ## Different letters differ statistically; * Non-representative number of subjects for the statistics analysis; ** Inexistence of data for the studied degree.

TABLE 3. Comparison of severity in the three therapeutic models considering the initial and final non-acquired segments.

	Therapeutic Models					
	ABAB-Withdrawal and Multiple Probes		Maximal Opposition		Modified Cycles	
Severity	**NASi**	**NAS_f**	**NAS_i**	**NAS_f**	**NAS_i**	**NAS_f**
Severe	15,5 (4,2)[a]	9,7 (3,6)[a]	13,0 (*)[a]	10,0 (*)[a]	**	**
Moderate-Severe	10,7 (1,6)[a]	7,3 (4,0)[a]	9,2 (1,2)[a]	5,7 (2,9)[a]	10,7 (1,5)[a]	5,0 (3,6)[a]
Mild-Moderate	6,8 (2,2)[c]	3,5 (2,4)[b]	6,7 (2,3)[a,c]	2,0 (2,6)[a]	4,4 (2,6)[b]	2,4 (3,2)[a]
Mild	2,7 (1,5)[d]	0,6 (0,9)[b,c]	3,7 (1,1)[b,c]	1,7 (0,6)[a]	3,0 (*)[a,b]	1,0 (*)
P	**0,00**	**0,00**	**0,00**	**0,01**	**0,00**	**0,27**

Subtitle: NAS: non-acquired segments; NASi: initial non-acquired segments; NASf: final non-acquired segments; AS: acquired segments; # Equal Letters don't differ statistically; ## Different letters differ statistically; * Non-representative number of subjects for the statistics analysis;** Inexistence of data for the studied degree.

Discussion

From the analysis of the PCC, the initial and final NAS and the AS percentage in the phonological system in the different severities of PD, in the three models of therapy, it was observed that these ones had improvement during the analyzed period. Such findings agree with the studies of Mota et al (2002) and Pagan and Wertzner (2002), where the applying of these models presented improvement in the phonological system.

In the analysis of the initial and final PCC, it was verified the increase in all severities in the different models. However, the increase was bigger in the smaller values of PCC, in other words, for the SD, in the Models ABAB- Withdrawal and Multiple Probes and Modified Maximal Opposition. This agrees with the study of Pagan and Wertzner (2002) that, when treating the subjects with PD with the Maximal Opposition Model, it was verified bigger evolutions to the ones who presented lower values of PCC.

Blanco (2003) applied the Modified Cycles Model in subjects with MSD, MMD and MD and she verified that the ones with MMD presented bigger evolution of PCC. According to the author, such findings can be justified by the fact that the MMD is not so compromised in relation to the more severe disorders, nor softly altered in relation to the one with MD, being them more susceptible to changes.

This discordance in relation to the improvement of the PCC in the different degrees can be related to the models of treatment that were used. Williams (2000a) considered that certain models can be more effective for the specific degrees of PD. Besides this, the results got can be justified by the fact of the sample of Blanco (2003) which was not composed by subjects with SD.

In the groups treated with different models of phonological therapy, it happened a reduction in the number of NAS in their phonological system, which agrees with the studies of Mota and Pereira (2001); Mota et al. (2002); Blanco (2003); Barbarena et al. (2004) and Mota et al. (2007), that reported the increase of segments in the phonological system after the therapy using the phonological models, and consequently the reduction in the number of NAS.

Considering the Models ABAB- Withdrawal and Multiple Probes and Modified Cycles, the reduction in the number of NAS was bigger in the groups with more accentuated severity, because they were more compromised and they needed to establish a bigger number of segments in the phonological system and bigger distinctions of traces (Barbarena, 2005).

However, in the group of subjects submitted to the treatment with the Modified Maximal Opposition Model, the biggest reduction was observed on the MMD, that establish, consequently, more segments in their phonological system, corroborating with the findings of Bagetti (2005), where the biggest changes happened in the MSD and MMD.

The results show that all groups treated with the different models of therapy present an increase in the number of AS after a period of studied treatment. Nevertheless, the statistic analysis showed that there isn't a significant difference between the models of therapy applied. This shows that all these models were equally effective in the treatment considering the variable studied. This finding agrees with the study of Mota et al. (2007) in which it were applied three different therapeutic models in the treatment of PD and all of them promoted improvements in the phonological system of the treated groups, having no difference among them.

In relation to the PCC change, when analyzed by the therapeutic model applied, however having an increase on the final PCC to all models, it was observed that the change was statistically significant only for the ABAB-Withdrawal and Multiple Probes. These findings can be justified by the fact that the group treated with this model presents a bigger number of subjects with a more accentuated degree of PD.

When making reference to the NAS ones, it is observed that when it is bigger the severity of PD more NAS the subjects presented in their phonological systems in all the studied models. Supporting the current study, exists the work of Williams (2000b) that examines the three groups in relation to their severities and it was observed a more evident result for the subjects who had more to learn from the intervention, in other words, in the more severe cases.

Conclusion

The findings of this survey allow concluding that the three models of therapy applied were effective in treatment of different severities of phonological disorder. Besides this, it was verified that the bigger changes occurred in the phonological system happened in the groups that presented a more severe degree of PD, a smaller PCC and a bigger number of non-acquired segments in their phonological system.

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