EFFECTS OF TEACHING EQUIVALENT RELATIONS BETWEEN DICTATED WORDS, WRITTEN WORDS, AND OBJECTS ON SPEECH INTELLIGIBILITY IN ADOLESCENTS WITH CEREBELLAR HYPOPLASIA

Efeitos de ensino envolvendo equivalência entre palavra ditada, palavra escrita e objeto sobre a inteligibilidade da fala em adolescente com hipoplasia cerebelar

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ABSTRACT

Within these many brain structures involved in language, the cerebellum fulfill an important role in coordinating the movements responsible for speech, so that any alteration in this structure may compromise the development of oral language. Considering the planning of teaching and intervention while a factor that can alter the phenotypic expression imposed by cerebellar hypoplasia, this case study aimed to verify the effects of an teaching program (involving equivalence between dictated word, written word and object) on the intelligibility of speech in a teenager twelve year old, male gender, with cerebellar hypoplasia. The sessions were conducted in the clinical setting and with use of preference toys participant's. The program consisted of phases of assessment, teaching, post-test and retention, on which were presented selection tasks, vocalization, writing and composition of words. During the assessment, observed a low performance in all tasks, especially in objects naming; in the course of teaching, the vocalizations were monitored, indicating a gradual improvement in speech intelligibility when the participant named objects, reaching accuracy in post-test and retention. This suggests that, for the case presented, strengthening the network of relationships between stimulus and stimuli-verbal actions promoted by teaching program, favored improvements in speech intelligibility.

KEYWORDS: Cerebellar Diseases; Speech Disorders; Verbal Behavior; Rehabilitation of Speech and Language Disorders; Speech Intelligibility

INTRODUCTION

Expressive language has multiple phonological, semantic-syntactic, pragmatic, and cultural aspects[1,2] and it also depends on the relationship between organic and environmental variables[3] that can infer different manifestations of patterns of speech and language[3,4]. From this perspective, human speech is conceived as a behavioral phenotype because it depends on interactions between genotype, several anatomical systems (e.g., neurological, muscular, and articulation) that integrate the production of

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orofacial movements[5,6] and environmental stimulation and teaching conditions.

The cerebellum is ananatomic structure related to speech production that plays an important role in emission, speed, and vocal cadence by controlling motor and muscular responses involved in this process[5-7]. It also integrates the neurological bases of language processing[5,7-9]. Cerebellar hypoplasia is defined in medical sciences as a cerebellar malformation caused by the reduction or premature interruption of cellular production/migration during its formation, and it is associated with genetic, teratogenic, or infectious factors[10-12]. This reduction of cells can affect the entire cerebellar complex (i.e., diffuse hypoplasia) or specific regions (i.e., focal hypoplasia),[10,11]resulting in different types and levels of motor and cognitive impairment, including language in general and speech in particular[10-12].

Significant impairment in the control of the phonoarticulatory system[9-14] and consequent behavioral deficits in speech in individuals with cerebellar hypoplasia are reflected by alterations in rhythm, intonation, and tone (i.e., dysprosody),[10,14,15] phonemic omissions/distortions, and agrammatism,[10,14,15] which are some of the possible speech disorders that can be related to cerebellar hypoplasia. This provides an important behavioral prognosis for professionals who work with this population in the language/speech field[3,4]. However, different conditions can interfere with the way that behavioral phenotypes are expressed, such as the social circumstances in which speech occurs, the stimulation offered by the supporting network, the consequences of speech, educational exposure, and clinical interventions. Notably, the majority of studies on cerebellar hypoplasia investigate genetic-clinical characteristics,[6,10,11,13-15] with few studies that have reported strategies and therapeutics that are specific for this population[12].

Changing speech, when considered as a phenotypic manifestation, comes with some responsibilities. Interventions need to consider the behavioral aspects that are expressed so that speech becomes understood as an action[16]. If speech is an action, and every action occurs in a given environment (e.g., a social environment) with consequent implications for the behavior of the speaker,[16] then the interventions need to be performed on a case-by-case basis by considering specific characteristics in these contexts.[16,17]If the verbal action does not occur as expected, then procedural modifications of the interventions are required (e.g., changes in context),[17] followed by new observations. Improvements in verbal action that result from the intervention can contribute to defining the best type of behavioral manifestations observed under these conditions, whether genetic or environmental.

One of the principles that formed the basis for the interventions performed in the present study was that the handling of the consequences for vocal actions did not affect the possibility of occurrence of future action,[16] and the situations under which the action could occur were selected[18]. When a child says “ball” (i.e., a vocal action) at the beginning of education when presented with the printed word “ball” (i.e., the stimulus that preceded the action), followed by being repeatedly praised by parents or teachers (i.e., the consequence), then this same vocalization will tend to occur again when the printed word “ball” is presented again. However, the child may have learned to respond to the printed stimulus “ball” only because of visual tracking, without necessarily understanding the meaning of what was read or the phonological process involved[19,20]. in this case, an objective measure of a child’s understanding of what was read,[20,21] would be when faced with the printed word “ball” the child relates a ball figure that is located among several other figures (e.g., frog, cat, anddoll). This has been adopted as an operational model of reading with comprehension, in which stimuli without physical similarities, such as a printed word and figure, come to share equivalent relations or mutual substitution because they were paired with a common stimulus (e.g., the same dictated word)[18,21,22]. This model offers an operational description of complex phenomena, such as the questions behind language and symbolic processes[23,24.]

The goal of the initial study[21] was to verify whether an adolescent with microcephalus and severe intellectual deficiency would be able to read and understand printed words without being directly taught only through teaching the pairing of dictated words (set A) and printed words (set C; relation AC). A pretest showed that the participant already related the dictated words (A) with the corresponding figures (B; relation AB)and named (D) the respective figures (B; relation BD). However, the individual did not display any type of reading, regardless of whether it was receptive (e.g., pointing to the written word after the word was dictated [relationAC] or pointing to the written word after the figure was presented [relation BC]) or expressive (e.g., saying the name of the written word [relation CD]). The participant learned the relation between the dictated word and printed word (relation AC) within a set of nine words. After teaching, tests of untaught direct relations were performed but derived from the teaching conditions. The participant was successful both in the selection of the printed word when presented with the figure (relation BC)and in the selection of the figure with

the printed word (relation CB). Considering that the participant already named the figures (relation BD), and the figures came to be linked to the printed words (relations BC and CB), at the end of the study, the participant successfully read the words (relation CD). This study was pioneering[21]. Based on the results, the equivalent relations paradigm has generalized to different procedures and populations, thus providing important contributions to the development of symbolic and linguistic skills[21-23,25-29].

Investigations of speech intelligibility that use the equivalent relations paradigm are still incipient in the literature. The first studies were performed with patients with audition deficits who received cochlear implants[22,26]. These studies showed that the systematic teaching and strengthening of relation networks (stimulus-stimulus and stimulus-vocal action) could improve vocalizations in persons with speech impairments, which could reach precision in some cases. In one study,[26] improvements in figure naming in four children with prelingual cochlear implants (who presented distortions/omissions in the emission of words) were obtained after they were exposed to auditory-visual tasks associated with echoic training. Teaching consisted of relations between dictated words (A) and known figures (B; relation AB) and between the same dictated word (A) and abstract figures (C; relation AC). Teaching also sought to strengthen vocal imitation (relation AD) in the participants. In the tests, the participants displayed precision in the relations between conventional and abstract figures (relations BC and CB) and also showed improvements in speech intelligibility when naming conventional (relation BD) and abstract (relation CD) figures. In another study,[22] the network of relations between dictated words(A), figures (B),and written words (C) was strengthened in six children with reader cochlear implants, who presented results close to precision in reading (relation CD) but presented several distortions, omissions, and changes in naming the figures (relation BD).After teaching, which strengthened the network of relations that involved reading (relations AB and AC), the same vocalizations sometimes emitted with the printed word (relation CD) were extended to the figure (relation CD)such that speech intelligibility in naming the figures was close to the levels obtained in reading.

Considering the applicability of the equivalent relations model in the study of and intervention in linguistic skills and possible technological contributions to favoring speech intelligibility, one can question whether the generality of the results obtained in studies of equivalence can be extended to conditions produced by cerebellar hypoplasia. The objective of the present study was to evaluate the effects of a teaching program based on the equivalent relations paradigm, specifically in the strengthening of the network of relations between stimuli and between stimuli and verbal actions, on pronunciation and speech intelligibility in an adolescent with cerebellar hypoplasia.

PRESENTATION OF THE CASE

The present study was conducted during a professionally supervised stage of the first author's Psychology degree studies. The people who were responsible for the participant authorized the registration and disclosure of the results by signing an informed consent term according to Resolution 196/96. The data obtained in this study are part of a more comprehensive project that was approved by the ethical committee in research of the Science School of Bauru/Paulista State University "Julio de Mesquita Filho" (FC/UNESP-Bauru; approval no. 13653/46/01/12).

The present work was a case study that was developed during the care of an adolescent with cerebellar hypoplasia in the clinical school of psychology in a university in São Paulo state, Brazil.

Juca (fictitious name) isa12-year old adolescent with cerebellar hypoplasia, with compromised oral/expressive language, balance, and fine motor movements. He was in the fifth grade of public elementary school and was receiving specialized educational care once per week because of his difficulties speaking, reading, and writing.

Brief History of the Case

An analysis of Juca's record revealed that his parents were young adults, both without a history of genetic syndromes. However, their first child displayed significant motor issues (ataxia) and muscular issues(spasticity) in the first years of life and was diagnosed with cerebellar hypoplasia. Juca's gestation was normal. He was born at term and displayed typical development until 10 months of age, at which time his parents began to note rough involuntary and recurring movements. After medical evaluation, the diagnosis of cerebellar hypoplasia was confirmed.

Given the early notice by the family with regard to this syndromic issue and early diagnosis, Juca was exposed to precocious and regular interventions in the areas of physiotherapy, phonoaudiology, occupational therapy, and neurology, which favored reductions of ataxic movements, improved muscular spasticity and balance, the strengthening of gross (e.g.,walking, running, and jumping) and fine (e.g., cut and paint)motor movements, and better control of his phonoarticullatory system. This

set of interventions allowed Juca to develop more mature walking around 2 years of age and improve his vocalizations across the school years (e.g., the emission of more paused vocalizations that favored the intelligibility of some parts of speech). Psychological care began 6 years ago as indicated by phonoaudiologists. Juca was stimulated mainly in the area of language, with an emphasis on the skills of recognizing the phoneme (listening)–grapheme (printing/writing)–phoneme (speaking) relation in isolated words using *Alfabetização Fônica Computadorizada* software[30], thus complementing and supporting school activities.

With regard to Juca's school trajectory, at 8 years of age, he presented good social behavior, although some teachers reported that he presented difficulties in writing and reading. Successive visits to the school revealed that the professionals responsible for making curricular changes did not stay in the school, and Juca was receiving unsystematic pedagogic attention in classrooms and then gradually stopped performing school tasks.

Materials, Stimuli, and Conditions of the Intervention

The intervention was conducted in the clinical school of psychology in a state university in São Paulo state in a room prepared with chairs and tables for presenting the tasks and a video camera to record the case's vocalizations.

With regard to the materials used in this study, we used a printed protocol to annotate performance in the selection tasks, A4 sheets of paper, colored pens, and the toys that Juca preferred, which consisted of (1) *Montplay do Gugu*, a game with pieces composed of a small table with a perpendicular panel with 11 tools and mountable blocks, all made of plastic, (2) *Jogo das Letras*, which includes a wood box that contains 92 square pieces, on which alphabetical letters are printed, and (3) *Jogo da Forca*, which has two EVA's bases in a tree shape with spaces to place letters, two six-part segmented dolls (head, left arm, right arm, trunk, right leg, and left leg),and 92 printed cards with letters of the alphabet.

The chosen stimuli in the teaching and test sessions were grouped in three sets: set A represented auditory stimuli (dictated words: "hammer," "screw thread," "screw," and "handsaw");set B was composed of the respective three-dimensional objects ("hammer," "screw thread," "screw," and "handsaw") that are part of the game *Montplay do Gugu*; set C grouped the printed words that referred to the objects of set B ("H-A-M-M-E-R," "S-C-R-E-W T-H-R-E-A-D," "S-C-R-E-W," and "H-A-N-D-S-A-W"), and these words were displayed by assembling anagrams with the pieces of the game *Jogo das Letras*.

The teaching program comprised nine sessions, with weekly sessions of 50 min each, for a total of approximately 4 months, that were organized in phases of evaluating the verbal repertoire, teaching, posttest, retention, and a debriefing interview with the client's parents.

Procedure

The arrangement of the tasks in this study was organized in three phases —initial evaluation, teaching, and posttests – in which the client was exposed to several stimulus-stimulus or stimulus-action relations, classified according to the modality of the responses involved: tasks of selection, vocalization, writing, and constructed response (described below).

Tasks of the selection of three-dimensional objects

Juca was instructed to select, among the objects of the game *Montplay do Gugu* presented on the table, the object that was related to the spoken or printed stimulus presented by the therapist (i.e., a stimulus-stimulus pairing task). In this kind of task, the therapist dictated a word (A) and asked Juca to handle the corresponding object (B), thus strengthening the relation AB, with instructions such as, "Take the object that goes with...," "Select the one that corresponds to...," and "Play with the object that I said." The behavioral selection was also solicited when the therapist presented the printed word (C) composed of an anagramin the game *Jogo das Letras*, and Juca should select the object that referred to the presented word("Take the object that goes with this word"; "Select the one that goes with this word"), thus strengthening the relation CB.

Tasks of vocalization

These tasks required Juca's vocal actions in three different relations. In the first case, a vocal imitation was solicited (echoic), in which the therapist presented an instruction of repeating a dictated word ("Repeat...," "Imitate...," or "Say the same..."), and Juca should imitate with the maximum amount of punctual correspondence as possible (relation AD). In the second case, Juca should name objects of the game *Montplay do Gugu* following a specific instruction ("Say the name of this object"; "What is this?"), and the vocalized response should correspond to the object in question (relation BD). In the last case, a vocalization response was solicited that consisted of a typical reading activity, in which the therapist showed a printed word (assembled from pieces/letters of the game *Jogo das Letras*) placed

on the table, and the instruction was to vocalize the respective word ("Read this word"; "What is written here?"). The vocalization response should correspond to the words composed of the anagrams (relation CD).

Tasks of writing

Writing behavior referred to Juca's written motor response (F), which was sometimes solicited when presented with a spoken word (A) or object (B). Both cases corresponded to a typical dictation task. In the case of open dictation, the therapist dictated a word, and Juca should write it on an A4 sheet of paper (relation AF).In the case of mute dictation, the therapist presented an object from the game *Montplay do Gugu*,and Juca should write it (relation BF).

Tasks of constructed response

This type of task was quite analogous to the written task, although the writing response was built by the selection of letters in an ordered way, in this case by the pieces/letters of the game *Jogo das Letras*. In this task, the therapist selected an object from the game *Montplay do Gugu* (B) and spread all of the pieces of the game *Jogo das Letras* on the table, soliciting the client to use the letters to compose the word (E) that best represented the object in question (relation BE).

The initial evaluation and posttest phases were composed of tasks of object selection when presented with a dictated word (AB), naming objects (BD), the constructed response of printed words (BE),and writing in the presence of an object (BF; Table 1). During evaluation, the therapist did not provide hints or feedback for Juca's responses because this was the time when the therapist identified the baseline repertoire (pretest), what Juca had learned during teaching, and the effect of teaching on speech intelligibility during the naming object tasks(posttests). All of these repertoires were evaluated in a single session that used games and entertainmentto achieve this goal. In this same session, teaching was initiated and maintained through seven sessions (Table 1).

In the teaching phase, responses defined as correct received feedback in the form of praise and incentive (e.g., "Very good," "Congratulations," "You are the best," and "Keep it up").Responses defined as incorrect were followed by silence and presentation of the next trial. During teaching, which was maintained for seven sessions, criteria were established for advancement for the selection and constructed response activities only (100% correct responses), and the other tasks (writing and vocalization) did not have a minimal performance criterion to continue the activities. During teaching, the four task modalities (i.e., selection, vocalization, writing, and constructed response) were alternated across sessions (Table 1). At the end of each task in this phase, Juca was exposed to the naming (BD) posttest.

Learning retention was evaluated in posttest sessions 8 and 9. The same tasks in the initial evaluation session were presented to Juca, with the goal of verifying speech intelligibility in object naming tasks and evaluating the learning of the auditory recognition of words by pointing to objects, writing, and composing words in response to the referred object. Additionally, in session 9, the objects used during the intervention were presented to Juca's legal guardians.

The selection, writing, and constructed responses were scored according to a protocol developed for this purpose, in which the number of correct responses by Juca was recorded. Vocal responses were recorded, transcribed, and analyzed with regard to whether the vocalizations presented point-by-point correspondence with the conventions established by the verbal community. From these records, a performance percentage was obtained with the vocalizations, expressed as the ratio between the correctly vocalized phonemes and network of existing phonemes in the referred word (*n* correct phonemes ´ 100 / total of phonemes of the word).

Fig. 1 presents a diagram with stimulus-stimulus and stimulus-action relations that were interlaced in the teaching and test phases. In the diagram, squares represent stimuli, and ellipses represent actions/responses. Solid arrows represent relations that were taught or strengthened, and dotted arrows indicate the relations that were tested.

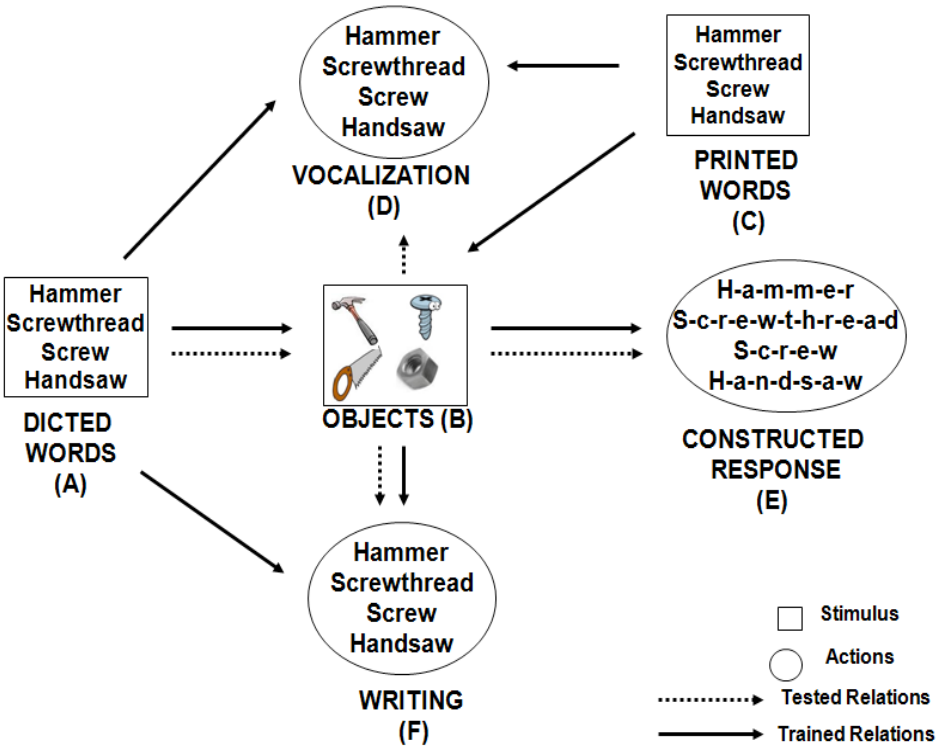

Figure 1 – Diagram of the relations taught and tested

RESULTS

Table 1 shows the design, adopted tasks, and percentage of correct responses obtained by the participant in each of the programmed activities. In the pretest, Juca obtained a low percentage of correct responses for the relations of object selection in the face of a dictated word (25%), naming objects (34.48%), anagram construction (34.48%),and writing (34.48%). Overall, Juca obtained good results in the teaching sessions that involved the selection of objects following a dictated word, the selection of objects when presented with the printed word, the vocal imitation of words, and the constructed response and writing words. In addition to learning the taught relations, he also displayed precise results in relations that involved writing, construction, and especially naming objects (BD), which was the focus of this study.

Table 1 – Percentage of correct responses obtained by the participant in the pretest, teaching, posttest, and retention sessions

Session	Pretest		Teaching		Posttest	
	Task	Correct responses	Task	Correct responses	Task	Correct responses
1	Dictated word– Object	25%	Dictated word – Object	100%	Object – Vocalization	87.50%
	Object – Vocalization	34.48%	Dictated word – Vocalization	87.50%		
	Object– Construction	34.48%				
	Object –Writing	34.48%				
2			Dictated word– Object	100%	Object– Vocalization	87.50%
			Dictated word– Vocalization	71.42%		
3			Dictated word– Object	100%	Object– Vocalization	86.48%
			Printed word– Vocalization	86.36%		
4			Dictated word– Object	100%	Object – Vocalization	95.65%
			Object- Writing	86.36%		
			Printed word– Object	100%		
5			Dictated word– Object	100%	Object – Vocalization	100%
			Object –Writing	90.90%		
6			Printed word – Vocalization	100%	Object– Vocalization	100%
			Dictated word–Writing	100%		
7			Object – Construction	100%	Object– Vocalization	100%
			Object –Writing	100%		
8				Retention	Dictated word– Object	100%
					Object – Vocalization	100%
					Object – Construction	100%
					Object –Writing	100%
9					Dictated word– Object	100%
					Object – Vocalization	100%
					Object– Construction	100%
					Object –Writing	100%

In teaching the selection of objects after a dictated word (relation AB), Juca obtained 100% correct responses in the first exposure and maintained performance during the subsequent teaching sessions (sessions 1-5), in the posttest (session 8), and in the retention session (session 9). When exposed to tasks of vocal imitation (relation AD), Juca presented high indices of correspondence between vocalization and the dictated word, obtaining 87.5% (session 1) and 71.42% (session 2) correct responses in two consecutive sessions.

An additional analysis of Juca's intervention comprised the results obtained between the third and sixth sessions when the tasks of reading printed words (relation CD), writing words in the face of objects (relation BF),and selecting objects in the face of printed words (relation CB) were performed. In the reading words task, Juca obtained 86.36% correct responses (session 3).When the task was to write a word after object presentation, he showed 86.36% correct responses (session 4).In tasks of object selection in the face of printed words, he obtained 100% correct responses (session 4).When repeating the writing task in the face of an object (session 5), Juca obtained 90.9% correct responses, thus improving performance compared with session 4. In the sessions in which relations that involved printed and written words were strengthened (sessions 3 to 7), object naming (BD) was evaluated. We observed an increase in punctual correspondence with linguistic conventions, reaching 100% correct responses (session 5).

Fig. 2 illustrates the progression of speech intelligibility in the object naming task (target relations) during the teaching program, in which Juca initially presented low indices (34.48% in the initial evaluation).He demonstrated an increase in intelligibility (87.50% in sessions 1 and 2, 86.36% in session 3, 95.65% in session 4) during the successive teaching steps, reaching precision (100%) in session five onward.

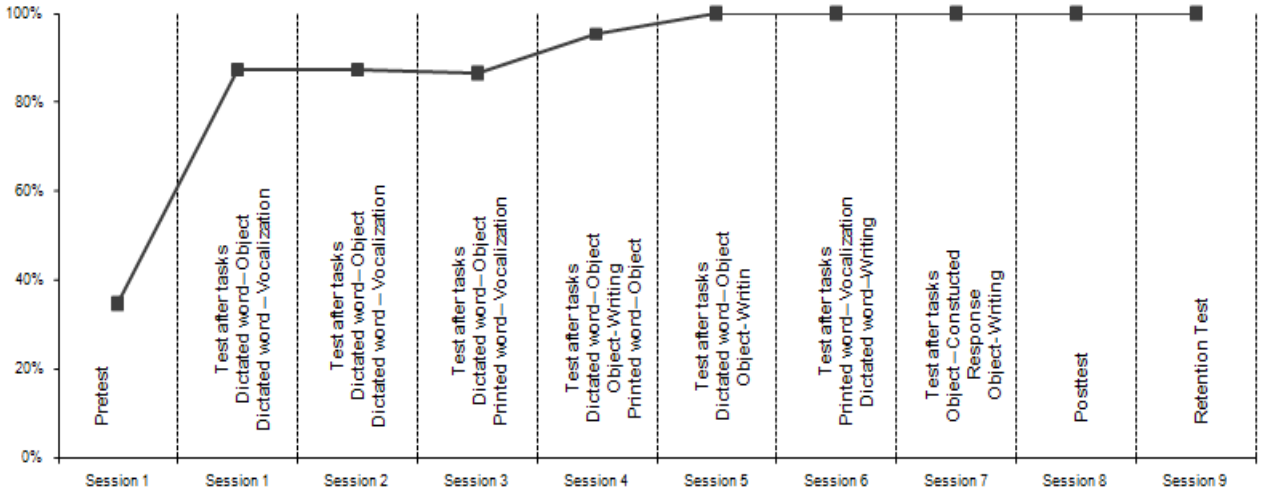

Figure 2 – Performance in speech intelligibility in tests of object naming

DISCUSSION

The goal of the present study was to verify the generalization of the guided teaching program in an equivalent relations paradigm—between objects, dictated words, printed words, word reading, and writing—to speech intelligibility in tasks of naming objects in an adolescent with cerebellar hypoplasia. The adopted strategies allowed improvements in the quality of the subject's oral production. This study replicates previous studies conducted with populations with different special teaching requirements, in which the discrepancies observed between reading and naming were reduced after strengthening the equivalent relations network[22].

Another aspect that contributed to the improvement in naming could be the alternating pattern of the tasks based on the selection of objects (relation AB) associated with the vocalization tasks (relation AD). This activity of orally repeating the dictated words could have directly influenced how the subject spoke, allowing a gradual approximation of word vocalization with the acoustic model provided by the therapist (i.e., the standard phonological patterns used by the linguistic community). The improvement in vocal imitation performance suggests that this intelligibility could be extended to object naming tasks, in which the results improved to 87.5% correct responses already in the first vocal imitation training session. These findings are consistent with results obtained with people with audition deficits who use cochlear implants, in which an improvement in figure naming was obtained after teaching of relations between dictated words and figures associated with echoic training[26].

During the sessions in which the relations that involved printed and written words were strengthened (sessions 3-7), we observed that object naming (BD) exhibited an increase in punctual correspondence with linguistic conventions, reaching speech precision (100% correct responses) in session 5. Along the sessions, only Juca's vocalizations were evaluated (i.e., they were not direct targets of the intervention, in contrast to the vocal imitation sessions). The literature indicates that verbal actions, such as reading (relation CD) and writing (relation BF), require that each unit of the word presented during the action (emitted phonemes or graphemes) corresponds to each smaller printed unit (grapheme)[19,20]. If this repertoire integrates the network of relations (as described in Fig. 1), then this means that it now shares equivalent relations.[18,21,25]and an element of a network (such as a written word) becomes related to the element of the another network (spoken word).

In Juca's case, the vocal imitation tasks (AD) presented important conditions for improving object naming (BD). However, by exposing Juca to activities that involved reading, writing, and integrating the network of relations, sufficient conditions were created for smaller word units (graphemes), which initially regulated only reading and writing, to become regular vocalizations that were more precise in object naming tasks because these stimuli and verbal actions are part of the equivalent relations network. The evolution of object naming (relation BD) is shown in Fig. 2. These findings are consistent with previous studies[22] that reported improvement in figure naming by children with prelingual cochlear implants after strengthening the

network of relations that involved reading (relation CD), the selection of figures when presented with a dictated word (relation AB), and the selection of a printed word when presented with the same dictated word (relation AC). If vocalization (D) occurred with precision when presented with the printed word (C) through stimulus equivalence, then it also occurred when presented with the figure (B). In the case of the teaching program to which Juca was exposed, although we cannot estimate the direction of this interference, the adopted design allowed us to confirm that similar processes are related to improvements in the intelligibility of his speech.

The last sessions (sessions 8 and 9) showed that Juca was able to maintain what he acquired, especially the relations that involved object naming, although no additional training was provided.

These results indicate that the language rehabilitation process, the target of which was speech intelligibility, can provide theoretical and methodological contributions to two distinct areas: phonoaudiology (audition, speech, language, and the implementation of therapeutics) and psychology (the behavioral processes involved in learning a language and the analysis and systematization of teaching procedures). The interdisciplinarity between these two areas of knowledge can offer potential conditions for conducting studies on changes in behavioral speech phenotypes (e.g., in cases of genetic syndromes), the conditions necessary and sufficient to facilitate the learning of verbal competencies, and reducing social and linguistic deficits in children with special education needs.

FINAL COMMENTS

The present study investigated the effects of a systematic teaching program on speech intelligibility in a subject with cerebellar hypoplasia, demonstrating generalization of the results through an equivalent relations network. The present study also showed that the arrangement of specific teaching conditions with regard to the subject's initial repertoire and target repertoire can modify speech expression in specific syndromes and in people with genetic anomalies,[3,4] such as cerebellar hypoplasia. The systematic planning and arrangement of environmental elements in the clinical and educational context can allow language/speech professionals to analyze the variables (i.e., genetic and environmental) involved in each case and implement effective interventions that can alter behavioral speech patterns in patients with different types of disorders.[3,14,17]

Among the possibilities of environmental conditions that involve speech and other symbolic behaviors (e.g., relating stimuli and reading, writing, and composing words), the equivalent relations model can operationally contribute to human speech interventions,[22,24,26]specifically with regard to intelligibility as demonstrated in the present study. The strengthening of a network of relations between dictated words, objects, printed words, the actions of reading, writing, and composing (using letters),and vocalization by teaching some of these relations gradually taught the subject to vocalize when presented with objects (naming) that corresponded to the phonemic conventions of the linguistic community (speech intelligibility) and allowed the subject to present meaning and comprehension that are shared by the community. When Juca vocalized "handsaw," he related this vocalization with the object handsaw, the printed word "HANDSAW," and so on. These elements integrated a network of relations that are considered symbolic.

Although the guided teaching program in the equivalent relations model[18,21,25]presented positive effects in speech intelligibility in the present study's participant, one can highlight the importance of conducting additional studies on the effects of teaching and intervention on comprehensible speech in people with cerebellar hypoplasia. The present results refer to a single case and cannot necessarily be generalized to all conditions that fulfill this diagnosis.

RESUMO

Dentre as muitas estruturas cerebrais envolvidas na linguagem, o ceberelo cumpre um papel importante na coordenação dos movimentos responsáveis pela fala, de modo que qualquer alteração nesta estrutura pode comprometer o desenvolvimento da linguagem oral. Considerando o planejamento do ensino e as intervenções enquanto um fator que pode alterar as expressões fenotípicas impostas pela hipoplasia cerebelar, este estudo de caso teve como objetivo verificar os efeitos de um programa de ensino (envolvendo equivalência entre palavra ditada, palavra escrita e objeto) sobre a inteligibilidade da fala de um adolescente com doze anos, gênero masculino, com hipoplasia cerebelar. As sessões foram conduzidas em contexto clínico e com uso de brinquedos de preferência do participante. O programa consistiu em etapas de avaliação, ensino, pós-testes e retenção, no qual eram apresentadas tarefas de seleção, vocalização, escrita e composição de palavras. Durante a avaliação, observou-se um baixo desempenho em todas as tarefas, especialmente na nomeação de objetos; no decorrer do ensino, as vocalizações foram monitoradas, constatando-se uma gradativa melhora na inteligibilidade da fala quando o participante nomeava objetos, chegando à precisão no pós-testes e retenção. Pode-se concluir que, para o caso apresentado, o fortalecimento da rede de relações entre estímulos e estímulos-ações verbais promovido pelo programa de ensino, favoreceu melhorias na inteligibilidade da fala.

DESCRITORES: Doenças Cerebelares; Distúrbios da Fala; Comportamento Verbal; Reabilitação dos Transtornos de Fala e Linguagem; Inteligibilidade da Fala

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