The treatment with rothics and generalization obtained in two models of phonological therapy

O tratamento com os róticos e a generalização obtida em dois modelos de terapia fonológica

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ABSTRACT

This study had the aim to analyze both the phonological changes and the generalization obtained in the treatment with rothics in two models of phonological treatment. The sample consisted of four subjects diagnosed with phonological disorder, with ages between four and six years. All of them were assessed before and after the phonological therapy. Two groups were established for the treatment with rothics. One group was treated with ABAB – Withdrawal and Multiple Probes Model, and the other group with the Maximal Opposition Model. The phonological system and the occurrence of generalizations before and after the treatment were analyzed. It was found that none of the subjects acquired the rothics that were practiced in the treatment, however, the occurrence of generalization to untreated items was observed only in the subjects treated by the ABAB – Withdrawal and Multiple Probes model. The other types of generalization occurred in both models. The Maximal Opposition Model provided greatest changes in the phonological system of the subjects, which can have been favored by the other target-sound of the pair.

RESUMO

Este estudo teve como objetivo analisar as modificações fonológicas e as generalizações obtidas após tratamento com sons róticos por meio de dois modelos de terapia fonológica. A amostra foi constituída por quatro sujeitos com desvio fonológico, com idades entre quatro anos e seis anos e quatro meses. Todos foram avaliados antes e após terapia fonológica. Foram estabelecidos dois grupos para o tratamento com róticos. Um grupo foi tratado com o Modelo ABAB-Retirada e Provas Múltiplas e o outro com o Modelo de Oposições Máximas. Analisou-se o sistema fonológico e a ocorrência de generalizações pré e pós-tratamento. Nenhum sujeito adquiriu os róticos trabalhados, porém observou-se generalização a itens não utilizados no tratamento apenas por sujeitos tratados pelo modelo ABAB-Retirada e Provas Múltiplas. Os outros tipos de generalização ocorreram em ambos os modelos. O Modelo de Oposições Máximas favoreceu um número maior de modificações no sistema fonológico, o que pode ter sido favorecido pelo outro som-alvo do par.

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INTRODUCTION

Rothics are all the 'r' sounds, and are named this way because they have similar acoustic characteristics and phonological pattern to those of laterals, with which they constitute the liquids. In the Portuguese dialect spoken in the South of Brazil there are phonetically two rothics in simple onset position, the *tap* (weak 'r') and the velar fricative (strong 'r')[1]. However, there is a great difference in the period of acquisition of the strong 'r' in relation to the weak 'r'[2], as the first one is learned before the second one.

Children with phonological disorder present difficulties in the acquisition of Portuguese liquid sounds. A study[3] analyzed the favorable environments for the acquisition of the phoneme /r/ in a subject with phonological disorder, treated by the ABAB – Withdrawal and Multiple Probes model. The authors observed that the selected target-words did not present the favorable environments for the acquisition of the phoneme, but the subject presented generalizations.

Generalization, which is the increase in the production and in the correct use of target-phones stimulated in therapy to other contexts or untreated environments, is the most important criterion to measure the success of the treatment[4]. There are two fundamental concepts of generalization that are essential in phonological therapy: structural and functional[4]. Structural generalization, which is the aim of this study, may occur when children use the pattern they learn in other words that were not the therapy target; when they learn a sound in a position in the word and use it correctly in other positions; when they expand the learning to other sounds that belong to the same class of the sound that was learned; or when they expand it to other sound classes.

Many studies[5-10] report the occurrence of generalization in their phonological treatments. However, specific studies that aim at analyzing the possible generalizations from rothics have not been developed yet.

Many therapeutic models can be used for the treatment of phonological disorders, and among them the ABAB – Withdrawal and Multiple Probes Model[11] and the Maximal Opposition Model[12], which have already been applied[9] and had their effectiveness proven, stand out.

The therapeutic principle of the ABAB – Withdrawal and Multiple Probes Model[11] is that the treatment of more difficult sounds facilitates a great change in the phonological systems of the children. Nevertheless, the treatment of less complex sounds causes a smaller change in the phonological system. This model consists in treatment cycles, with Basic Target Probes (BTP), which measure the acquisition of the target-sounds in the target-words. In this Model only a target-sound in simple words is selected to be treated during a cycle (nine sessions) or more, intercalated with the Withdrawal Period, which are sessions without direct treatment of the target-sound. In this period, Generalization Probes (GP) are applied to evaluate if the treated features based on the selected target-sound were generalized to the untreated sounds.

In the Maximal Opposition Model two words that differ in only one phoneme are selected[12]. The selection of the target-sounds is based on the phonemic mistakes of the child in relation to the target. The child is taught to contrast sounds that are not used appropriately, with those that are correctly used in his/her phonological system. What makes this model different from the ABAB – Withdrawal and Multiple Probes Model is that the first one contrasts two target-sounds that differ from each other maximally in distinctive features, whereas in the second one only one target-sound is stimulated during the whole treatment cycle.

This research aimed at analyzing the phonological changes and the generalization obtained by four subjects with phonological disorder based on the treatment with rothics in two models of phonological therapy: ABAB – Withdrawal and Multiple Probes Model and Maximal Opposition Model[11,12].

CLINICAL CASES

Four children participated in this research; all of them were boys with phonological disorder and aged between 4 years old and 6 years and 4 months old. The children were part of the database of a studies center, of the project entitled "The generalization obtained by the treatment with /r/ and /R/ in three models of phonological therapy", registered and approved by the Research Ethics Committee of Universidade Federal de Santa Maria (UFSM), under Nº 063/2004. For the children to participate in the research project, their parents signed a free and informed consent term, which authorizes the development of the research and the publication of its results.

The children underwent speech pathology evaluations, including the evaluation of the comprehensive and expressive language, of the oral-motor system, of the auditory discrimination and the phonological evaluation. They also underwent complementary evaluations (otorhinolaryngological, audiological and neurological ones).

In these cases, the subjects did not present meaningful alterations in those evaluations, except for the phonological one. This evaluation revealed disorders in the phonological level and a reduced phonetic inventory, with problems in speech intelligibility.

The phonological evaluation of the subjects was carried out based on the Phonological Assessment of the Child instrument (AFC)[13]. In the research of the speech data the contrastive analysis and the distinctive features analysis were carried out. The contrastive analysis consists in the comparison between the child's phonological system and the adult standard system.

The results of the contrastive analysis made it possible to determine if the phonemes were acquired or not in the children's phonological system. In order to do this, the following criteria were considered: 80%-over (acquired segment); 40%-79% (partially acquired segment); 0%-39% (unacquired segment)[14].

Based on the substitutions of the contrastive phonemes, the regularities of the disordered system were found in the analysis by distinctive features, by identifying the distinctive features in which alterations would implicate in the difference between the child's system and the adult standard system. The percentage of 85% of correct productions was adopted as the criterion for feature acquisition.

The results of the analyses were the basis for the choice of distinctive features and segments to be dealt with in the phonological therapy. The distribution of the children in each model was made by convenience, as they were part of a database in which there were 40 children who underwent the treatment by the ABAB – Withdrawal and Multiple Probes, in which only 14 were treated with rothics in the first cycle. In the database of the Maximal Opposition Model there were 42 children, of which 19 were treated with rothics since the first session. Based on this, the subjects were randomly chosen according to the treated rothics, that is, one subject of those treated with /r/ and one of those treated with /R/ in Initial Onset (IO) position were selected at random for each therapy model, who were matched according to their age.

Both Subject 1 (S1), 4 years 11 months, and Subject 2 (S2), 4 years, were treated by the ABAB – Withdrawal and Multiple Probes Model[11], but S1 was treated with /R/ in IO position and S2 was treated with /r/ in Medial Onset (MO) position.

The results obtained in the collection of the speech data (A1) were analyzed by recording spontaneous speech and applying the AFC instrument, with phonological analysis. After that, the altered distinctive features were determined and, based on this, the target-sound for the treatment was delimitated.

The therapeutic intervention began in the first cycle of the treatment (B1), with approximately five weeks (nine sessions) of duration, in two weekly sessions of speech therapy with 45 minutes of duration each. During the cycle, three Basic Target Probes (BTP) were made, in the first, fifth and ninth session, which assed the acquisition of the target-sound in the target-words and in the non-target ones. From the BTPs, the generalization to untreated words was observed.

After that, the Withdrawal Period (A2) began – an interval for the accomplishment of planned probes with duration of approximately three weeks, that is, five sessions (without direct intervention on the sounds chosen as the target), which aimed at observing the generalizations, in terms of treated sound and sound class. During this period, the Generalization Probes (GP) were applied and samples of spontaneous speech of the child were collected.

The GP was accomplished by the application of the AFC instrument. The samples of spontaneous speech were collected and recorded in the interval between two PGs, in the third session, during the withdrawal period. The results were organized based on the contrastive analysis.

In short, the first cycle of the ABAB – Withdrawal and Multiple Probes Model is composed by three sessions of initial evaluations, nine sessions of treatment and five sessions of reevaluations. The results obtained in this research refer to the ones of the first cycle of treatment.

S3 and S4 underwent the therapy by the Maximal Opposition model[12]. S3, 6 years 4 months, was treated with /R/ x /l/ in IO position, and S4, 6 years, was treated with /r/ x /ʃ/ in MO position.

The treatment was based on the session structure proposed in a research[15], in which the baseline is made first, that is, a follow-up made before the beginning of the therapy in which each unacquired sound is tested, by selecting at most six words that contain this phoneme and that can be represented in pictures, which must be named by the child.

After determining the baseline, the treatment itself was started. For all the treatments in analysis, there were five sessions of stimulation with the selected pairs. In the sixth session, the first session, the first follow-up was carried out, which was made the same way as the baseline. If the child reached 50% of correct productions, five new sessions with the same minimal pairs in the sentence level were repeated, but if the percentage of correct productions was less than 50%, the treatment in the word level was repeated. In the sixth session, the children underwent one more follow-up. In the follow-up, after the cycle with sentences, if 80% of correct productions were reached, new target-sounds were determined. Otherwise, the treatment in the sentence level was repeated. The therapeutic session was started and finished with the auditory bombardment and, in addition, the parents were guided as to the stimulation process to be carried out at home.

The treatment of the children who underwent the maximal opposition model consisted of two weekly sessions, distributed in the following way: five sessions and one follow-up. After the 25 sessions, an evaluation of the phonological system of the children was made again, by collecting the speech data with the AFC.

For the analysis of the data, the phonological system of the children before and after the treatment and the different types of generalization were compared[4]: generalization to untreated words; generalization to other positions in the word; generalization within sound class; and across sound class.

Chart 1 concerns the acquired phonemes (AP), partially acquired phonemes (PAP) and unacquired phonemes (UP) before and after the treatment of S1 and S2, treated by the ABAB – Withdrawal and Multiple Probes Model.

Chart 2 refers to the acquired phonemes (AP), partially acquired phonemes (PAP) and unacquired phonemes (UP) before and after the treatment of S3 and S4, treated by the Maximal Opposition Model.

Chart 3 show the generalization to untreated words, to other position in the word, within sound class and across sound class presented by the subjects.

DISCUSSION

In the phonological system after the treatment, it was found that S3 presented the greatest number of acquired phonemes, followed by S4, both subjects who underwent the treatment by the Maximal Opposition model, and, at last, S2, who was exposed to the therapy by the ABAB – Withdrawal and Multiple Probes. S1, who was treated by the ABAB – Withdrawal and Multiple Probes model, did not acquire phonemes in his phonological system. This shows that the Maximal Opposition Model presented the greatest number of acquisitions in the phonological system of the children. These findings go against the results of a research[8], in which the authors compared the phonological changes related to the phonological system of children with phonological disorder who underwent different therapeutic models (Modified Cycles, ABAB – Withdrawal and

Chart 1. Phonological system before and after the therapy of S1 and S2, treated by the ABAB – Withdrawal and Multiple Probes Model

Subject	Position	Initial assessment			Treated sound	Final assessment		
		Phonological system				Phonological system		
		AP	PAP	UP		AP	PAP	UP
S1	IO	/p/, /b/, /t/, /d/, /f/, /v/, /m/, /n/		/k/, /g/, /s/, /z/, /ʃ/, /ʒ/, /R/, /l/	/R/ IO	/p/, /b/, /d/, /f/, /v/, /m/, /n/,	/t/, /R/	/k/, /g/,/s/, /z/,/ʃ/, /ʒ/, /l/
	MO	/p/, /b/, /t/, /d/, /f/, /v/, /s/, /z/, /m/, /n/, /ɲ/		/k/, /g/, /s/, /z/, /ʃ/, /ʒ/, /R/, /l/, /ʎ/, /r/		/p/, /b/, /t/, /d/, /f/, /v/, /m/, /n/, /ɲ/.	/r/	/k/, /g/,/s/, /z/,/ʃ/,/ʒ/, /R/, /l/, /ʎ/
	MC			/s/, /r/			/s/, /r/	
	FC			/s/, /r/				/s/, /r/
S2	IO	/p/, /b/, /t/, /d/, /k/, /g/, /f/, /v/, /s/, /z/, /ʃ/, /ʒ/, /m/, /n/, /l/		/R/	/r/ MO	/p/, /b/, /t/, /d/, /k/, /g/, /f/, /v/, /s/, /z/, /ʃ/, /ʒ/, /m/, /n/, /l/		/R/
	MO	/p/, /b/, /t/, /d/, /k/, /g/, /f/, /v/, /s/, /z/, /ʃ/, /ʒ/, /m/, /n/, /ɲ/. /l/, /ʎ/		/R/, /r/		/p/, /b/, /t/, /d/, /k/, /g/, /f/, /v/, /s/, /z/, /ʃ/, /ʒ/, /m/, /n/, /ɲ/. /l/, /ʎ/	/r/	/R/
	MC		/s/	/r/			/s/	/r/
	FC		/s/	/r/		/s/		/r/

Legend: AP = acquired phonemes; PAP = partially acquired phonemes; UP = unacquired phonemes; IO = initial onset; MO = medial onset; MC = medial coda; FC = final coda

Chart 2. Phonological system before and after the therapy of S3 and S4, treated by the Maximal Opposition Model

Subject	Position	Initial assessment			Treated sound	Final assessment		
		Phonological system				Phonological system		
		AP	PAP	UP		AP	PAP	UP
S3	IO	p/, /b/, /t/, /d/, /f/, /v/, /ʃ/, /ʒ/, /m/, /n/	/s/	/k/, /g/, /z/, /R/, /l/	/R/ x /l/ IO	/p/, /b/, /t/, /d/, /f/, /v/, /s/, /z/, /m/, /n/		/k/, /g/, /ʃ/, /ʒ/, /R/, /l/
	MO	/p/, /b/, /t/, /d/, /f/, /v/, /s/, /z/, /ʃ/,/m/, /n/, /ɲ/	/ʒ/	/k/, /g/, /R/, /l/, /(/, /r/		/p/, /b/, /t/, /d/, /f/, /v/, /s/, /z/, /ʃ/, /ʒ/,/m/, /n/, /ɲ/.		/k/, /g/,/s/, /R/, /r/, /l/, /ʎ/
	MC			/s/, /r/				/s/, /r/
	FC	/s/		/r/		/s/	/r/	
S4	IO	/p/ /t/, /d/, /k/, /g/, /f/, /v/, /m/, /n/, /l/, /R/	/b/	/s/, /z/, /ʃ/, /ʒ/	/r/ x /ʃ/ MO	/p/, /t/, /d/, /k/, /g/, /f/, /v/, /ʃ/, /ʒ/, /m/, /n/, /l/, /R/		/b/, /s/, /z/
	MO	/p/, /b/, /t/, /d/, /k/, /g/, /f/, /v/, /m/, /n/, /ɲ/. /l/, /ʎ/, /R/		/s/, /z/, /ʃ/, /ʒ/, /r/		/p/, /b/, /t/, /d/, /k/, /g/, /f/, /v/, /ʃ/, /ʒ/, /m/, /n/, /ɲ/. /l/, /ʎ/, /R/		/s/, /z/, /r/
	MC	/s/, /r/				/s/, /r/		
	FC	/s/, /r/				/s/, /r/		

Legend: AP = acquired phonemes; PAP = partially acquired phonemes; UP = unacquired phonemes; IO = initial onset; MO = medial onset; MC = medial coda; FC = final coda

Multiple Probes and Maximal Opposition) before and after the treatment, and found that the number of phonemes after the use of the three models was similar, which shows the efficacy in the treatment of phonological disorder.

By comparing S3 and S1, who were both treated with /R/ (the first one by the Maximal Opposition model and the second one by the ABAB – Withdrawal and Multiple Probes), it was possible to notice that S3 acquired a greater number of

Chart 3. Generalization to untreated words, to other position in the word, within and across sound classes presented by the subjects

Subject	Target sound	Generalization to untreated items (other words) % of correct productions	Generalization to other position in the word Other positions	% of correct productions IA	FA	Generalization within sound classes Stimulated class	Untreated sound	% of correct productions IA	FA	Generalization to other sound classes Untreated class	Untreated sound	% of correct productions IA	FA
S1	/R/ OI	PAB 1 = 2,25 PAB 2 = 69,23 PAB 3 = 97,76	/R/ OM	0	0	Liquid	/l/	0	2,25	Stop	/k/	1,14	0
							/ʎ/	0	0		/g/	3,57	0
							/r/	3,85	0	Fricative	/s/	3,92	0
											/z/	6,25	0
											/ʃ/	0	0
											/ʒ/	0	0
S2	/r/ OM	PAB 1= 81,48 PAB 2 = 75,68 PAB 3 = 88,57	/r/ CM /r/ CF	5,26 0	8 7,41	Liquid	/R/	0	3,57	Fricative	/s/	58,49	78,79
S3	/R/x/l/ OI	/R/ OI = 0 /l/ OI = 0	/R/ OM /l/ OM	0 0	0 0	Liquid	/ʎ/ /r/	0 0	0 0	Stop Fricative	/k/ /g/ /s/ /z/ /ʒ/	4,54 12,5 78,94 72,72 76,16	0 0 100 100 100
S4	/r/x/ʃ/ OM	/r/ OM = 0 /ʃ/ = 100%	/r/ CM /r/ CF /ʃ/ OI	- - 0	- - 100	Fricative	/s/ /z/ /ʒ/	27,27 11,11 0	0 0 100	Stop	/b/	78,57	0

Legend: IA = initial assessment; FA = final assessment; BTP = Basic Target Probe

phonemes than S1, but none of them acquired the target-sound.

The velar fricative [R], which presents a perceptual salience of the feature [+continuant] and is a [-sonorant] segment, presents a difficult contradiction for the ones who are acquiring the Portuguese language, because at the same time it has a phonetic characteristic of a fricative, it has the phonological function of a liquid in the adult system[1]. The behavior of S3, when he listens to this segment and it is impossible to characterize it, may be that of letting it absent in his phonological system, due to its similarity with the default values of liquids or fricatives[1].

Among the subjects treated with /r/ in MO, S4, treated with the pair /r/ x /ʃ/, acquired one additional phoneme, compared with S2, treated by the ABAB – Withdrawal and Multiple Probes, but none of the subjects acquired the selected rotic.

According to a study[2], children present difficulties in the acquisition of the liquid /r/, which explains repair strategies that are applied usually in the speech of children with disorders.

The analysis of the generalization to untreated words made it possible to notice that both subjects S1 and S2, treated by the ABAB – Withdrawal and Multiple Probes Model, presented this type of generalization, which may be observed through the BTPs. It was possible to observe an increase of correct answers of the BTP from 1 to 3 for S1, since the treatment from the target-sound /R/ in IO made it possible to verify the occurrence of this generalization, in the second and in the third BTPs. These findings agree with a research[9] in which the authors verified the occurrence of this generalization mainly in subjects treated by the ABAB – Withdrawal and Multiple Probes Model.

The generalization to other position in the word occurred in both subjects who were treated with the rotic /r/. However, this type of generalization was greater in S4, treated by the Maximal Opposition Model and with the pair /r/ x /ʃ/ in MO position, as he increased to 100% the number of correct productions of /ʃ/ in IO. According to a study[2], in the normal acquisition of the phonemes in Portuguese, the MO is usually acquired after the Initial Onset (IO). Thus, stimulating the target-sound in the medial position facilitates the acquisition in IO.

S2, treated by the ABAB – Withdrawal and Multiple Probes Model with the target /r/, presented generalization to other position in the word, but not as much as S4. However, the /r/ treated with another target-sound, by the Maximal Opposition Model, leaded to the greatest number of generalizations to other position in the word.

S1 and S3, treated with the /R/ by the ABAB – Withdrawal and Multiple Probes and the Maximal Opposition models, respectively, presented 0% of right productions of /R/ in the MO position, and it was not evident which model was more effective for the generalization of /R/. However, studies[5,6] report the occurrence of this type of generalization in both models in analysis.

The generalization within a sound class occurred mostly in S4, who was treated by the Maximal Opposition model, as there was the generalization to the fricative /ʒ/ in 100% of the times. Compared to S2, who was also treated with the target-sound /r/, but by the ABAB – Withdrawal and Multiple Probes Model, S4 was the one who presented the greatest number of

occurrences of generalizations, but did not present it for the class of liquids.

As to S1 and S3, treated with the target-sound /R/ by the ABAB – Withdrawal and Multiple Probes and the Maximal Opposition models, respectively, S1 was the one who presented generalization to /l/ of the class of liquids, even though the result was not very expressive.

A study[10] compared the generalization within a sound class and across sound classes in three therapeutic models (ABAB – Withdrawal and Multiple Probes, Modified Cycles and Maximal Opposition) and found the occurrence of generalization inside a sound class in all the models in analysis.

The generalization across sound classes was greater in S3, who was treated by the Maximal Opposition model with the /R/ x /l/ in IO position, as he had the possibility of generalizing to the class of plosives and fricatives, and he presented 100% of correct occurrences for the fricatives. In the class of plosives, however, the percentage of correct productions reduced to 0%. S2, treated with the /r/ in MO position by the ABAB – Withdrawal and Multiple Probes Model, also presented generalization to the fricative /s/.

In the comparison of the subjects treated with the /R/ in IO position, it was observed that S3 was the child who presented the greatest number of generalizations of this type, if compared to S1. Between S2 and S4, treated with the /r/, the generalization across sound classes was more expressive in S2. A study[10] presented the occurrence of this type of generalization in the models in analysis.

Still, these findings might be related to the number of target-sounds selected in each model, as in the Maximal Opposition two target-sounds are selected to contrast two words, whereas in the ABAB – Withdrawal and Multiple Probes, only one sound in simple word is selected.

FINAL COMMENTS

The results of this research show that none of the children acquired the treated rothics, that is, the models in analysis were not capable of eliminating the difficulty in the production of the rotic sound. However, both models favored the different types of generalization in analysis, except for the generalization to lexical items that were not used in the treatment, which was not observed in the treatment by the Maximal Opposition Model. Nevertheless, this model caused the greatest number of acquisitions in the phonological system after the treatment, which may be explained by the fact that when we contrast two phonemes, both the rotic of the pair and the other target-sound might lead to generalizations.

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