THE INFLUENCE OF THE CHOICE OF TARGET SOUNDS AND THERAPY MODEL IN CHILDREN WHO PRESENT DEVOICING

A influência da escolha dos sons-alvo e do modelo de terapia em crianças que apresentam dessonorização

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ABSTRACT

The purpose of this paper was verifying the ABAB-Withdrawal and Multiple Probes Model effectiveness in the phonological system restructuring of children who present devoicing and the influence of target sounds choice in this process. Seven children were selected from a data basis of a federal institution. All of them were authorized to participate by their guardians and had to present devoicing before the intervention, being treated after by ABAB-Withdrawal and Multiple Probes Model. Speech and additional evaluations were performed to obtain the diagnosis. The disorder severity was obtained by Percentage of Consonants Correct-Revised. The subjects presented mild-moderate or moderate-severe disorders, the ages ranged from 5 to 7 years and 1 month. Three of them were treated with liquids and four with /ʒ/. The speech samples from the first two sessions of withdrawal of the first therapy cycle were analyzed using the Mann-Whitney U test. The means between initial and final evaluations or the evolution means between the groups were compared. There were significant increase of the sounds acquired number and the correct production of fricatives. However, the same didn't occur with the Percentage of Consonants Correct-Revised. The plosives and liquids consonants didn't demonstrate significant increase of correct production either. In the comparison between the groups treated by liquids versus treated by fricatives, there was no difference to the variables. It follows that the ABAB-Withdrawal and Multiple Probes Model improves some aspects of phonological systems of children who present devoicing. Nevertheless, the target sounds for therapy don't influence this process.

KEYWORDS: Child; Speech; Articulation Disorders; Speech, Language and Hearing Sciences; Speech Therapy

INTRODUCTION

In the speech disorder, the children present a kind of stagnation in the phonological acquisition in certain point of development. This occurs because the absence or difficulty to stabilize some sounds, distinctive features and/ or syllable structures [1].

In these cases, considering that children don't know the production of a certain sound, they need to use strategies that allow them to keep conversations. So, they use repair strategies or phonological processes. They use this resource (production of the wrong sound or sound omission) in place of the sound and/or syllable structure that they don't know yet [2].

The devoicing is one of the most prevalent repair strategies[3] and most difficult to overcome. It's characterized by substitution of a voiced sound by its devoiced pair, like /v/ à [f] or /d/ à [t], for example. This strategy is one of the most harmful to the phonological organization, because it can occur in many sounds in different classes and complexity levels, damaging the child speech inteligibility[4-6]. Furthermore, these changes that affect so many

sounds can affect the writing abilities too, causing difficulties in literacy, impairing reading and spelling.

Based on the above, researches that seek the best strategies to resolve this difficulty are very important. The studies can be about the choice of therapeutic model, target words or target sounds; or even in techniques/ articulatory exercises, among others.

So, the purpose of this study is to verify ABAB-Withdrawal and Multiple Probes Model effectiveness in the phonological system restructuring of children who present devoicing and the influence of target sounds choice in this process.

■ CASE REPORT

The speech data of these children came from a database of a federal institution of higher education and took part of two projects approved by its Ethical Research Committee under the numbers 052/04 and 23081.0117157/2009-63.

This research is a case report with seven children who presented devoicing and were treated by therapeutic model ABAB-Withdrawal and Multiple Probes[7].

All children verbally consented their participation in the study and their guardians signed the Consent Form of the research project.

The inclusion criteria were: to have problems only with the phonological level of language, to be aged between 4:0 and 8:0, not to have been previously submitted to speech therapy, to have the repair strategy of devoicing to one sound at least, with percentage equal to or greater than 40% [8].

Pre-treatment assessments performed

As project routines, the following assessments were performed to establish speech disorder diagnosis: interview with the parents and/or the guardians, phonological evaluation, evaluation of the stomatognathic system, of language, of vocabulary, of phonological awareness skills and of auditory processing. Moreover, the subjects were led to audiological and otorhinolaryngologic assessment to dismiss organic factors that could determine the speech errors. The interview aimed to eliminate cognitive and/or neurological factors, which might interfere in the phonological development.

The collection of speech data was held through "*Avaliação Fonológica da Criança*" (AFC) [9]. The

speech data were recorded and phonetically transcribed by three judges. At least two of the three transcriptions should be coincidental. When there was no agreement, the word was excluded from the sample. Based on those data, the contrastive analysis was held to determine the phonetic and phonological inventory of the children, using the following criteria: occurrence from 0 to 39% - absent or not acquired sound (NA); occurrence from 40% to 79% - partially acquired sound; occurrence equal to or greater than 80% - acquired sound [8].

Afterwards, the PD's severity was calculated from the Percentage of Correct Consonants- revised (PCC-R)[10]. This calculation classifies the deviations in mild disorder (MD) – PCC-R between 86% e 100%, mild-moderate disorder (MMD) - PCC-R between 66% and 85%, moderate-severe disorder (MSD) - PCC-R between 51% and 65%, and severe disorder (SD) - PPC-R equal to or lower than 50%.

Subjects Selection

The data of all 46 subjects from a federal-institution's database, who were treated by ABAB-Withdrawal and Multiple Probes, were analyzed. Initially, one verified the number of children among the 46, who devoiced sounds previously to the speech therapy beginning.

Thus, 11 children were pre-selected from this initial criterion. From these 11 children, one observed that one presented SD, six presented MSD and four presented MMD. So, using the severity disorder as criterion, one opted for excluding the children with SD to standardize the sample.

From the ten children also included, one wanted to know what target-sounds were used in the first therapy cycle. So, four children were treated with /ʒ/; two were treated with /g/ (but one of them dropped out of treatment before the first cycle conclusion); one child was treated with /z/ and three children were treated with liquid sounds, being one with /r/, one with /λ/ and one with /R/. To compare the target-sounds, one opted for excluding the children treated with /g/ and /z/, so that not to have only one child in each group. So, two groups were formed: one with four children treated with /ʒ/ and one with three children treated with liquid sounds.

Figure 1 shows the profile of the included children.

Subject	PCC-R	Age	Non acquired sounds in PS (IA)	Target sound
S1	69%	7:0	/b/, /d/, /g/, /v/, /s/, /z/, /ʃ/, /ʒ/, /l/, /ʎ/, /r/, [tʃ], [dʒ]	/ʎ/
S2	62,1%	5:5	/b/, /d/, /k/, /g/, /v/, /z/, /ʃ/, /ʒ/, /l/, /ʎ/	/r/
S3	62,1%	5:11	/k/, /g/, /s/, /z/, /ʃ/, /ʒ/, /l/, /ʎ/, /r/, /R/	/R/
S4	82,9%	7:1	/b/, /d/, /g/, /z/, /ʃ/, /ʒ/, /ʎ/, [dʒ]	/ʒ/
S5	55,7%	6:8	/b/, /d/, /g/, /f/, /v/, /s/, /z/, /ʃ/, /ʒ/, /l/, /ʎ/, /r/, /R/, [dʒ]	/ʒ/
S6	64,1%	5:0	/b/, /d/, /g/, /v/, /z/, /ʃ/, /ʒ/, /l/, /ʎ/, /r/, /R/, [dʒ]	/ʒ/
S7	68,4%	5:1	/b/, /d/, /g/, /v/, /s/, /z/, /ʃ/, /ʒ/, [dʒ]	/ʒ/

Legend: PCC-R = Percentage of correct consonants-revised; PS = Phonological System; IA = Initial Assessment.

Figure 1 – Subjects profile

Therapeutic Procedures

The therapeutic procedures to all subjects were performed based on the structure proposed by the authors of ABAB-Withdrawal and Multiple Probes Model[7]. The children were treated by different speech therapists, students from the last year of Speech Pathology graduation or master's degree students in Human Communication Disorders.

The ABAB-Withdrawal and Multiple Probes therapy begins with the collection and analysis of speech data (A1) to determine the target-sound. The intervention itself begins with the first treatment cycle (B1), which lasts nine sessions, performed in five weeks (two 45-minutes-week-sessions). During the first cycle of treatment, target sound follow-ups are performed through the Basic Target Proofs (BTP – naming the pictures used in treatment and other 24 pictures which contained the target-sound in different positions and syllable structures). After the first cycle, one performs the withdrawal periods (A2) – without direct interventions with the target-sound (five sessions). In that period the phonological system surveys occurs, using the Generalization Probes (GP) in which speech samples are collected through naming and spontaneous speech. In the beginning and at the end of each therapy session, the auditory bombardment of 15 words is read to the child. If the child has a correct production percentage of target sound greater than 50% in BTP, it's possible to change the target sound in the following treatment cycle[7].

One analyzed the assessments performed after one therapy cycle plus six withdrawal sessions, thus one considered the AFC (naming) performed in the fourth withdrawal session and the spontaneous speech of the fifth session of withdrawal. One couldn't observe more than one therapy cycle, because the target sounds were different among the subjects in the second cycle. The statistical analysis was performed through the U test of Mann-Whitney, comparing the means between initial assessment (pre-therapy) and final (the last GP) or the evolution means between the groups. The significance level considered in the tests was 5%.

■ RESULTS

Table 1 has the number of acquired sounds in the General phonological system, considering the 19 sounds of Brazilian Portuguese and the two allophones [tʃ] and [dʒ] pre and post-treatment, showing that was statistical significance in the therapeutic evolution.

Table 1 – General phonological system of subjects pre and post-therapy

Subject	Target sounds	Number of sounds acquired in GPS - IA	Number of sounds acquired in GPS - FA	P value
S1	/ʎ/	8	11	
S2	/r/	9	20	
S3	/R/	11	13	
S4	/ʒ/	13	18	p = 0.0409*
S5	/ʒ/	7	8	
S6	/ʒ/	11	15	
S7	/ʒ/	11	20	
Mean		10	15	

Legend: GPS = General Phonological System; IA = Initial assessment; FA = Final assessment; * = statistically significant results. Statistical Test used: U Mann-Whitney, significance level adopted: 5%.

Table 2 – Percentage of correct consonants-revised of subjects pre and post therapy

Subject	Target sound	PCC-R pre therapy	PCC-R post therapy	P value
S1	/ʎ/	69%	73,5%	
S2	/r/	62,1%	87,3%	
S3	/R/	62,1%	65,6%	
S4	/ʒ/	82,9%	90,4%	p= 0,0639
S5	/ʒ/	55,7%	63,8%	
S6	/ʒ/	64,1%	71,8%	
S7	/ʒ/	68,4%	81,4%	
Mean		66%	76,2%	

Legenda: PCC-R = Percentage of correct consonants-revised. Statistical Test used: U Mann-Whitney, significance level adopted: 5%.

Table 2 compares pre and post-treatment assessments through PCC-R. No difference was found.

In Figure 2, one observes the average percentage of correct production of stops pre and post treatment. The *p* value was 0,3379, so it didn't have significant increase in the average percentage of stops correct production.

In Figure 3, one observes the average percentages of correct production of fricatives pre and post treatment. The *p* value was 0,0181, thus it had significant increase in the average percentage of fricatives correct production.

In Figure 4, one observes the average percentages of liquids correct production pre and post treatment. The *p* value was 0,1599, thus, the average percentage of increase of liquids correct production wasn't significant.

The average percentages of nasals correct production wasn't evaluated because all children produced them correctly pre intervention.

In Table 3, all variables (number of sounds in general phonological system, PCC-R, increase average percentage of stops, fricatives and liquids) are presented to compare the therapeutic evolution between the groups 1, treated by liquids and 2, treated by the fricative /ʒ/. No significance was found to all variables between the groups.
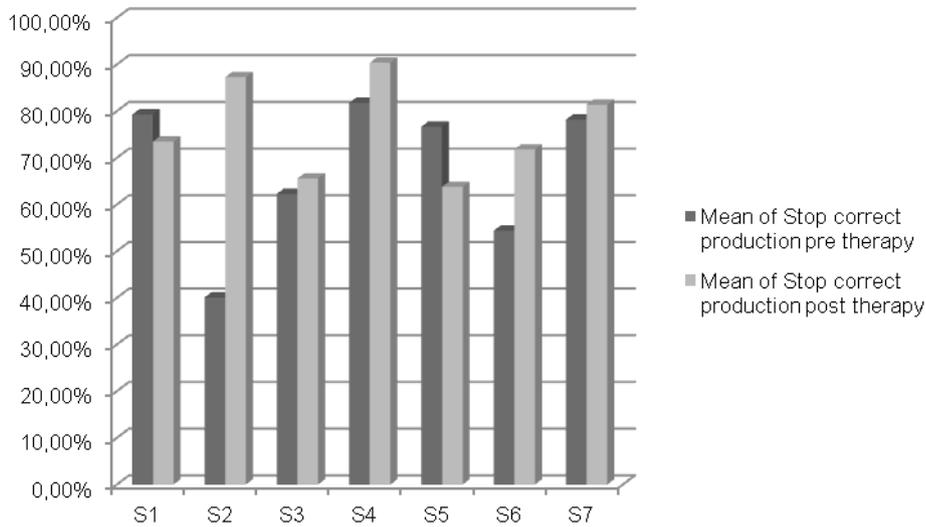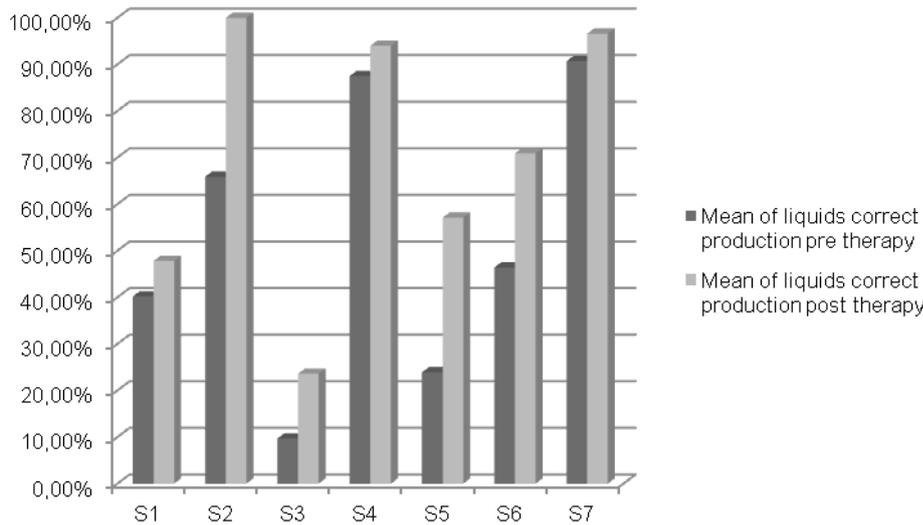
Statistic test used: U Mann-Whitney, significance level adopted: 5%.

Figure 2 – Graphic of mean percentage of stop correct production increase pre and post therapy
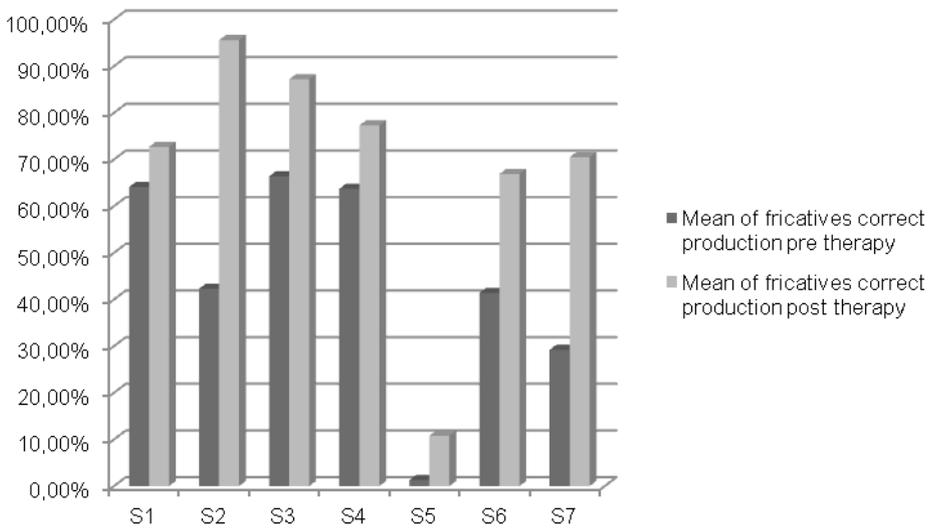
Statistic test used: U Mann-Whitney, significance level adopted: 5%.

Figure 3 - Graphic of mean percentage of fricative correct production increase pre and post therapy

Statistic test used: U Mann-Whitney, significance level adopted: 5%.

Figure 4 - Graphic of mean percentage of liquid correct production increase pre and post therapy

Table 3 – Differences of therapeutic evolution between the groups according to sound/class treated

Variable	Group	Mean	Difference between the groups	P values
Number of acquired sounds in GPS	Treated with liquid	5,3	0,6	p = 1,0
	Treated with /ʒ/	4,7		
Increase percentage in PCC-R	Treated with liquid	11,1%	2%	p = 0,4795
	Treated with /ʒ/	9,1%		
Increase percentage in correct production of stops	Treated with liquid	27,4%	24,9%	p = 0,8597
	Treated with /ʒ/	2,5%		
Increase percentage in correct production of fricatives	Treated with liquid	27,6%	12,5%	p = 1,0
	Treated with /ʒ/	40,1%		
Increase percentage in correct production of liquids	Treated with liquid	18,5%	1%	p = 0,4795
	Treated with /ʒ/	17,5%		

Legend: GPS = General Phonological system; PCC-R = Percentage of correct consonants-revised. Statistical test used: U Mann--Whitney, significance level adopted: 5%.

■ DISCUSSION

Based on Table 1 and Figure 3, one can assure that ABAB-Withdrawal and Multiple Probes therapeutic model [7] is effective in restructuring children's phonological system who devoice, because of the increase of correct production of the sounds in general. The same was observed in other researches that used this model [7,11,12].

But, regarding to PCC-R (Table 2), no statistical significance was observed between the initial and final assessments. This calculation corresponds to the sum of all sounds produced by the child. So, the increase in the number of children's acquired sounds, post therapy, doesn't necessarily imply significant increase in PCC-R, because it corresponds to a general percentage. In another research[13], the authors observed significant increase in PCC-R only in children who presented MD and not in children who presented MSD and MMD.

Also, no statistical significance was observed to the increase of the correct production of stops (Figure 2). This fact occurred because no child was treated with these target sounds. Nevertheless, one

could expect that there would be a generalization of the distinctive feature [+ voice] in children treated with the fricative /ʒ/, because all other voiced consonants in Portuguese are less complex than /ʒ/. This could also occur to children treated with liquids, in other words, a generalization to other sound classes[14,15].

As for the fricative consonants, one observed statistical significance in the increase of correct productions (Figure 3). This fact was expected, because four children were treated with fricative /ʒ/. So, the generalization inside a sound class occurred. For children treated with liquids, the generalization to other sound classes occurred [15]. These generalizations were also observed in other researches [6,11].

For liquids evolution, no statistical significance was observed (Figure 4). The increase percentages of correct productions of liquids were very similar between the groups. One could expect more evolution in the children treated with liquids[14], but it didn't occur. It's possible that the difficulties of liquid production have remained because this consonants are more difficult to acquire, they are the most complex in terms of acoustics and articulation and they suffer more repair strategies [3,12].

No variable, among those analysed, had statistical difference regarding to the target sounds of therapy (Table 3). This indicates that the improvement in the phonological system of children with devoicing is not influenced by this variable. Specifically, regarding the number of acquired sounds and increase in PCC-R, one could expect that one group was better than another, because both variables involve the phonological system in general.

Regarding to the percentage of increase in sound classes, the children treated with /ʒ/ could have had higher stop percentages (because the feature [+voice]) and fricatives (because they are from the same sound class) [15] than the children treated with liquids. On the other hand, one expected that the children treated with liquids had higher percentages of increase in liquids correct production, because they are from the same sound class [15].

Stops and liquids didn't present any statistically significant increase in any group. The incorrect production of stops may have remained because these consonants suffer devoicing. Devoicing corresponds to a difficulty in coordinating the glottic and supraglottic events. So, it's very difficult to overcome this strategy which has high prevalence [3-6]. The permanence of incorrect production of liquids, as already mentioned, could occur because its late acquisition, with complex productions and occurrence of too much substitutions and omissions [3,12].

This research brings some benefits for treating devoicing, and the choice of therapeutic model and of the target sounds as well. However, the data about devoicing here presented and others already published need to be enhanced to generate more specific information. Given the above, it would be important to carry out other studies testing other therapeutic models in the treatment of devoicing, with more subjects and comparing other target sounds like stops, other fricatives or even, the affricates.

■ **FINAL CONSIDERATIONS**

The presented results can't be generalized because this research is a study case with only seven children. Even though, it could be observed that the therapeutic model ABAB-Withdrawal and Multiple Probes[7] is effective in some aspects in treatment of children who present devoicing and choice of target sounds of therapy doesn't influence in this process, because both children treated with the fricative /ʒ/ and those treated with liquids showed therapeutic evolution in the same proportion.

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RESUMO

O objetivo deste estudo foi verificar a eficácia do Modelo ABAB-Retirada e Provas Múltiplas na reestruturação do sistema fonológico de crianças com dessonorização e a influência da escolha dos sons-alvo neste processo. Sete crianças foram selecionadas de um banco de dados de uma instituição federal. Todas estavam autorizadas por seus responsáveis a participar e deveriam apresentar dessonorização previamente à intervenção, sendo tratadas após pelo modelo ABAB-Retirada e Provas Múltiplas. Realizaram-se avaliações fonoaudiológicas e complementares para a obtenção do diagnóstico de desvio fonológico. A gravidade do desvio foi obtida por meio do Percentual de Consoantes Corretas-Revisado. Os sujeitos apresentavam desvios levemente-moderado ou moderadamente-grave, as idades variaram entre 5 anos e 7 anos e 1 mês. Três foram tratados com líquidas e quatro com a fricativa /ʒ/. Analisaram-se as amostras de fala das duas primeiras sessões de retirada do primeiro ciclo de terapia, utilizando-se o teste U de Mann-Whitney. Compararam-se as médias entre avaliação inicial e final ou as médias de evolução entre os grupos. Houve aumento significante do número de sons adquiridos e das produções corretas das fricativas. Porém, o mesmo não ocorreu com o Percentual de Consoantes Corretas-Revisado. As consoantes plosivas e líquidas também não demonstraram aumento significante de produções corretas. Na comparação entre os grupos tratado com líquidas *versus* tratado com a fricativa /ʒ/, não houve diferença para nenhuma das variáveis. Conclui-se que o modelo ABAB-Retirada e Provas Múltiplas melhora em alguns aspectos os sistemas fonológicos de crianças com dessonorização. Já os sons-alvo para terapia não influenciam neste processo.

DESCRITORES: Criança; Fala; Transtornos da Articulação; Fonoaudiologia; Fonoterapia

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