Speech therapy for phonological disorders with basis on stimulation of phonological awareness skills

Terapia fonoaudiológica para os desvios fonológicos com base na estimulação de habilidades em consciência fonológica

Terapia fonoaudiológica para los desvíos fonológicos basados en la estimulación de habilidades de conciencia fonológica

Roberta Freitas Dias[*]
Carolina Lisboa Mezzomo[*]

Abstract

Objective: *propose and apply a therapeutic approach for phonological disorders based on stimulation of phonological awareness skills and words with controlled phonological structure.* ***Methods:*** *three subjects with mild-moderate phonological disorder level participated in this study. They were first year students of Elementary School and they received therapy with basis on stimulation of phonological awareness skills. The considered phonological variables to select words to be part of the phonological awareness tasks were: word length, syllable structure and segmental properties. The analyzed results were pre and post phonological system therapy, phonological awareness and impact of phonological variables which were referred in two tasks, syllabic segmentation and segmental identification. The data were analyzed in qualitative way.* ***Results:*** *the number of segments in the phonological system of the three subjects increased and the phonological disorder severity decreased. The scores obtained for phonological awareness indicated improvement of this skill for all subjects. Word length and syllable structure caused impact on syllabic and segmental task resolution, respectively.* ***Conclusion****: the applied therapeutic approach caused phonological system reorganization in the three cases. The phonological structure of the words which comprise the phonological awareness tasks may have impact in the performance of the observed children, considering the proposed phonological awareness tasks.*

Keywords: *Speech; Speech Disorders; Speech Therapy; Child*

*Universidade Federal de Santa Maria (UFSM) - Santa Maria-RS - Brazil.
Authors' contributions: RFD responsible for the collection, tabulation, analysis, and discussion of the data presented in this study. CLM supervised the development of our research and all the stages of manuscript elaboration.

Correspondence address: Roberta Freitas Dias. **E-mail:** robertafdias@hotmail.com
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Resumo

Objetivo: *propor e aplicar uma abordagem terapêutica para os desvios fonológicos com base na estimulação de habilidades em consciência fonológica e palavras com estrutura fonológica controlada.* ***Método:*** *três sujeitos com desvio fonológico de grau levemente-moderado participaram deste estudo. Eles estavam cursando o primeiro ano do ensino fundamental e receberam terapia com base na estimulação de habilidades em consciência fonológica. As variáveis fonológicas consideradas para a seleção das palavras que integraram as tarefas de consciência fonológica aplicadas foram: extensão de palavra, estrutura silábica e propriedades segmentais. Foram analisados os resultados pré e pós-terapia do sistema fonológico, da consciência fonológica e do impacto das variáveis fonológicas referidas, em duas tarefas: segmentação silábica e identificação segmental. Os dados foram analisados de maneira qualitativa.* ***Resultados:*** *o número de segmentos no sistema fonológico dos três sujeitos aumentou e a gravidade do desvio fonológico diminuiu. Os escores obtidos para a consciência fonológica indicaram um aprimoramento dessa habilidade para todos os sujeitos. A extensão de palavra e a estrutura silábica causaram impacto na resolução de tarefas silábica e segmental, respectivamente.* ***Conclusão:*** *a abordagem terapêutica aplicada promoveu a reorganização do sistema fonológico nos três casos estudados. A estrutura fonológica das palavras que compõem tarefas de consciência fonológica parece ter impacto no desempenho das crianças observadas, face às tarefas de consciência fonológica propostas.*

Palavras-Chave: *Fala; Distúrbios da fala; Fonoterapia; Criança.*

Resumen

Objetivo: *proponer e implementar un enfoque terapéutico para los desvíos fonológicos basados en la estimulación de las habilidades de conciencia fonológica y palabras fonológicas con estructura controlada.* ***Método:*** *tres sujetos con desvíos fonológicos con grado ligeramente-moderado participaron de esto estudio. Ellos estaban cursando el primer año de la escuela primaria y recibieron terapia basada en la estimulación de habilidades de conciencia fonológica. Las variables fonológicas consideradas para la selección de las palabras que integraron las tareas de conciencia fonológica aplicadas fueron: extensión de palabras, estructura silábica y propiedades segmentarias. Fueran analizados los resultados pre y pós terapia del sistema fonológico, de la conciencia fonológica y el impacto de las variables fonológicas referidas, en dos tareas: segmentación silábica e identificación segmentaria. Los dados fueran analizados de forma cualitativa.* ***Resultados:*** *el número de segmentos en el sistema fonológico de los tres sujetos aumentó y la severidad de la desviación fonológica disminuyó. Las puntuaciones obtenidas para la conciencia fonológica indicaron una mejora de esta habilidad para todos los sujetos. La extensión de las palabras y estructura silábica causaron impacto en la resolución de tareas silábica y segmental, respectivamente.* ***Conclusión:*** *El enfoque terapéutico aplicado promovió la reorganización del sistema fonológico en los tres casos estudiados. La estructura fonológica de las palabras que componen tareas de conciencia fonológica parece tener impacto en el desempeño de los niños observados, relativo a las tareas de conciencia fonológica propuestas.*

Palabras claves: *Habla; Trastornos del Habla; Logoterapia, Niño.*

Introduction

The relationship between stimulation of phonological awareness and phonological therapy was developed simultaneously in the 90's, and both themes still require attention and advances in theory. The phonological awareness is a skill to identify and to manipulate language phonological units (syllables, syllabic constituents and segments) and their organization in words formation, regardless their meaning. To make it happen, it is necessary to present thinking (to determine and to compare), and ability to operate on the syllables and segments (to count, to segment, to link, to add, to suppress, to transpose)[1-4].

The phonological awareness evaluations allow therapists to analyze the children's speech processing system integrity and to obtain information about elaboration of speech-therapy intervention [2].

The phonological disorder, also called phonological disturbance, is a disorder which affects production and which is caused by problems in speech sounds mental representation, in the acquisition of language internalized knowledge. When there is failure in these sounds mental representation, the phonological disorder may be characterized as a phonemic alteration. In this case, the way the sound information was stored and represented in the mental lexicon is impaired, with linguistic or cognitive origin[5].

The use of different therapy models to treat phonological impairments in Brazil enabled the investigation of aspects related to the phonological system reorganization process in these cases, such as: generalizations[6], phonological regression[7], role of the linguistic context (favorable and neutral environments)[8] and phonological awareness[9].

In relation to phonological awareness, several studies have the purpose of investigating the performance of children with phonological disorders in tasks involving this ability, and also comparing these results to the results of children with typical phonological development[5,10-14]. The authors of these studies verified that there are differences among groups, with positive relationship between alterations in productions with phonological nature and low performance in tasks related to phonological awareness skills.

The phonological awareness development is an essential condition for reading and writing learning. This skill enables the conscious access to the phonological level of the phonological system and the cognitive manipulation of this level representations, which are necessary for reading and writing[1-3,15-19]. Children with phonological disorders who have low phonological awareness skills may have difficulties in the literacy process, thus, it is important the proper diagnosis and treatment[1,2,5,13,20,21].

In national and international literature, there are several researches which used phonological awareness skills stimulation in therapy of phonological disorders. These therapeutic procedures contrasted or combined this approach with other types of therapy, phonological or articulatory[4,10,22-,25]. All these applications for phonological disorders therapy showed improvements in the treated subjects' phonological system, as well in their phonological awareness skills.

The phonological structure of the task words to evaluate or to stimulate phonological awareness skills is an aspect which was not investigated enough in Brazilian Portuguese (BP), although it plays an important role in these words performance.

Some tests which were created for phonological awareness evaluation, developed for BP, presented criteria to be elaborated in relation to words phonological structure. The Instrument of Sequential Evaluation of Phonological Awareness (CONFIAS)[3], for example, is a widely used instrument in national research. It brings, in its description, the following criteria: to select words which are part of the child's vocabulary; syllable types which are preferentially consonant-vowel and consonant-vowel-consonant; number of syllables in progression into each item; same tonicity and same number of syllables in the model words and in the selected words to segmental and syllabic identification.

In the investigation of the performance of children with phonological disorders in phonological sensitivity tasks, rhyme and alliteration by CONFIAS, it was highlighted important aspects such as segment length and perceptual salience, as characteristics which influence these tasks resolving. The authors referred that such aspects should also be considered during therapeutic intervention[12]. This finding reinforces the care that should be taken in relation to the phonological structure of the used words to test this population's phonological awareness[27].

Based on the presented theoretical assumptions, it is believed that stimulating phonological awareness skills in children with phonological disorders may promote the reorganization of their phonological system, improving their ability to think about the speech sounds. Besides, the use of linguistically controlled words, in an ascending complexity order, according to the phonological acquisition, may benefit two aspects: the solving of phonological awareness tasks, avoiding that children provide wrong answers because they do not present correct subjacent representation of them, and the awareness of their speech altered segments.

Therefore, this study had the purpose of suggesting and applying a therapeutic approach for phonological disorders based on stimulation of phonological awareness skills, using words with controlled phonological structure, and to test this application in three clinical cases.

Presentation of the clinical cases

This is a longitudinal qualitative study, developed at a university school. The project which originated this investigation was approved by the university ethics research committee, number 0202.0.243.000-11. The consent term was signed by the children's responsible/guardians, and the subjects' agreement was essential for their participation in the study and for the speech therapy.

It was analyzed the therapeutic process of three children, Brazilian Portuguese (BP) monolingual speakers: a boy, six years and six months, S1; another boy, six years and one month, S2; and a girl, six years and eight months, S3. The three subjects presented diagnosis of phonological disorders, mild-moderate degree and they were in the first year of elementary school.

The conditions for their participation in the study were: age from five years and six years, 11 months and 30 days; authorization to participate in the study through the consent term; the children's agreement to participate in the activities. The excluded children were the ones who have received previous speech therapy; who presented other speech disorders, except phonological disorder; and children who presented evident neurological, cognitive or psychological alterations.

The children's diagnosis of phonological disorders was confirmed through a series of speech and language evaluations (anamnesis, oral expressive and understanding language, stomatognathic system, articulatory examination to analyze the phonetic inventory, phonological system and auditory evaluation) and complementary evaluations (neurological and otorhinolaryngological), performed at the school clinic were the study was developed.

To obtain the data analyzed in this study, before and after therapy, it was used: the CPA – Children's Phonological Assessment[28], the CONFIAS - Instrument of Sequential Evaluation of Phonological Awareness[3] and an evaluation instrument which consists of a syllabic tasks (syllable segmentation) and a segmental task (segmental identification), created by the authors of this study.

The data collected through CPA were analyzed through the phonetic inventory and contrastive analysis, before and after therapy. Through the contrastive analysis, it was possible to define the PCC-R (Percentage of Consonant Correct – Reviewed)[29] and each children's phonological system. Based on the PCC-R, the disorder severity was classified in: severe disorder, with percentage of consonant correct under 50%; moderate-severe disorder, with percentage of consonant correct between 51% and 65%; mild-moderate disorder, with percentage of consonant correct between 66% and 85%; mild disorder, with percentage of consonant correct over 86%.

The CONFIAS[3] evaluates the phonological awareness in two levels: syllable awareness and phoneme awareness. The first part consists of the following tasks: S1 – Synthesis, S2 – Segmentation, S3 – Initial syllable identification, S4 – rhyme identification, S5 – Word production with given syllable, S6 – Medial syllable identification, S7 – Rhyme production, S8 – Exclusion, S9 – Transposition. In the second part, there were the phonemic tasks: F1 – Production of a word which starts with a given sound, F2 – Initial phoneme identification, F3 – Final phoneme identification, F4 – Exclusion, F5 – Synthesis, F6 – Segmentation, F7 – Transposition. In relation to score, the correct answers are worth one point and the incorrect answers have no value. In the first part, the syllabic, the maximum score is 40 and in the second part, the phonemic, the maximum score is 30, a total of 70 points, which corresponds to 100% of success. To verify the patients' performance, it is considered the expected minimum and maximum scores, according to different writing hypothesis.

The syllabic segmentation and segmental identification tasks formed the evaluation instrument created by the authors of the present study. Both evaluation tasks were created to analyze the impact of the phonological structure on the integral words. In the syllable segmentation task, 39 words were selected, and two more test-words. The analyzed phonological properties were:

- Word length (monosyllable, disyllable, trisyllable and polysyllable);
- Segmental properties, regarding the articulatory manner (lateral liquid à /l/, non lateral liquid à /r/, nasal à /n/, fricative à /s/, plosive à /t/);
- Syllable complexity (simple onset, coda and complex onset).

In the segmental identification task, 22 words were selected, and two more words test. The investigated phonological properties were:

- Segmental Properties (articulatory manner) (lateral liquid à /l/, non lateral liquid à /r/, nasal à /n/, fricative à /s/, plosive à /t/);
- Syllable complexity (simple onset, coda and complex onset).

In both tasks, some pictures were used (created especially for this instrument) which represented the instrument words. This instrument was applied individually, in two parts, with duration of about twenty minutes each. In the first part, it was performed the syllable segmentation task and, in the second, segmental identification tasks. For both tasks, the correctly solved items were scored 1 (one) and the incorrect items did not score any point.

Procedures

Application of therapy based on phonological awareness skills

The therapy based on stimulation of phonological awareness skills was devised by the authors of this study and it suggested exclusive use of tasks involving phonological awareness skills in children with phonological disorders. Thus, it was defined a therapy plan about treatment of auditory discrimination for speech sounds and stimulation of the phonological awareness levels, syllabic and segmental, along a maximum of 25 therapy sessions (CHART 1).

<table>
<tr><th>Therapy Sessions</th><th>Phonological awareness tasks</th><th>Example of applied tasks</th></tr>
<tr><td>5 sessions</td><td>BASELINE
Auditory discrimination training

Syllabic Awareness</td><td rowspan="5">- Auditory discrimination of: voiceless and voiced phonemes.
- Identification of words with the same initial syllable.
- Syllabic segmentation.
- Identification of words with the same final syllable.
- Final, initial e medial syllables omission.
- Syllables Inversion.</td></tr>
<tr><td colspan="2">SURVEY 1</td></tr>
<tr><td>5 sessions</td><td>Auditory discrimination training
Syllabic Awareness</td></tr>
<tr><td colspan="2">SURVEY 2</td></tr>
<tr><td>5 sessions</td><td>Auditory discrimination training
Segmental awareness</td></tr>
<tr><td colspan="2">SURVEY 3</td><td rowspan="6">- Phonemes auditory discrimination, in relation to point of articulation: labial, dorsal and coronal.
- Identification of segments in words.
- Identification of words with the same initial segment.
- Identification of words with the same final segment.
- Production of Word with the same initial segment.
- Segmental analysis and synthesis.</td></tr>
<tr><td>5 sessions</td><td>Auditory discrimination training
Segmental awareness</td></tr>
<tr><td colspan="2">SURVEY 4</td></tr>
<tr><td>5 sessions</td><td>Auditory discrimination training
Segmental awareness</td></tr>
<tr><td colspan="2">SURVEY 5
PHONOLOGICAL REEVALUATION
PHONOLOGICAL AWARENESS REEVALUATION</td></tr>
</table>

Chart 1. Therapeutic structure of the approach based on stimulation of phonological awareness skills

The phonological levels which integrate this proposal were applied in an ascendant complexity sequence, starting with the syllabic tasks in the ten first therapy sessions, followed by segmental tasks in the next 15 sessions. It was decided to emphasize the segmental level, because it is the most difficult for children with phonological disorders[11]. It is highlighted that in case the child did not present skills to solve the segmental level tasks, the syllabic level was kept until he/she could accomplish simple words segmental tasks.

It was included in this plan the syllabic and segmental levels and the auditory discrimination for speech sounds, based on a program to develop phonological awareness for European Portuguess[16], edited by the Portuguese Ministry of Education. It is pointed out that the discrimination training was performed in only five therapy sessions, as the emphasis of this approach was given to the phonological awareness skills – syllabic and segmental.

In each therapy session, two or three tasks were applied, for example: in the first syllabic level session, there were word production tasks with the same initial syllable and identification of words with the same initial syllable, and an activity to discriminate voiced and voiceless segments. When it was possible, these tasks were inserted in playful activities (set of tracks, memory, bowling, etc.). When there was no possibility to insert the tasks in playful activities, the children knew that in some moments, among games, they would have to 'think' about their speech sounds. It is important to mention that it was not stimulated that they 'worked' at home, the parents/guardians were only asked to provide the correct speech model to the children.

The words used in all therapeutic activities were controlled in relation to phonological structure, using, first, words with simple structure (CV) and disyllable (*pato* – duck), and ending with words with more complex syllable structures (CCV) and polysyllable (*bicicleta* – bicycle), regardless the speech exchanges performed by the subjects. About the segments class, as for syllabic as for segmental tasks, it was used first words containing plosives and nasals, followed by fricatives and liquids (*moto, folha* – motorcycle, sheet), according to the typical phonological acquisition of these sound classes.

It is necessary to mention that the speech exchanges performed by the subjects, identified through the CPA, were not considered as errors in the tasks performance. The subject S3, for example, had not acquired the sound /g/ in IO (initial onset) and MO (medial onset) in his/her phonological system. So, his/her answer for the word "mago" (wizard) in the task of syllabic inversion was "coma", considered as correct.

Following the form of another phonological therapy model[30], the effect of the therapy approach in the reorganization of each subject's phonological system was tested through baseline application (survey performed before the therapy beginning) and surveys, every five speech and language therapy sessions. In these tests, the sounds which were not totally acquired in the children's phonological system were tested. In this regard, a maximum of six words representable by pictures were selected, for each not acquired sound, considering the different word position (initial onset, medial onset, medial coda and final coda). The child should name the pictures without the therapist's model.

The data from the present study were described and analyzed in quantitative way, under comparison between evaluations before and after therapy, of each one of the three subjects.

The Chart 3 presents the phonological system (acquired, partially acquired and not acquired segments) and the phonological disorder severity, before and after therapy, and also the number of performed sessions of each subject.

Subject	Word Position	Before therapy				After therapy				Number of sessions
		AS (n)	PAS	NAS	DL	AS (n)	PAS	NAS	DL	
S1	IO	/p/, /b/, /t/, /d/, /k/, /g/, /f/, /v/, /s/, /z/, /m/, /n/, /l/, /R/ (14)		/ʃ/, /ʒ/	MMD (83.3%)	/p/, /b/, /t/, /d/, /k/, /g/, /f/, /v/, /s/, /z/, /ʃ/, /ʒ/, /m/, /n/, /l/, /R/ (16)			MD (97.2%)	20 sessions
	MO	/p/, /b/, /t/, /d/, /k/, /g/, /f/, /v/, /s/, /z/, /m/, /n/, /ɲ/, /l/, /ʎ/, /R/ (16)	/r/	/ʃ/, /ʒ/		p/, /b/, /t/, /d/, /k/, /g/, /f/, /v/, /s/, /z/, /m/, /n/, /ɲ/, /l/, /r/, /ʎ/, /R/ (17)	/s/, /ʃ/,/ʒ/			
	MC	/s/ (1)	/r/			/s/, /r/ (2)				
	FC	/s/, /r/ (2)				/s/, /r/ (2)				
S2	IO	/p/, /t/, /k/, /f/, /s/, /ʃ/, /m/, /n/, /l/, /R/ (10)	/b/, /d/, /g/, /v/	/z/, /ʒ/	MMD (80.6%)	/p/, /t/, /k/, /f/, /s/, /m/, /n/, /l/, /R/ (9)	/b/, /v/, /ʃ/	/d/, /g/, /z/, /ʒ/	MD (88.2%)	25 sessions
	MO	/p/, /b/, /t/, /k/, /f/, /s/, /ʃ/, /ʒ/, /m/, /n/, /ɲ/ /l/, /ʎ/, /R/ (14)	/d/, /g/, /v/	/z/, /r/		/p/, /b/, /t/ /k/, /f/, /s/, /z/, /ʃ/, /ʒ/, /m/, /n/, /ɲ/, /l/, /ʎ/, /R/, /r/ (16)	/d/, /g/, /v/			
	MC	/s/, /r/ (2)				/s/, /r/ (2)				
	FC	/s/, /r/ (2)				/s/, /r/ (2)				
S3	IO	/p/, /t/, /k/, /f/, /s/, /m/, /n/, /l/, /R/ (9)	/v/	/b/, /d/, /g/, /z/, /ʃ/, /ʒ/	MMD (67.3%)	/p/, /t/, /k/, /f/, /s/, /ʃ/, /m/, /n/, /l/, /R/ (10)	/v/	/b/, /d/, /g/, /z/, /ʒ/	MMD (78%)	25 sessions
	MO	/p/, /t/, /k/, /f/, /s/, /m/, /n/, /ɲ/, /l/, /ʎ/, /R/ (11)	/b/	/d/, /g/, /v/, /z/, /ʃ/, /ʒ/, /r/		/p/, /t/, /k/, /f/, /s/, /ʃ/, /m/, /n/, /ɲ/, /l/, /ʎ/, /r/, /R/ (13)	/v/	/b/, /d/, /g/, /z/, /ʒ/		
	MC	/s/ (1)		/r/		/s/, /r/ (2)				
	FC	/s/ (1)		/r/		/s/, /r/ (2)				

Legend: AS: acquired segments; PAS: partially acquired segments; NAS: not acquired segments; DL: phonological disorder level; MD: mild disorder; MMD: mild-moderate disorder; IO: initial onset; MO: medial onset; MC: medial coda; FC: final coda.

Chart 2. Comparison between the phonological system and phonological disorder level before and after therapy

For all subjects, it was observed phonological system improvements, with increase of acquired segments, as well as increase of the percentage of consonants correct and, for S1 and S2, there was decrease in the phonological disorder severity. It is highlighted that S1 needed less therapy sessions to acquire new segments and to decrease the phonological disorder severity. This subject was discharged after 20 therapy sessions.

The obtained results for phonological awareness, through CONFIAS, before and after therapy, may be verified in Chart 3. The three subjects presented scores improvements, as for syllabic tasks, as for phonemic tasks, with higher improvements in tasks about segments. In the total score, S1 and S2 obtained higher difference between initial and final scores, with 21 and 15 points of difference, respectively.

PE tasks			Subject S1		Subject S2		Subject S3	
			IE (success/ total)	FE (success/ total)	IE (success/ total)	FE (success/ total)	IE (success/ total)	FE (success/ total)
Syllable level	S1	Synthesis	4/4	4/4	4/4	4/4	4/4	4/4
	S2	Segmentation	4/4	4/4	4/4	4/4	4/4	4/4
	S3	Initial syllable identification	3/4	4/4	4/4	3/4	3/4	2/4
	S4	Rhyme identification	1/4	3/4	3/4	2/4	0/4	1/4
	S5	Word production with given syllable	4/4	4/4	4/4	4/4	3/4	4/4
	S6	Medial syllable identification	0/4	3/4	2/4	4/4	2/4	3/4
	S7	Rhyme production	0/4	1/4	4/4	4/4	0/4	0/4
	S8	Exclusion	7/8	7/8	3/8	5/8	2/8	2/8
	S9	Transposition	3/4	4/4	0/4	4/4	0/4	2/4
	Total of syllable level success (frequency %)		26/40 (65%)	34/40 (85%)	28/40 (70%)	34/40 (85%)	18/40 (45%)	22/40 (55%)
Phoneme level	P1	Word production with given sound	2/4	4/4	1/4	4/4	2/4	4/4
	P2	Initial phoneme identification	3/4	3/4	3/4	2/4	2/4	4/4
	P3	Final phoneme identification	2/4	2/4	1/4	3/4	0/4	1/4
	P4	Exclusion	4/6	6/6	2/6	1/6	0/6	0/6
	P5	Synthesis	3/4	4/4	0/4	2/4	2/4	2/4
	P6	Segmentation	0/4	4/4	0/4	4/4	0/4	0/4
	P7	Transposition	0/4	4/4	0/4	0/4	0/4	0/4
	Total of phoneme level success (frequency %)		14/30 (46.7%)	27/30 (90%)	07/30 (23.3%)	16/30 (53.3%)	06/30 (20%)	11/30 (36.7%)
Total of PA success (frequency %)			40/70 (57.1%)	61/70 (87.1%)	35/70 (50%)	50/70 (71.4%)	24/70 (34.3%)	33/70 (47.1%)

Legend: PE – phonological evaluation; IE – initial evaluation; FE – final evaluation; S – syllabic; P – phonemic.

Chart 3. Comparison of phonological awareness skills through CONFIAS in moments before and after therapy

The results of syllable segmentation and segmental identification tasks, in the applied instrument, showed, in general, score increase in the comparison between initial and final evaluations (CHART 4). In the same way, as it was observed in the CONFIAS application, the score increase was more significant in the segmental task.

S	Syllabic segmentation		Segmental identification		Total of success	
	IE success/total *(Freq.)*	FE success/total (Freq.)	IE success/total (Freq.)	FE success/total (Freq.)	IE success/total (Freq.)	FE success/total *(Freq.)*
S1	38/39 *(97.4%)*	38/39 *(97.4%)*	18/22 *(81.8%)*	21/22 *(95.5%)*	56/61 *(91.8%)*	59/61 *(96.7%)*
S2	37/39 *(94.9%)*	39/39 *(100%)*	13/22 *(59%)*	18/22 *(81.8%)*	50/61 *(82%)*	57/61 *(93.4%)*
S3	37/39 *(94.9%)*	36/39 *(92.3%)*	13/22 *(59%)*	21/22 *(95.5%)*	50/61 *(82%)*	57/61 *(93.4%)*

Legend: S – subjects; IE – initial evaluation; FE final evaluation; Freq. – frequency.

Chart 4 – Comparison of the instrument of phonological awareness skills evaluation, before and after therapy In the task of segmental identification, S1 presented identification errors in the initial evaluation of words containing /r/ /l/ and /s/, mainly, in complex syllables CVC and CCV [*porco* (pig), *tecla* (keyboard), *nariz* (nose) and *fumaça* (smoke)]. In the final evaluation, this subject presented error only in one word which contained /l/ [*ligado* (on)].

The subject S2 presented errors in words with /r/, /l/, /n/, /s/ and /t/, with emphasis for the words 'porco' (pig), 'motor' (motor) and 'pasta' (folder), with CVC syllables. In the final evaluation, this subject kept making errors in words with CVC syllable, such as 'porco' (pig) and 'pasta' (folder).

Before starting therapy, the third subject, S3, presented errors of segmental identification in words with complex syllable structures CVC and CCV [*bruxa* (witch), *placa* (plate) and *nariz* (nose)]. In the final evaluation, the subject made a mistake only in the word 'tomada' (outlet).

Discussion

The data obtained before and after therapy for the treated subjects phonological system showed that the proposed and applied therapeutic approach promoted changes in the phonological systems of the three subjects, what may be verified through the PCC-R increase in all of them and through the increase of acquired phonemes in their phonological systems.

The effectiveness of a therapeutic approach can be proved through indicators such as PCC, increase of phonological system acquired phonemes, and generalizations[7,10,24,25,30]. From these indicators, the generalizations are crucial, because they promote increase of target-sounds correct production, stimulated for other contexts or environments which were not trained in therapy (other words, other sound class, the same sound class, other word positions)[6,7].

In the therapeutic approach in question, it was not possible to analyze the generalizations, because there were no target-sounds. However, considering the sounds which were acquired by the treated subjects, it can be assumed that there were 'generalizations' for other syllable positions. As an example, there is the /r/ acquisition by all subjects. Initially, this segment was partially acquired by S1 (medial onset and medial coda), not acquired by S2 (medial onset) and by S3 (medial onset, medial and final coda). Besides, all of them did not present /r/ in complex onset. After 20 or 25 therapy sessions, the /r/ was acquired by all the three subjects, in all possible syllable positions (medial onset, medial and final coda, complex onset), according to each one's phonological system.

This result disagrees with the findings of a study which analyzed the phonological changes and the generalizations obtained after therapy with rhotics ('r' sounds), after different therapeutic models for phonological disorders, without considering phonological awareness skills. The authors observed that the four treated subjects presented generalizations (other word position, into a sound class, for other sound classes). However, the rhotics, treatment target-sounds, such as the /r/, during 25 therapy sessions, remained not acquired or partially acquired.

The segment /r/ acquisition was also studied considering the linguistic environment of the used words in phonological disorders therapy. The influence of favorable and neutral environment in the acquisition of this segment was analyzed. The authors observed that the neutral environment, which does not play determining role in phonological acquisition, was the most effective in /r/ acquisition in medial onset[8]. Although these results are seen with caution by the own authors, as they disagree with data obtained for typical phonological development, they reinforce the hypothesis that the discovery of phonemic segments by children may result in changes in the way the words are cognitively structured[24]. It is believed that this discovery may be provided by the improvement of the skill to think about speech sounds (syllable and segments) and to manipulate them, through phonological awareness skills, regardless the linguistic environment of the segment. The positive result of the three subjects of the present study for the /r/ segment in all possible syllable positions is attributed to this.

A relevant data from the results of the present study is the regression in the acquisition of some segments by the three subjects. For S1, it was observed that the segment /s/ changed from acquired to partially acquired, in the final evaluation, in medial onset. The S2 presented the most cases of regression, the /ʃ/ (initial onset) changed from acquired to partially acquired, and the segments /d/ and /g/ (medial onset) from partially acquired to not acquired. The S3 presented the segment /b/ (medial onset) as partially acquired and it changed to not acquired, in the final evaluation.

Regression in phonological disorders was verified in a previous study, with three subjects treated through a model based on implicational hierarchy of distinctive features. The selected segment to

be stimulated was /r/ and the results showed the occurrence of regressions, mainly in fricatives, in simple onset segments, acquired or not, in the initial phonological evaluation. The researchers suggested possible relationship between the feature oral cavity [+continuous] of the target sound and of the regressed segments[7]. Observing the three treated subjects of the present study, it is verified that there also seems to be a relationship between the features of the /r/ segment, [+continuous] and [+voice], and the features of the regressed segments. It suggests that the segments regression in these cases, during phonological therapy, may be related to the phonological system reorganization and acquisition of certain segments, even if they were not stimulation targets.

In relation to phonological awareness, the results obtained through the CONFIAS[3] showed improvements in all subjects' scores, before and after therapy, as in specific tasks (syllabic and phonemic), as in the total score. Several studies about phonological awareness stimulation, in children with phonological disorders or typical phonological development, expressed score improvement in syllabic and segmental tasks[14,15,17,19].

Although there was CONFIAS total score increase for the three subjects, some tasks kept with scores lower than a half for two of them, in the evaluations after therapy. In the syllabic tasks, S1 and S3 kept with scores lower than a half in the task of rhyme production. Moreover, S3 presented low scores of rhyme identification, exclusion and syllabic transposition.

The low scores in rhyme tasks, obtained for the subjects S1 and S3, could be caused by the fact that they were not included in the stimulated skills of the proposed therapeutic approach. However, a previous investigation showed that tasks of rhyme and alliteration production were more difficult than rhyme and alliteration identification[12]. The purpose of that investigation was to characterize the performance of a pre-school group with phonological disorders in metaphonological tasks of segments identification and production, in rhyme and alliteration.

In the phonemic tasks, S2 and S3 kept with scores lower than half, for tasks of phonemic exclusion and transposition in the evaluation after therapy. S3 also presented low score in tasks of final phoneme identification and phonemic segmentation. These results agree with the data from a study which analyzed the performance of children with phonological disorders in syllabic and segmental tasks, with and without speech therapist's intervention[9]. The authors observed that as the tasks difficulty level increased the number of subjects who were able to solve them decreased, in the same way as the tasks of segmentation and phonemic transposition. In general, all the children presented difficulties in segmental tasks, with or without phonological therapy.

It is important to highlight that all subjects of the present study who received phonological therapy were in the beginning of the literacy process, what also contributed to improvements in the phonological awareness scores, mainly in segmental tasks. Considering the reciprocal relationship between literacy and the development of phonological awareness skills in the segmental level, it was expected that some tasks of this level would present low scores[1-3,5,17-19].

Investigating the performance of children with phonological disorders, with and without therapeutic intervention, in different phonological awareness tests, the results of two studies developed in Brazil showed that phonological therapy, with phonological focus, is not enough to fully develop children's phonological awareness skills. The authors emphasize the importance to focus this skill, because there will be repercussion in the literacy process of individuals with phonological disorders[9,13].

In relation to the evaluation instrument developed by the authors of the present study to verify the influence of the phonological structure of words in phonological awareness tasks, the results before and after therapy demonstrate that the word length seems to be an important aspect in the syllable segmentation task. In the segmental identification, the syllable structure played an important role.

Another study determined that the word length presented relevant role in syllabic tasks solving, by children with phonological disorders. Even after being submitted to phonological therapy, these children did not achieve success in syllabic tasks with longer words, trisyllable and quadrisyllable[9].

In the task of segmental identification, the difficulty to identify liquids in syllable sequences CVC or CCV was evident. The liquids are the most difficult segments to be acquired by children with phonological disorders[6], as well as the complex syllable structures CVC and CCV. It reinforced the

hypothesis that there is parallelism between phonological development and phonological awareness, as it was verified in a study about EP[16].

In the Portuguese research, the authors verified that the labial and coronal points of articulation are the first to be acquired and they favor the performance of a segmental awareness task, different from the dorsal point. On the other hand, the articulatory manner [+continuous] favored the performance of the same task, in contrast to what is observed during the phonological development, when the articulatory manner is the first to emerge[26].

Even if the data obtained for the syllabic and segmental tasks in the present study did not present conclusions, but tendencies, they reinforce the hypothesis referred decades ago, that the phonological structure of words which form phonological awareness tasks should be observed, mainly in cases of phonological disorders[27].

In a study about phonological awareness performance of three groups of children with speech disorders (typical exchanges, atypical exchanges and distortions), the authors observed a positive correlation between atypical exchanges and the performance in phonological awareness. They related this finding to the poor phonological representation of these subjects. So, they recommend that the speech errors should be considered in the evaluation and treatment of children with phonological disorders[20].

The phonological awareness cannot be treated independently, because it is integral part of articulation and phonological intervention[2]. Even so, in Brazil, there are only a few studies which proposed the investigation of this skill stimulation as important component of speech and language therapy of phonological disorders. Besides, there are no investigations about the influence of words phonological structure to solve phonological awareness tasks and to stimulate this skill. This study brought some hypothesis after the obtained results, but which could not be conclusive, because of the reduced number of treated subjects.

Conclusion

The therapeutic approach proposed in this study, therapy based on stimulation of phonological awareness skills, was effective for the three treated subjects, because it promoted a reorganization of their phonological systems, resulting in the acquisition of new phonemes, in the increase of percentage of consonant correct and in the phonological awareness development. In relation to the phonological structure of the words which appeared in the phonological awareness tasks, the results from this study showed influence of word length, in syllabic tasks, and of the syllabic structure, in segmental tasks.

Considering the importance of the phonological awareness in the literacy process, it is suggested that studies like this should be reproduced with more subjects, in order to prove, or not, the effectiveness of this therapeutic approach. Investigations like this contribute for speech and language therapy, because innovative proposals of therapeutic approaches for phonological disorders focusing other aspects, not only the phonological system, may be even more effective, avoiding the emergence or worsening of other difficulties caused by phonological deficits.

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