PHONOLOGICAL CHANGES OBTAINED IN THE TREATMENT BASED ON THE MULTIPLE OPPOSITION APPROACH

Mudanças fonológicas obtidas no tratamento pelo modelo de oposições múltiplas

Marizete Ilha Ceron [(1)], **Márcia Keske-Soares** [(2)]

ABSTRACT

Purpose: to analize the phonological changes resulting from the application of the Multiple Opposition Approach concerning the Percentage of Consonants Correct – Revised (PCC-R), on the number of phonemes that were acquired in the phonological inventory and on the types of generalization. **Method:** the researched group included five subjects with phonological disorders. It was carried out phonological and complementary assessments. The speech data were transcribed and analyzed through the phonological assessment pre and post-treatment. The subjects underwent the treatment based on the Multiple Opposition Approach. **Results:** an increase in PCC-R, number of acquired phonemes and presence of different types of generalization in the final assessment, which was statistical difference, except the results of the generalization within sound class were not statistical difference in the pos-treatment. **Conclusion:** the Multiple Oppositions Approach was effective for the treatment of Brazilian Portuguese speakers because the model provided changes in the PCC-R, number of acquired phonemes and some generalizations (to lexical items non used during treatment, to another position of the word, inside a sound class and to other sound class).

KEYWORDS: Speech; Speech Disorders; Speech Therapy; Generalization, Response

■ INTRODUCTION

The purpose of phonological intervention is to teach children how to develop contrast among words, through contrastive pairs[1,2]. Several approaches for phonological intervention have been created during the last decades. Some of these models (Modified Cycles Model, Maximal Oppositions, ABAB--Withdrawal and Multiple Probes) are often used with children who are native speakers of Brazilian Portuguese[3-9]. However, the Multiple Opposition Approach is used in only a few studies[10-12] in Brazil to treat phonological disorders.

Children with phonological disorders present many phoneme omissions and substitutions when they speak. When the contrastive function of several sounds is absent, the result is the presence of homonyms, which happen when two or more words are produced in the same way, but they have different meanings[13]. It results in reduction of speech intelligibility and there is communication breakdown.

These children replace many phonemes of the adult system by just one sound[13-15]. Through the Multiple Opposition Approach, the child faces several sounds simultaneously, considering the replaced phonemes and their successor. The intervention involves the selection of word pairs which contrast the child's altered productions with the target-sound, comparing each other[2].

This Multiple Opposition Approach is described in literature as an intervention model for children who present more severe disorders[14-16]. Its application in Brazilian Portuguese native speakers may increase the clinical performance of children who

(1) Speech-Language Pathologist; Doctoral Student of Human Communication Disorders at Universidade Federal de Santa Maria – UFSM, Santa Maria, RS, Brazil; Master in Human Communication Disorders at Universidade Federal de Santa Maria – UFSM, REUNI Scholarship Student.

(2) Speech-Language Pathologist; Professor at the Speech--Language Course and at the Post Graduation Program in Human Communication Disorders at Universidade Federal de Santa Maria – UFSM, Santa Maria, RS, Brazil; Doctor in Applied Linguistics at Pontifícia Universidade Católica do Rio Grande do Sul – PUCRS.

present phonological disorders. To verify the effectiveness of the approach, the phonological inventory and the types of generalization obtained after therapy will be analyzed.

What the phonological therapy approaches have in common is the conception of inducing changes in the sounds inventory, in order to reorganize the children's speech[1,4,17]. Several researches[1,4-6,13-16,18-20] have mentioned the changes occurred in the subjects' phonological inventories after being submitted to varied therapeutic approaches.

Another purpose of the phonological therapy is to induce generalization. The phonological intervention approaches are based on the premise that the target contrast is possible to be generalized to another phonetically similar sound which was affected by the child's altered pattern[13,21]. After generalization, the duration of the therapy may be reduced[13].

The generalization is defined as an extension or the transfer of learning. In other words, it is the occurrence of sounds which are treated in other contexts or not treated words. It can also occur inside a sound class and for other sound classes[22]. The same author also mentions that the last two types of generalization are especially desirable during the treatment, because they contribute to global changes in the child's phonological inventory.

The Multiple Opposition Approach[13,14] is one of the most recent proposed approaches, and it is not used large-scale with Brazilian Portuguese native speakers. However, the development of this research will possibly contribute to the expansion of the clinic performance possibilities to help children who present more severe phonological disorders. The approach can confront simultaneously several sounds which are altered in the phonological inventory.

So, this study has the purpose to analyze the phonological changes resulting from the application of the Multiple Opposition Approach regarding the Percentage of Correct Consonants-Revised (PCC-R), through the number of phonemes which are acquired in the phonological inventory and the types of generalization.

■ METHOD

The sample consisted of five children with phonological disorders, two male and three female, aged between 4:2 and 8:11. All selected participants were submitted to speech and hearing screening at the Speech Hearing Course school-clinic. After being diagnosed as having phonological disorders, the children were referred to the speech care where they started the therapy, connected to research projects, according to the vacancies. In order to participate in this research, the parents or the people responsible for the children signed the Free and Clarified Consent.

The inclusion criteria of this research were: phonological disorders diagnosis, having a phonological inventory which is compatible with the Multiple Opposition Approach proposal[13], replacing several phonemes by just one sound; presenting alteration in more than three phonemes of the phonological inventory; having normal hearing; not presenting significant alterations in speech hearing and complementary evaluations, except in the phonological evaluation.

To confirm the phonological disorder diagnosis and to discard other impairments which can interfere with the language development, the studied children were submitted to the following evaluations: anamnesis, receptive and expressive language, repetitive articulatory test, orofacial motor assessment, auditory discrimination test, simplified assessment of auditory processing, phonological awareness assessment, and phonological assessment. Besides, all children were submitted to the following complementary evaluations: inspection of the external auditory canal, audiological and neurological exams.

The Phonological Assessment of Child Speech[23] was performed through spontaneous picture naming, which allowed a significant linguistic sample, with all language phonemes in different word positions and in different words. All speech data were recorded using a digital recorder. They were also phonetically transcribed and analyzed through contrastive analysis.

The accuracy of the transcriptions was analyzed by three different correctors. First, one reviser carried out the phonetic and phonologic data transcription. Then, a second reviser checked the transcriptions based on the first evaluation. If there were discrepancies in the analyzes, they were showed to another reviser in order to verify the data correctness.

Through contrastive analysis, it was possible to obtain the phonological inventory of each subject, in which a phoneme was considered as acquired when 80% to 100% of the productions were correct; partially acquired when 40% to 79% of the productions were correct; and not acquired when 0% to 39% of the productions were correct[24]. In Table 1, the acquired and partially acquired phonemes in the phonological inventories pre-therapy are presented.

Table 1 – Acquired and partially acquired phonemes into the subjects' phonological inventory pre-treatment

Subjects	Phonological Inventory p, b, t, d, k, g, f, v, s, z, ʃ, ʒ, m, n, ɲ, l, r, ʎ, R	Total number of acquired phonemes
S1	p, b, t, (d)*, k, m, n , (ɲ)*	6
S2	p, (b)*, t, (d)*, (k)*, (f)*, v, (ʃ)*, (m)*, (n)*, (ɲ)*	3
S3	p, (b)*, t, d, k, f, s, (z)*, (ʃ)*, m, n, ɲ, ʀ	10
S4	p, t, k, f, s, m, n, ɲ, l	9
S5	p, (b)*, t, (d)*, k, f, (v)*, s, ʃ, m, n, ɲ, (l)*, ʀ	10

The Percentage of Correct Consonants-Revised[25] (PCC-R) was calculated for each subject. The PCC-R was described considering as "error" in the calculation of the disorder severity the substitutions and the omissions. For the classification, the same percentages described for PCC[25] were used: average disorder, with percentages between 86% and 100%; average-moderate disorder, with percentages between 66% and 85%; moderate-severe disorder, between 51% and 65%; and severe disorder, lower than 50%.

Target-sounds selection

To select the targets, some modifications and adaptations to Brazilian Portuguese were necessary. These changes happened because sounds substituted in different sound classes and with different syllable structure are rare (onset instead of consonant cluster) and it is even more difficult to form word pairs with meanings, in order to form word groups to be treated.

The approach received the following adaptations: when there were no substituted sounds which belong to other sound classes (not the class of the produced phoneme) some target-sounds which belong to the same sound class were used; and words with a real meaning were rather used.

S1 used to substitute phonemes /l/, /R/, /z/ and /v/ by [j]. All the five mentioned sounds were contrasted during therapy. The words which were used in the therapy were ['kaju], ['kalu], ['kaRu], ['kazu] e ['kavu]. For S2 and S5, the phonemes /s/, /z/ e /ʒ/ were contrasted with [ʃ]. For both subjects, the selected target-words were ['kaʃə], ['kasə], ['kazə] e ['kaʒə], this last word has no meaning because it is difficult to find related pairs in Portuguese. However, this word received a "nickname". S3 was treated with /ʒ/, /l/, /ʎ/, /r/ and [z], which was produced instead of the targets. The words which were chosen for the treatment were ['kaʒə], ['kalə], ['kaʎə], [karə], ['kazə]. For S4, the selected sounds were /z/, /ʃ/

and /ʒ/, which were produced as [s]. The selected target-words were ['kaʃə], ['kasə], ['kazə] e ['kaʒə].

For all the subjects, the targets were worked in onset position and simultaneously. This position was chosen for four subjects (S1, S2, S4, S5), because for the target /z/ it was difficult to find word pairs in initial position. For S3, this position was selected because some target-sounds do not exist in initial position.

Therapeutic Procedures

After the evaluation and target-sounds selection, the three phase therapeutic procedures start. They are described below: 1) Baseline; 2) Phonological Therapy; 3) Sounding:

Phase 1. Baseline

First, the baseline in which each absent or partially acquired phoneme was tested was performed. Six words which did not present other difficulties, except regarding the evaluated sound, were selected. All words were different from the target-words and they were easily represented by the pictures, which the child should name without any model.

The baseline was performed in order to confirm the target-sounds which were chosen for therapy.

Phase 2. Phonological Therapy

After determining the baseline, the therapy based on the Multiple Opposition Approach initiated. This stage consists of five therapy sessions to stimulate the selected targets and one of sounding. Depending on the sounding result, the five sessions are repeated in the word level, or it starts the sentence level. The targets were stimulated through Perception, Production – Words Imitation, Production – Independent Naming, Production – Minimum Pairs. All target-words were stimulated with games, simultaneously.

Each therapy session started and finished with auditory bombardment, which is constituted of a 20

words list which is read for the child, who should only listen to it, without repeating it.

Phase 3. Sounding

The sounding starts in the sixth session, which was performed in the same way as the baseline. It means that all absent and partially acquired sounds were tested with the same words used for the baseline. The child should name the words without a model from the therapist.

When the target-sounds reached a percentage lower than 50% of correct production, five more sessions were repeated with the same targets; in the sixth session, the sounding was repeated. If the target-sounds reached more than 50% of correct production, the words were stimulated in the sentence level.

For this research, the first 25 therapy sessions were considered. They were performed twice a week, with 45 minutes each. One subject was submitted to only 15 therapy sessions and the targets were acquired. There was no possibility of keeping the same therapy approach for this subject, because the phonological inventory was not compatible to select new targets. After 25 sessions, a phonological reevaluation was accomplished in order to verify the changes in the phonological inventory and

the occurrence of the generalization types, what is positive in therapies with phonological basis.

This research is linked to a research project, registered on the Gabinete de Projetos (GAP) under No 018278, and approved by the Comitê de Ética em Pesquisa – CEP (Research Ethics Committee) of a Higher Education Institution, under No 046/02.

To verify these changes, the phonological evaluations pre- and post-therapy were compared, based on the Multiple Opposition Approach regarding the PCC-R values; on the amount of acquired phonemes in the phonological inventory; and on the types of generalization (to lexical items non used during treatment, to another position of the word, inside a sound class and to other sound class). For the analysis, the Student's t-test was used for equal samples. The STATA software 10.1 was used with significance level set at 5% ($p < 0.05$).

■ RESULTS

The phonological inventory of each subject was obtained pre- and post-treatment and, after that, they were compared. Table 2 presents the phonemes which are absent and partially acquired in each subject's phonological inventory, pre- and post-treatment.

Table 2 – Absent and partially acquired phonemes into the subjects' phonological inventory pre and post-treatment

Subjects		Phonological Inventory		Acquired phonemes
		PAP	AP	
S1	Pre	d, ɲ	g, f, v, s, z, ʃ, ʒ, l, r, ʎ, R	5 (v,s,ʃ,d, ɲ)
	Post	b, z, R	g, f, ʒ, l, r, ʎ	
S2	Pre	b, d, k, f, ʃ, m, n, ɲ	g, s, z, ʒ, l, r, ʎ, R	8 (b,d,f, ʃ,ʒ,m, n, ɲ)
	Post	k, g, l, R	s, z, r, ʎ	
S3	Pre	b, z, ʃ	g, v, ʒ, l, r, ʎ	9 (b, z, ʃ, g, v, ʒ, l, r, ʎ)
	Post	-	R	
S4	Pre	-	b, d, g, v, z, ʃ, ʒ, r, ʎ, R	0
	Post	v, z	b, d, g, ʃ, ʒ, r, ʎ, R	
S5	Pre	b, d, v, l	g, z, ʒ, r, ʎ	2 (d, ʒ)
	Post	b, v, z, l	g, r, ʎ	

Legend: PAP: partially acquired phoneme; AP: absent phoneme

It is possible to observe that, after therapy, there was a decrease of absent phonemes in the subject's phonological inventory. S1 acquired five phonemes; S2, eight; S3, nine; and S5, two phonemes. S4 did not acquire any phoneme, but /v,z/, which were absent, became partially acquired.

It was evidenced that the subjects who acquired more phonemes were S2 and S3 (both acquired eight phonemes). They all presented plosives, fricatives, and liquids alterations. From these, the two last ones were the most altered classes. Only S2 presented nasals alterations (partially acquired), but

they were acquired after therapy. Because of the increase of phonemes in the phonological inventory, there was a consequent PCC-R improvement.

Table 3 describes the PCC-R averages, the amount of acquired phonemes and the type of generalization (to lexical items non used during treatment, to another position of the word, inside a sound class and to other sound class) from all five subjects pre- and post-treatment.

Table 3 – Description of PCC-R average, number of acquired phonemes and types of generalization obtained through the Multiple Opposition Approach

	Pre-treatment % (SD)	Post-treatment % (SD)	p
PCC-R	53.8 (11.3)	73.6 (7.9)	0.01
N. AP	7.2 (2.7)	11.8 (3.6)	0.03
Lexical Items not used in treatment	14.9 (16.6)	53.3 (21.3)	0.01
Other word position	14.5 (16.2)	52.7 (14.3)	0.00
Into a sound class	34.8 (33.3)	62.8 (25.8)	0.06
To other sound classes	35.2 (20.7)	60.5 (29.6)	0.01

Legend: PCC-R: Percentage of Correct Consonants-Revised. AP: Acquired phonemes. SD: Standard deviation. Significance: $p < 0.05$.

After the analysis of PCC-R, of the number of acquired phonemes into the phonological inventory and of the types of generalization presented by the subjects submitted to the Multiple Opposition Approach, it was possible to observe that they improved their performance during the analyzed therapy period.

It was observed a PCC-R increase (from 53.8% to 73.6%) and also an increase in the number of acquired phonemes into the phonological system

(from 7.2 to 11.8%), post-treatment. They are statistically significant, $p=0.01$ and $p=0.03$, respectively.

Figure 1 shows the generalization of lexical items which were not used in the treatment, pre- and post-therapy, of the subjects treated through the Multiple Opposition Approach. This generalization was considered when the child produced correctly the target-sound in other words, but not the one stimulated during therapy.
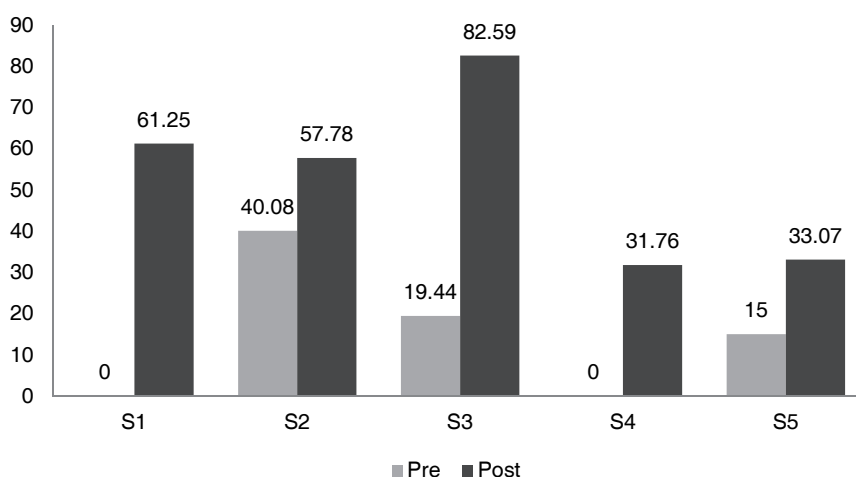

Figure 1 – Subjects' generalization average for not used lexical items, pre- and post-treatment

It was possible to perceive that all subjects presented important improvements in this type of generalization, but S3 (63.15%) and S1 (61.25%) improved the most. These two subjects were the only who had as treatment targets liquid sounds, not only fricatives. S2, S4 and S5 who were stimulated with only fricative sounds also improved, but not as much as the others.

Figure 2 shows generalization to another word position by the subjects submitted to the Multiple Opposition Approach. This generalization was observed when the stimulated target-sound was correctly produced in other word positions, not the stimulated ones.
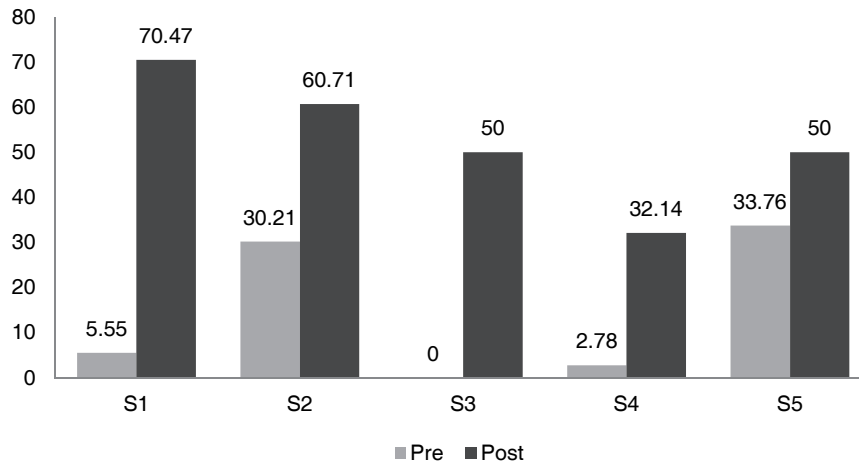

Figure 2 – Subjects' generalization average to other word positions pre- and post-treatment

It is noticed that S1, S3, and S4 presented the lowest pre-treatment percentages, but they were the ones who expressed higher percentage difference related to generalization to another word position after therapy.

Figure 3 shows generalization inside a sound class of subjects treated through the Multiple Opposition Approach. This generalization was verified during the post-treatment phonological evaluation, when the child produced correctly the sounds which belong to the same classes as the target sounds'.
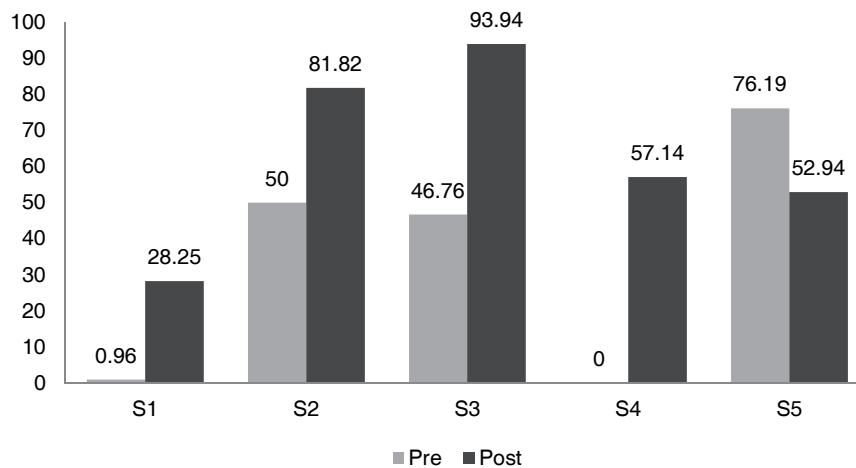

Figure 3 – Subjects' generalization average into a sound class pre- and post-treatment

It is possible to observe that most subjects presented this type of generalization, but the highest percentages were found for S3 (47.18%) and S4 (57.14%). S5 did not present this type of generalization that, instead of increasing the percentage, it decreases it.

Figure 4 shows the generalization to other sound class obtained by subjects treated through the Multiple Opposition Approach. This generalization was verified in the phonological evaluation post-treatment when the child produced correctly sounds which belong to other sound class, but not the target-sound class.
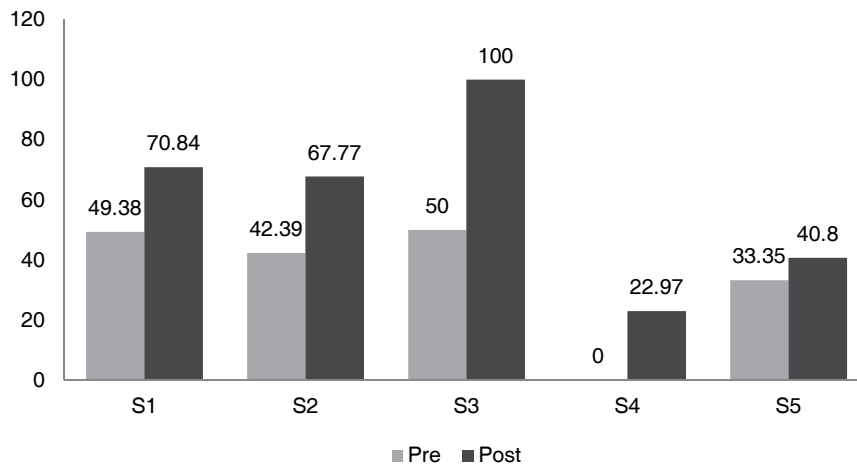

Figure 4 – Subjects' generalization average to other sound classes pre- and post-treatment

It is possible to notice that all subjects presented this type of generalization; S3 presented the highest (50%). Moreover, all subjects who had the highest percentage pre-treatment also presented the highest percentage of correct answers post-treatment.

◼ DISCUSSION

The PCC-R and the number of acquired phonemes increased post-treatment, what improved the subjects' speech intelligibility. These findings agree with other studies[5,8,13,18,19,27] in which the use of therapeutic approaches improved the subjects' phonological inventory. Authors of other studies[1,27] referred PCC-R increase during intervention, with decrease of phonological disorder severity.

The study[13] of a child with phonological disorders, who was treated through the Multiple Opposition Approach, observed a visible phonological reorganization related to the substituted phonemes pre- and post-treatment. The improvements were not only observed in the treated sounds, in the treated positions, but also in target and not target sounds, in not trained positions. The three substituted phonemes were eliminated or significantly reduced. So, the aim of the intervention of expanding the child's inventory by introducing new contrasts was obtained through therapy.

The generalization is perhaps the most interesting and important aspect to be studied, because it shows that children can transfer the learning to not treated real words, to consonant clusters and to other contexts[17]. There was value increase for all researched types of generalization in this study. There was significant statistical difference for the generalization to lexical items non used during treatment, to another word positions, and to other sound classes. The results of the generalization into a sound class did not find statistically significant difference pre- and post-treatment. However, the occurrence of generalization during therapy improved the subjects' speech intelligibility. Other studies[2,27] referred phonological changes post-treatment, and this changes were extended to target-sounds in other word positions, in words which were not trained and in other not trained sounds.

Considering the types of generalization, there was value increase for all researched types. Similar results were found in other studies[2,6,8,15,18,19,27,28] which reported generalization percentage increase with different phonological therapy approaches and consequent reduction of therapy time.

All types of generalization presented improvements, with percentage increase post-treatment, even when the statistical analysis revealed that there was no statistically significant difference for

generalization inside a sound class. This result can be justified by the fact that most targets which were selected to treat the subjects belong to the same sound class, the fricative. Three subjects were treated with four fricative targets, so, there was occurrence limitation for this type of generalization, because most sounds of the class were stimulated.

Regarding the generalization of lexical items non used during treatment, all presented important gradual development, and it was not necessary to teach targets in all words. Similarly, there is a study[19] that, when analyzing three different therapy approaches related to severity of phonological disorder, observed that the generalization of lexical items which were not used in therapy occurred in all analyzed approaches. Other studies[8,18,27] refer the emergence of this type of generalization post-treatment.

Related to generalization to another word position, it was observed that the subjects who presented less sounds pre-treatment generalized the most. It means that they presented higher percentage post-treatment. For example, S1, S3 and S4 are the ones with lower percentages pre-treatment, but they presented the highest percentage difference post-treatment. Some studies[1,2,10] verified that the Multiple Opposition Approach provided the expansion of target-sounds to other positions which were not treated during therapy. Another research[13] referred the occurrence of generalization to another word positions by using two other therapy approaches.

Regarding generalization to other word and syllable position, it was observed that all subjects were stimulated in Medial Onset, and this learning was transferred to Initial Onset, Medial Coda and Final Coda, according to the selected targets possibilities. This finding showed that the work with Simple Onset provides improvements in Coda position, although this class is more complex during syllable acquisition. It was verified that this type of generalization occurred for all analyzed subjects, and the ones who presented learning gaps were the ones who improved the most. A research[14] detected,

in its study, that more changes occurred to children who had more to learn through intervention.

The generalization inside a sound class was obtained by most subjects, while the generalization to other sound class was observed in all subjects who were treated through the Multiple Opposition Approach. Some studies[2,8,15,18] agree with these results and found target-sounds generalization to other sounds which were not worked during therapy. An author[22] reported the importance of both types of generalization, because they contribute to more global changes in the children's phonological inventory. Besides, in other studies[6,27] the authors referred the presence of both types of generalization in their researches.

S1 and S3 were submitted to treatment with fricatives and liquids, what means that two sound classes were treated. So, these subjects presented more generalization to lexical items non used during treatment and to another word position. S3 presented more generalization to other sound classes, the plosives. S2, S4 and S5 were stimulated with only fricatives, and S4 presented more generalizations inside a sound class, when compared to the others. All subjects could present all types of generalization.

■ **CONCLUSION**

The Multiple Opposition Approach provided important changes in PCC-R, number of acquired phonemes into the phonological inventory, and regarding the occurrence of some types of generalization with statistical significance. So, this approach was effective to restructure the phonological inventory of this group of children who are Brazilian Portuguese speakers and present phonological disorders.

Summarizing, this article evidenced that the Multiple Opposition Approach was effective to promote phonological learning. The generalization to lexical items non used during treatment, to another word position, inside a sound class and to other sound class occurred for all researched subjects, what is an important reason to confirm the effectiveness of the treatment.

RESUMO

Objetivo: analisar as mudanças fonológicas decorrentes da aplicação do Modelo de Oposições Múltiplas no que se refere ao Percentual de Consoantes Corretas-Revisado (PCC-R), no número de fonemas adquiridos no inventário fonológico e nos tipos de generalização. **Método:** o grupo pesquisado foi constituído por cinco sujeitos com desvio fonológico. Foram realizadas avaliações fonoaudiológicas e complementares. Os dados da fala foram coletados e analisados por meio da avaliação fonológica pré e pós-tratamento. Os sujeitos foram submetidos à terapia pelo Modelo de Oposições Múltiplas. **Resultados:** constatou-se que houve diferença estatisticamente significante no que tange ao PCC-R, ao número de fonemas adquiridos, à generalização a itens lexicais não utilizados no tratamento, para outra posição da palavra e para outras classes de sons. Não houve diferença estatística para a generalização dentro de uma classe de sons, porém, observou-se um aumento do percentual no pós-tratamento. **Conclusão:** o Modelo de Oposições Múltiplas foi efetivo para o tratamento desses sujeitos falantes do Português Brasileiro, pois proporcionou mudanças no PCC-R, no número de fonemas adquiridos e algumas generalizações (a itens lexicais não utilizados no tratamento, para outra posição na palavra, dentro de uma classe de sons, para outras classes de sons).

DESCRITORES: Fala; Distúrbios da Fala; Fonoterapia; Generalização da Resposta

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Mailing Address:
Marizete Ilha Ceron
Rua Bentevi, 215 – Jucelino Kubistchek
Santa Maria – RS
Zip code: 97035-130
E-mail: marizeteceron@hotmail.com