

PHONOLOGICAL EVOLUTION OF CHILDREN WITH SPEECH DISORDERS SUBMITTED TO DIFFERENT THERAPEUTIC APPROACHES

Evolução fonológica de crianças com desvio fonológico submetidas a diferentes abordagens terapêuticas

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ABSTRACT

Approximately between 4 or 5 years old, the child has already acquired all the phonemes of the Portuguese adult phonological system. However, this process does not always occur according to expectations, being noted separations/deviations in the acquisition of speech sounds. This study aimed to verify and compare the phonological evolution of, with phonological deviation submitted to phonological therapy associated with the stimulation or not of oral praxis skills. The sample was composed by six subjects (three girls and three boys) aged between 5:4 and 7:0 at the beginning of therapy. The subjects were divided in three groups, all receiving phonological therapy; to one group was added praxis stimulation of face and tongue (GFoLFa); tongue praxis stimulation (GFoL) to another and the third group was submitted only to phonological therapy (GFo). All of them were evaluated before and after therapy regarding: phonological system (Yavas, Hernandorena and Lamprecht, 1991); Orofacial Praxis Test (Bearzotti, Tavano e Fabbro, 2007) and Bucofacial Articulatory Praxis test (Hage, 2000). The results were analyzed descriptively by comparing the three groups. The results evidenced that all groups presented evolution in the phonetic inventory, the GFoLFa obtained bigger evolution in the PCC-R. At this, new ways of study applying this model are suggested, so that these results can be confirmed.

KEYWORDS: Speech; Child; Speech Disorders; Speech Therapy; Stomathognatic System

■ INTRODUCTION

The phonological acquisition occurs until the stabilization of the phonological system, according to children's linguistic community. When there is delay or distance in this acquisition, there is Phonological Disorder, which is characterized by omissions or substitutions in the production of phonemes^{1,2}. It affects the children's linguistic organization, not the

mechanic of speech production, so, it is believed that this impairment interferes only the speech input, not the output³.

There are different intervention models to adapt the disordered phonological system. Their main purpose is the improvement of the phonological system, as well as the stimulation of generalizations.

In literature, it is described some models with phonological basis: metaphon (it intends to perform changes in the phonological system of children with phonological disorders, through the use of metaphonological awareness), cycles and modified cycles (with the aim of treating the elimination of phonological processes which are present in children's speech, through the awareness of the characteristics of the target-sound which operate in that phonological process), minimum pairs – minimal, maximal, multiple oppositions (they aim at improving

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Conflict of interest: non-existent

the disordered phonological system through phonemes opposition, based on their distinctive features). Moreover, there are some models with phonetic/articulatory basis (which intend, through the improvement of the phonetic system, to adapt the phonological system).

It is noticed that it is not usually described in literature the differentiation between phonological and articulatory therapy⁴, and there are not studies which approach the use of strategies involving praxis orofacial skills in children with phonological disorders.

An author investigated the orofacial praxis skills⁵ and other aspects of the oral motor control of children with typical phonological development and with phonological disorders. In this study, the children with phonological disorders presented higher number of alterations of the investigated orofacial praxis, when compared with the children with typical phonological development. So, it is supposed that the difficulties in some orofacial praxis skills may be co-occurring with the phonological disorder. Children may present, with the phonological disorder, difficulties to organize the speech sounds and the interference of difficulties with orofacial praxis skills in the moment of performance/production of phonemes, which are subtle.

So, the motivation for this research is based on the hypothesis that the alterations of the orofacial praxis skills may interfere in the proper concretion of the phonemes (because it is necessary the correct coordination of those movements for speech production). Considering this fact, it is possible to think that the improvement of those skills may interfere in the children's phonological system (it is possible to think that by adjusting the articulatory/praxis level, it is possible the improvement in the phonological level of the linguistic organization).

Because of the necessity of studies involving orofacial praxis skills during the phonological therapy, the purpose of this study was to verify and to compare the improvements in the phonological system of children with phonological disorders which were submitted to phonological therapy, with or without stimulation of the orofacial praxis skills.

■ CASES PRESENTATION

This study is qualitative and longitudinal and it was organized at a speech laboratory at a university, connected to a research project, registered and approved by the ethics committee of the institution, n. 02010.0.243.000-10. All subjects' parents and responsible people authorized their participation in the research, as well as the publication of the results, by signing the free informed consent.

Six children between 5:4 and 7:0 were part of this research, in the beginning of the therapy, three male and three female, with diagnosis of phonological disorders, obtained during previous speech-language screening.

To be included in the study, the subjects should present diagnosis of phonological disorder, obtained in the speech-language screening, two absent sounds in the phonetic inventory, hearing in normal patterns for the speech tritonal average and not presenting significant alterations in the speech-language complementary evaluations, except the phonological evaluation⁶ and orofacial praxis skills^{7, 8}.

To confirm the diagnosis of phonological disorder and to discard other impairments which could interfere in the language development, the subjects were submitted to speech-language evaluations: anamnesis, comprehensive and expressive language, stomatognathic system, articulatory examination, auditory discrimination, simplified auditory processing, phonological awareness, orofacial praxis skills and phonological evaluation. For this study, it was considered only data from initial and final therapy phonological evaluations. It was considered data of phonological evaluation regarding phonetic and phonological inventories and the Percentage of Correct Consonants Reviewed (PCC-R).

To consider the sound as present in the phonetic inventory, it should be present in at least two correct productions. For the phonological inventory, it was considered the criteria of an author⁹ who observed that a phoneme is acquired when it is present from 40 to 79% of the possibilities and absent when it is present in less than 39% of the possibilities.

After the phonological evaluation, the phonological disorder was classified according to the severity, through the calculation of the Percentage of Consonant Correct Reviewed (PCC-R) proposed by the author¹⁰, who is based on the correct production of consonants, without considering the sound distortions and it is obtained through division of the number of correct consonants (NCC) by the number of correct consonant added to the number of incorrect consonants (NCI), or the total number of consonants; then this result is multiplied by 100. Thus, it was determined the severity of the phonological disorder, according to the classification by the mentioned authors: mild disorder (MD), with percentages from 86 to 100%; mild-moderate disorder (MMD), with percentages from 66 to 85%; moderate-severe disorder (MSD), with percentages from 51 to 65% and severe disorder (SD), with percentages lower than 50%.

Moreover, all of them were submitted to complementary evaluations: otorhinolaryngological with external auditory meatus survey and auditory evaluation.

After the evaluations and the confirmations of the diagnosis of phonological disorders, as well as the exclusion of subjects who did not fit in the inclusion and exclusion criteria, the six children were submitted to therapy and they were divided in three groups with the same number of participants: the first group received therapy essentially phonological (Gfo); the second group received phonological therapy and tongue praxis exercises (GfoL); and the third group received phonological therapy, praxis tongue exercises and intervention about orofacial praxis (praxis stimulation of face and cheek – GfoLFa).

All the studied children received phonological therapy through the Model of Minimal Pairs/Maximal Oppositions¹¹, according to the modifications proposed in a study¹². The model suggests the contrast of two phonemes maximally opposed (opposition of more than two distinctive features).

The praxis intervention for tongue movements (for the groups GfoL and GfoLFa) were based on results of a study¹³ and the face praxis exercises (for the GfoLFa) came from the orofacial praxis exercises^{7, 8}.

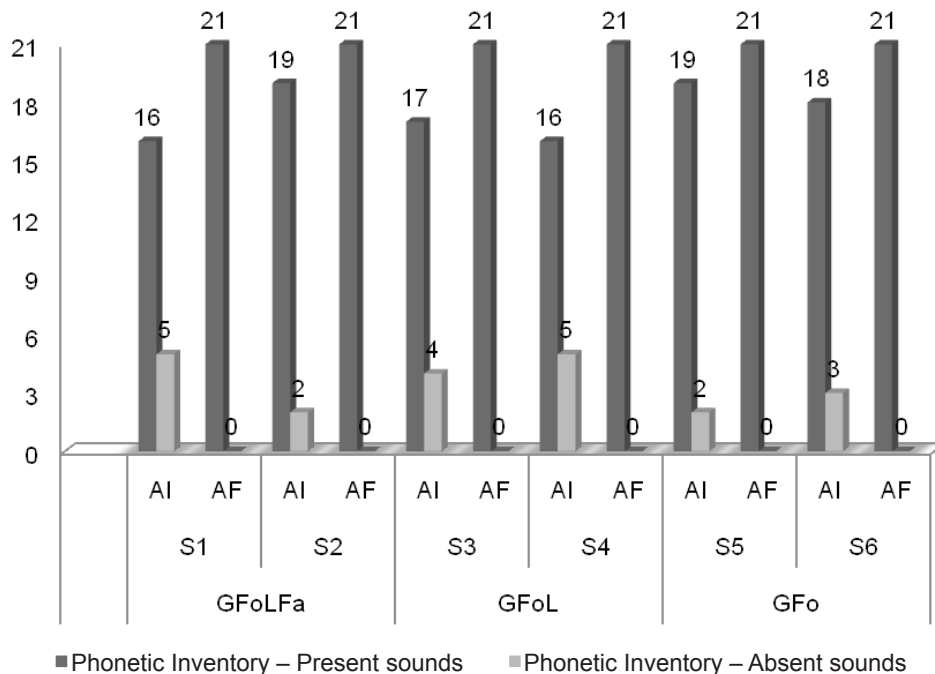
The subjects were attended in individual therapy sessions, with frequency of two sessions a week with 45 minutes each session. The sessions started and finished with the repetitive hearing of words with the target-sound and the parents' participation was always oriented. The tongue and/or face praxis exercises were always performed in the beginning of the therapy sessions (after the repetitive hearing of words with the target-sound) with approximate duration of 20 minutes (it was performed 30 repetitions of each exercise/ sequence). In cases of fatigue, the subject was oriented to rest and to retake the series later.

After the performance of 25 sessions for the groups GfoL and Gfo, and 20 sessions for the group GfoLFa, the reevaluation of the phonological system was accomplished and the data were tabulated in qualitative way, comparing the initial and final phonological evaluation.

■ **RESULTS**

As it is a qualitative study, the results will be presented in figures (charts and illustrations).

In Figure 1 there is the number of present and absent sounds in the phonetic inventory of the researched subjects in the initial and final phonological evaluations.



Legend: AI: Initial Evaluation; AF: Final Evaluation; GfoLFa: Group was added praxis stimulation of face and tongue; GfoL: Group tongue praxis stimulation; Gfo: Group phonological therapy.

Figure 1 - Number of sounds present and absent from the phonetic inventory of the subjects in the phonological initial and final evaluations

Figure 2 describes the phonetic inventories before and after therapy of the studied subjects.

All the subjects presented absence of at least two sounds in their phonetic inventories in the beginning of the treatment. This is one of the inclusion criterion. After therapy, all the subjects presented improvements in their phonetic inventories, completing them in a period of 20 to 25 sessions.

It is evidenced that S1 and S2 presented the highest improvements in their phonetic inventories (acquiring five of the absent sounds), followed by S3 (with four more sounds in their inventory).

S6 acquired three sounds and, finally, S2 and S5 acquired the two sounds which were not acquired before therapy.

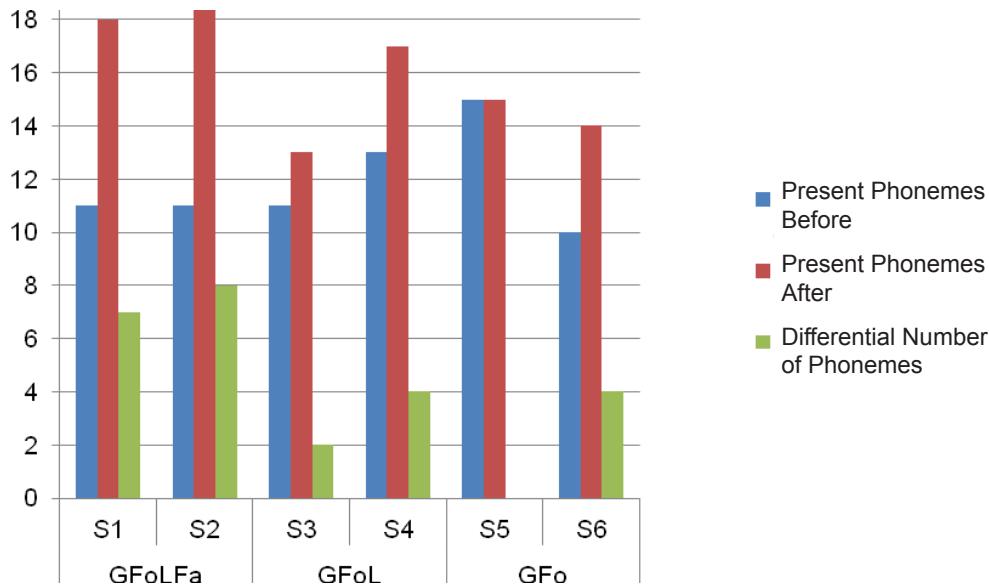
In Figure 3 it is presented the comparison among the present phonemes in the phonological inventory, as well as the distinguishment (difference between final and initial evaluations) of the number of acquired phonemes in the initial and final phonological evaluations.

Figure 4 illustrates the acquired, partially acquired and absent phonemes in the phonological inventory in the initial and final phonological evaluations.

Subjects	Evaluation	SP	SA	Number of acquired sounds
S1	AI	[p, b, t, d, f, v, s, ʃ, R, tʃ, dʒ, m, n, ø, l, λ]	[k, g, z, ʒ, r]	5
	AF	[p, b, t, d, k, g, f, v, s, z, ʃ, ʒ, R, tʃ, dʒ, m, n, ɲ, l, λ, r]	∅	
S2	AI	[p, b, t, d, k, g, f, v, s, z, S, R, tʃ, dʒ, m, n, ɲ, l, λ]	[ʒ, r]	2
	AF	[p, b, t, d, k, g, f, v, s, z, ʃ, ʒ, R, tʃ, dʒ, m, n, ɲ, l, λ, r]	∅	
S3	AI	[p, t, d, k, f, v, s, ʃ, ʒ, R, tʃ, dʒ, m, n, ɲ, l, λ]	[b, g, z, r]	4
	AF	[p, b, t, d, k, g, f, v, s, z, ʃ, ʒ, R, tʃ, dʒ, m, n, ɲ, l, λ, r]	∅	
S4	AI	[p, b, t, d, k, g, f, v, z, ʃ, ʒ, tʃ, dʒ, m, n, ɲ]	[s, R, l, λ, r]	5
	AF	[p, b, t, d, k, g, f, v, s, z, ʃ, ʒ, tʃ, dʒ, m, n, ɲ, l, λ, R, r]	∅	
S5	AI	[p, b, t, d, k, g, f, v, z, ʃ, ʒ, tʃ, dʒ, m, n, ɲ, l, λ]	[s, r]	2
	AF	[p, b, t, d, k, g, f, v, s, z, ʃ, ʒ, tʃ, dʒ, m, n, ɲ, l, λ, r]	∅	
S6	AI	[p, b, t, d, g, f, v, s, ʃ, ʒ, tʃ, dʒ, m, n, ɲ, l, λ]	[k, z, r]	3
	AF	[p, b, t, d, k, g, f, v, s, z, ʃ, ʒ, R, tʃ, dʒ, m, n, ɲ, l, λ, r]	∅	

Legend: AI: Initial Evaluation; AF: Final Evaluation SP: Sounds Gifts ; SA: Sounds Absent.

Figure 2 – Detailed phonetic inventory of the subjects in the first and final evaluations



Legend: AI: Initial Evaluation; AF: Final Evaluation; GFoLFa: Group was added praxis stimulation of face and tongue; GFoL: Group tongue praxis stimulation; GFo: Group phonological therapy.

Figure 3 – Number of sounds in the phonological inventory and differential number of phonemes acquired in initial phonological and final evaluations

	Initial Phonetical Inventory			Final Phonetical Inventory		
	FA	FPA	Fau	FA	FPA	Fau
S1	/p, b, t, f, s, ʃ, ʒ, R, m, n, ɲ/	/d, v, l/	/k, g, z, ʎ, r/	/p, b, t, d, k, g, f, v, s, z, ʃ, ʒ, R, m, n, ɲ, l, ʎ/	/r/	0
S2	/p, b, t, d, f, s, ʃ, R, m, n, ɲ/	/g, v, z, l, ʎ/	/k, ʒ, r/	/p, b, t, d, k, g, f, v, s, z, ʃ, ʒ, R, m, n, ɲ, l, ʎ, r/	0	0
S3	/p, t, k, f, v, s, R, m, n, ɲ, l/	/z, ʃ, ʒ, ʎ/	/b, d, g, r/	/p, t, k, f, v, s, ʃ, R, m, n, ɲ, l, ʎ/	/d, z/	/b, g, ʒ, r/
S4	/p, b, t, d, k, g, f, v, ʃ, ʒ, m, n, ɲ/	/z/	/s, R, l, ʎ, r/	/p, b, t, d, k, g, f, v, s, z, ʃ, ʒ, R, m, n, ɲ, l/	/ʎ/	/r/
S5	/p, b, t, d, k, g, f, v, ʃ, R, m, n, ɲ, l, ʎ/	0	/s, z, ʒ, r/	/p, b, t, d, k, g, f, v, ʃ, R, m, n, ɲ, l, ʎ/	/z, ʒ/	/s, r/
S6	/p, t, f, s, ʃ, R, m, n, ɲ, l/	/b, d, v, ʎ/	/k, g, z, ʒ, r/	/p, b, t, d, f, v, s, z, ʃ, R, m, n, ɲ, l/	/ʒ, ʎ/	/k, g, r/

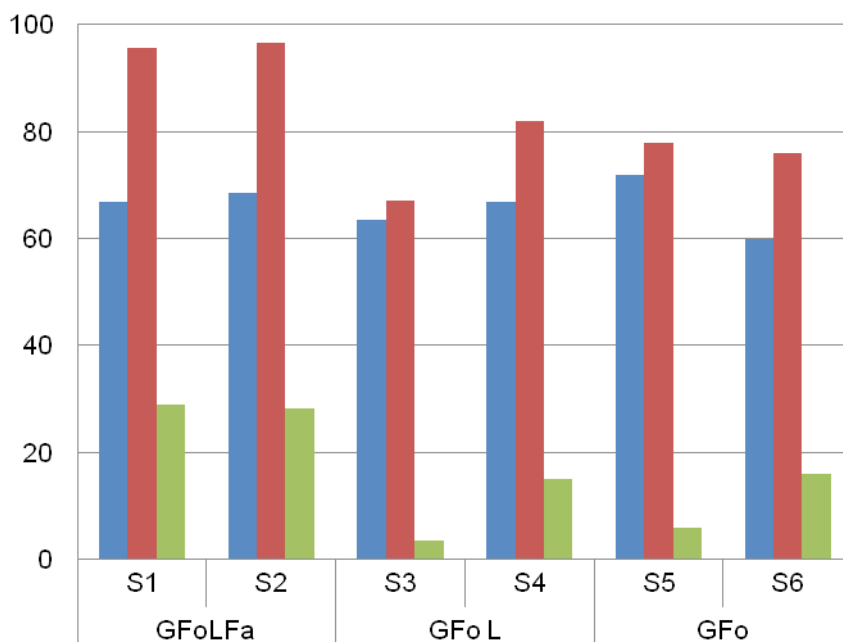
Legend: AI: Initial Evaluation; AF: Final Evaluation; GFoLFa: Group was added praxis stimulation of face and tongue; GFoL: Group tongue praxis stimulation; GFo: Group phonological therapy.; FA: Acquired phonemes; FPA: Partly Acquired phonemes; FAu: Absent phonemes.

Figure 4 – Acquired phonemes, partially acquired and absent from phonological inventory in initial and final phonological evaluation.

The group GfoLFa obtained the highest average of acquired phonemes in the phonological inventory (7,5 phonemes), followed by the GfoL which obtained the average of three acquired phonemes. The Gfo obtained the lowest average of acquired phonemes (2 phonemes).

Figure 5 presents the PCC-R and the distinction of it in the initial and final phonological evaluations.

The group which presented the highest PCC-R increase was the group GfoLFa, in which the difference was 28.51%, followed by the group Gfo (which obtained the difference of 10.90%). The group which presented the lowest PCC-R increase was the GFoL (average of 9.30%).



■ AFC Initial PCC-R	66,77	68,5	63,5	66,9	72	60
■ AFC Final PCC-R	95,6	96,7	67	82	77,8	76
■ Differential PCC-R	28,83	28,2	3,5	15,1	5,8	16

Legend: AFC: Phonological Assessment of Child ; PCC-R: Percentage of Consonants Correct-Revised; GFoLFa: Group was added praxis stimulation of face and tongue; GFoL: Group tongue praxis stimulation; GFo: Group phonological therapy.

Figure 5 – Results of PCC-R and the differential in this initial phonological and final evaluations

■ DISCUSSION

In the phonetic inventory, the initially damaged classes were the liquids and fricatives (for all subjects) and plosives (for S1, S3 and S6). All the subjects presented in their phonetic inventory the nasal class, data which agrees with literature^{14, 15}. Also, none of the subjects presented problems with the affricates [tʃ] and [dʒ].

All the sound classes which presented problems in the initial evaluation obtained acquisitions: S1, S3 and S6 presented acquisition of the classes liquid, plosives and fricatives and S2, S4 and S5 presented acquisition on the classes fricative and liquid. In general, the liquids and fricatives are the most affected in phonological disorder, because they are the most complex classes¹⁶.

The fricative class is the third to be acquired (after the plosives and nasals). The labial fricatives present initial acquisition, and the others present late acquisition. The liquid class is the last to be established in Brazilian Portuguese and, into this group of phonemes, the laterals are acquired before the non laterals¹⁶.

The phonological therapy, based on the Maximal Opposition/Empty Set Model, was effective for the studied subjects' phonetic inventories, agreeing with other previous studies about this same model¹⁷.

A study¹⁸ compared the effectiveness of three phonological therapy models with contrastive approach. The authors verified that the Minimal Pair Model – Minimal Oppositions and Maximal Oppositions/ Empty Set favored the highest number of acquisitions in the phonetic inventory of the subjects with moderate-severe and severe phonological disorder. This study agrees with the present research, because the subject who presented the highest number of acquired sounds in the phonetic inventory (S1) presented moderate-severe disorder.

The subjects with the highest improvements in the phonetic inventory (S1, S3 and S4) were treated with the associated therapy – phonological therapy with face and tongue praxis stimulation (GFoLFa and GfoL). None of the subjects, in the beginning of the treatment presented articulatory ability to produce the sound [r] and all of them were stimulated with this sound during therapy. Thus, all of them presented the acquisition of that sound in the phonetic inventory (with at least two productions of

the sound, and this is a criterion to consider a sound as present in the phonetic inventory).

It was verified that the GfoLFa obtained the highest average of acquired phonemes in the phonological inventory, followed by the GfoL, and, finally, the Gfo which obtained the lowest average of acquired phonemes, but it is important to highlight that this group also obtained improvements in their phonological inventories.

This obtained result agrees with other studies which verified improvements regarding acquisitions in the phonological inventory after phonological therapy. In a study¹⁸, the authors verified that the subjects which were treated with the models with contrastive approach presented significant changes in their phonological inventories, agreeing with the present research.

It is verified that there was increase of PCC-R for all groups. This finding could be expected, because the therapy has the purpose of organizing the children's phonological system, so, when there is organization of this system, there is also increase of PCC-R. This finding agrees with a study which researched in a corpus of 66 subjects the efficiency of treatments with three different therapy models in relation to the changes in their phonological system. It was verified that the PCC increases with speech therapy (and the suppression of speech disorders)²⁰.

Also, the present study agrees with another one²¹, which verified the efficiency of the speech-language intervention in the severe disorder in 30 children, in school age, during eight months. The children were divided in two groups: the first group received treatment during the four first months and

the second, during the four last months. The results demonstrated that there is statistically significant difference in PCC, after the four first months, only for the first group. After eight months, it was verified statistically significant difference between both groups, with the first group with higher PCC.

This result agrees with another study²² in which the authors verified that the subjects obtained PCC improvement with therapy intervention, with significant increase of correct production. Although all the groups presented significant improvements in PCC-R, it was verified that the group with the highest average was the GfoLFa, what suggests that the face and tongue praxis stimulation is useful in the production of phonemes.

■ CONCLUSION

This study, which aimed at verifying the improvements of the phonological system of children with phonological disorders submitted to contrastive approach, with stimulation of the praxis skills and the analysis of the obtained results for the studied sample, enabled the following conclusions: the model of Minimal Pairs – Modified Maximal Oppositions/ Empty Set was effective to improve the phonetic inventory of all subjects, because there was increase of the number of acquired sounds.

The GfoLFa (Phonological Group with face and tongue praxis stimulation) presented the highest scores in relation to: PCC-R and number of acquired sounds.

RESUMO

No Português Brasileiro, aproximadamente entre 4 ou 5 anos de idade, a criança já adquiriu todos os fonemas do sistema fonológico adulto. Porém, este processo nem sempre ocorre de acordo com o esperado, verificando-se afastamentos/desvios na aquisição dos sons da fala. O objetivo deste trabalho foi verificar e comparar a evolução do sistema fonológico de crianças com desvio fonológico submetidas à terapia fonológica, acrescida ou não de estimulação das habilidades práticas orofaciais. A amostra foi composta por seis sujeitos (três meninas e três meninos), com idades entre 5:4 e 7:0 no início da terapia. Os sujeitos foram divididos em três grupos, recebendo todos terapia fonológica, sendo os do grupo estudo tratados com estimulação de habilidades práticas de face e língua (GFoLFa), e com exercícios de habilidades práticas de língua (GFoL), e o grupo controle submetido apenas à terapia fonológica (GFo). Todos foram avaliados pré e pós-terapia quanto ao sistema fonológico (Yavas, Hernandorena e Lamprecht, 1991); ao Teste de Praxias Orofaciais (Berzoatti, Tavano e Fabbro, 2007); e ao Teste de Praxias Articulatórias e Bucofaciais (Hage, 2000). Os resultados foram analisados e descritos comparando os três grupos. Os resultados obtidos evidenciaram que todos os grupos apresentaram evoluções no inventário fonético, o GFoLFa obteve evoluções maiores no PCC-R. Conclui-se que os grupos que receberam intervenção prática obtiveram maiores evoluções fonológicas, porém, sugerem-se novos estudos aplicando este modelo, para que possam ser confirmados esses resultados, com outras amostras.

DESCRIPTORIOS: Fala; Criança; Distúrbios da Fala; Terapia de Fala; Sistema Estomatognático

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Received on: June 30, 2011

Accepted on: January 09, 2012

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