https://doi.org/10.23925/2176-2724.2020v32i4p658-668

Analysis of speech-language pathology intervention in speech apraxia in Down syndrome: a case study

Análise da intervenção fonoaudiológica em apraxia de fala na síndrome de Down: um estudo de caso

Análisis de la intervención fonoaudiológica en la apraxia del habla en el síndrome de Down: un estudio de caso

*Risayane Santos da Silva**
*Julyane Feitoza Coêlho**
*Manuela Leitão de Vasconcelos**
*Isabelle Cahino Delgado**
*Giorvan Ânderson dos Santos Alves**

Abstract

Introduction: Down syndrome (DS), chromosome 21 trisomy, is a genetic condition that stands out for its cognitive deficit and global developmental delay. Among the skills that may present difficulties in the development, these skills deserve to be highlighted as changes involving expressive language, with speech impairment. These changes can interfere with motor planning and programming, characterizing the occurrence of apraxia of speech in childhood, a disorder of neurological origin, in which the precision and consistency of movements underlying speech are impaired in the absence of neuromuscular deficits. **Objective**: To present a speech therapy intervention aimed at apraxia of speech in a child with DS. **Method**: The participant was a 07-year-old boy, diagnosed with speech apraxia associated with DS. The intervention

* Universidade Federal da Paraíba - Paraíba, João Pessoa – Brazil.

Authors' contributions:
RSS was responsible for the collection, analysis of the data and draft of the article.
JFC contributed in the data analysis and revision of the final version for publication.
MLV contributed with the methodology and critical review.
ICD contributed with the study design and critical review.
GÂSA contributed with the study design, methodology and orientation.

Correspondence e-mail: Risayane Santos da Silva - risayane@hotmail.com
Received: 06/14/2009
Accepted: 09/10/2020

was individualized, based on the principles of motor development and performed for 10 sessions, of 30 minutes each. In the presentation of the case, it is the data of the speech therapy evaluation, the objectives and procedures used in the proposed therapeutic planning. **Results**: The data collected during the combinations were previous and the effects of speech therapy were approved. The reassessment data showed that the movements of non-verbal praxis had better scores after the intervention, with the results being more expressive. In addition, the positive results regarding stimulation for speech development, with the best results obtained in the bilabial phonemes /p,b and m/ and in the glottal phoneme /h/. **Conclusion**: The intervention presents satisfactory results, providing high information for a better clinical practice in the area.

Key words: Speech-Language and Hearing Sciences; Speech Therapy; Down Syndrome; Apraxia; Articulation Disorders; Speech.

Resumo

Introdução: A síndrome de Down (SD), trissomia do cromossomo 21, é uma condição genética que se caracteriza por um déficit cognitivo e atraso global do desenvolvimento. Dentre as habilidades que podem apresentar fragilidades, merecem destaque as alterações envolvendo a linguagem expressiva, com comprometimentos na fala. Essas alterações podem interferir no planejamento e na programação motora, caracterizando a ocorrência da apraxia de fala na infância, um distúrbio de origem neurológica, no qual a precisão e a consistência dos movimentos subjacentes à fala são prejudicadas na ausência de déficits neuromusculares. **Objetivo**: Apresentar a intervenção fonoaudiológica voltada à apraxia de fala em uma criança com SD. **Método**: O participante foi um menino com 07 anos de idade, diagnosticado com apraxia de fala associada à SD. A intervenção foi individualizada, baseada nos princípios do aprendizado motor e realizada durante 10 sessões, de 30 minutos cada. Na apresentação do caso, são abordados os dados da avaliação fonoaudiológica, os objetivos e procedimentos utilizados no planejamento terapêutico proposto. **Resultados**: Os dados coletados durante as sessões foram descritos e os efeitos da fonoterapia foram analisados. Os dados da reavaliação apontaram que os movimentos de praxias não verbais apresentaram melhores escores após a intervenção, sendo os resultados mais expressivos. Além disso, os resultados foram positivos quanto à estimulação para o desenvolvimento da fala, com os melhores resultados obtidos nos fonemas bilabiais /p, b e m/ e no fonema glotal /h/. **Conclusão**: A intervenção apresentou resultados satisfatórios, disponibilizando informações relevantes para uma melhor prática clínica na área.

Palavras-chave: Fonoaudiologia; Fonoterapia; Síndrome de Down; Apraxias; Transtornos da Articulação; Fala.

Resumen

Introducción: El síndrome de Down (SD), trisomía del cromosoma 21, es una condición genética que se destaca por su **déficit cognitivo y retraso global** del desarrollo. Entre las habilidades que pueden presentar dificultades en el desarrollo, estas habilidades merecen ser destacadas como cambios que involucran el lenguaje expresivo, con alteraciones del habla. Estos cambios pueden interferir con la planificación y programación motora, lo que caracteriza la aparición de apraxia del habla en la infancia, un trastorno neurológico en el que la precisión y la coherencia de los movimientos subyacentes al habla se ven afectadas en ausencia de déficits neuromusculares. **Objetivo**: presentar una intervención logopédica dirigida a la apraxia del habla en un niño con SD. **Método**: El participante era un niño de 07 años, diagnosticado de apraxia del habla asociada a SD. La intervención fue individualizada, en base a los principios del motor y se realizó por 10 vías, de 30 minutos cada una. En la presentación del caso, son los datos de la evaluación logopédica, los objetivos y procedimientos utilizados en la planificación terapéutica propuesta. **Resultados**: Los datos recolectados durante las combinaciones fueron previos y se aprobaron los efectos de la logopedia. Los datos de la reevaluación mostraron que los movimientos de praxis no verbal tuvieron mejores puntuaciones después de la intervención, siendo los resultados más expresivos. Además, los resultados positivos en cuanto a estimulación para el desarrollo del habla, con los mejores resultados obtenidos en los fonemas bilabiales / p, bym / y en el fonema glotal / h /. **Conclusión**: La intervención presenta resultados satisfactorios, brindando alta información para una mejor práctica clínica en el área.

Palabras clave: Fonoaudiología; Logoterapia; Síndrome de Down; Apraxias; Trastornos de la

Introduction

Down Syndrome (DS) is a chromosomal disorder whose overall clinical condition stems from an imbalance in the cellular chromosomal constitution[1]. In Brazil, it occurs in 1 out of 600 births, which means that approximately 8 thousand babies with DS are born per year[2]. Thus, it is believed that 300,000 people with DS live in the country. Speech Therapy becomes important in this context, especially for orofacial motricity and oral and written language, regardless of the life stage in which difficulties occur.

The following problems stand out in the communication of children with DS: impairments in expressive syntax, in the emission of grammatical morphemes, in intelligibility and motor speech planning, in expressive vocabulary, and in verbal, visuospatial, and short-term memory.[3, 4]

Children with DS have a high incidence of speech unintelligibility. Among the causes, we can highlight: speech disorder of musculoskeletal origin; deficits involving motor control of breathing, phonation, articulation, and resonance, in the case of dysarthria; and difficulty in motor speech planning (programming, combining, organizing, and sequencing the movements necessary for speech), in the case of apraxias.[5,6]

Research has investigated the prevalence of types of speech disorders and speech motor disorders in individuals with DS through the analysis of speech samples from 45 participants aged between 10 and 20 years. For that, the researchers used perceptual and acoustic methods and measures in the Speech Disorders Classification System. In total, 97.8% of participants met the criteria for motor speech disorders, including childhood dysarthria (37.8%), speech motor delay (26.7%), childhood dysarthria associated with childhood apraxia of speech (CAS) (22.2%), and CAS alone (11.1%). Thus, CAS accounted for a frequency of occurrence of 33.3%. These results point to the relevance of studies that address the theme, considering from baseline assessment to clinical implications.[6,7]

Speech apraxia is defined as a communication disorder caused by a difficulty in speech articulation due to the impaired ability to voluntarily program the position of the muscles of phonoarticulatory organs, and thus to move muscles to produce phonemes and words. In this condition, these movements can be performed automatically, but not voluntarily.[8] Specifically, CAS can occur as a result of known neurological impairment, in association with complex neurobehavioral disorders of known or unknown origin, or as an idiopathic neurogenic speech sound disorder. This central commitment in the planning and/or programming of spatio-temporal parameters of the movement sequences results in errors in the production and prosody of speech sounds.[9]

Researchers recognize three segmental and suprasegmental characteristics as having diagnostic validity for CAS: inconsistent errors in consonants and vowels in repeated production of syllables or words; prolonged and interrupted coarticulatory transitions between sounds and syllables; and inadequate prosody, especially when performing lexical or phrasal stress.[9]

Considering the specific context of DS, a pioneering study investigated the scope with which CAS was being identified through the parents' perception of their children's speech. The data show that 15% of participants reported clinical features of CAS in their children. Daily examination of the speech characteristics identified by the parents indicated that many more children were showing clinical symptoms of CAS, although not having this diagnosis. The most common characteristics included decreased intelligibility, inconsistency in speech errors, difficulty in sequencing sounds and oral movements, and a higher receptive than expressive language pattern.[10] This result demonstrates an effective perception of family members regarding the aspects under study. However, the research highlights the importance of a specialized evaluation for differential diagnosis so as to ensure the best therapeutic approach, with significant impacts on clinical prognosis.

Discussions on CAS are recent in Brazil, and studies in the area are still incipient. Thus, there is a lack of research on the peculiarities involved in the diagnosis and speech therapy intervention directed to CAS associated with DS, representing a gap in the literature in the area.

In this sense, the present study makes a relevant contribution by presenting a therapeutic plan developed for a child with DS and CAS, analyzing the results obtained with a speech therapy intervention directed to the specific needs of the patient.

Therefore, this study presents a proposal for speech therapy intervention to treat a child with CAS associated with DS. The study describes the

speech therapy performed, the clinical procedures used, and the results found, pointing out the main contributions to the case.

Case presentation

This is a qualitative and descriptive case study. The study participant was a 7-year-old male student diagnosed with CAS associated with DS. The patient was attended at a speech therapy school clinic of a public higher education institution. The child's guardians authorized his participation in the study by signing the Informed Consent Form, in accordance with resolution 466/12 of the Brazilian National Health Council, meeting all ethical criteria. This research was approved by the Institution's Research Ethics Committee under Protocol No. 1,302,829.

Due to the lack of specific instruments for assessing CAS in Brazilian Portuguese[11] in the speech-language assessment, the Speech Apraxia Assessment Protocol[12] was used to assess verbal and nonverbal praxis.

Data were collected during speech therapy sessions. An initial interview and the said protocol were applied for the evaluations. This protocol consists of two types of tests. The first type assesses nonverbal praxis, requesting 27 isolated and sequential movements, performed after the evaluator's command. The second type assesses verbal praxis, with tasks of repetition of words and sentences, automatic speech, spontaneous speech, and reading aloud of words and sentences. However, the responses obtained were not satisfactory due to the limitations in oral production presented by the volunteer. This same protocol was reapplied after 10 therapeutic sessions, and all the steps were performed by the same therapist.

The data were recorded in video files using two SONY DCR-SX22 camcorders. The information collected during therapy was described with a view to identifying the effects of the intervention on CAS associated with DS. Subsequently, each task was classified according to a gradual scale of responses: correct and immediate response without hesitation (1), correct response after some errors in previous attempts (2), decrease in amplitude, adequacy, and speed of movement (3), partial response (4), perseverative response (5), irrelevant response (6), no response (7), and response after the therapist's demonstration (*).

The initial interview (anamnesis) was carried out with the child's mother, who reported a smooth and uneventful pregnancy. After the child's birth the pediatrician suspected DS still in the delivery room due to his physical appearance. Nonetheless, the diagnosis of chromosomopathy was confirmed by a geneticist when the child was three months old. The participant had a history of cardiac malformation (heart murmur) requiring specific monitoring in the area.

Regarding food, he was exclusively breastfed until seven months of age, then receiving dietary supplementation for up to one year and three months. According to the mother, psychomotor development was not delayed in relation to the aspects expected for his chronological age, except for speech. During the study period, the child was in a good general health condition, and was regularly monitored by speech therapists, psychopedagogists, and pediatricians.

Regarding communication aspects, the mother presented the results of the audiological exams previously performed: Newborn Hearing Screening (NHS) and Brainstem Auditory Evoked Potentials (BAEP). The exams were within normality standards. The child had been undergoing speech therapy since the age of three months, but was unable to develop comprehensible speech. This condition was previously diagnosed as language delay and only recently has the child been diagnosed with CAS.

The mother reported that the suspicion of CAS came with the patient not evolving through the speech therapy performed. Despite the early stimulation and multidisciplinary monitoring, the child's speech did not develop as expected. After understanding the theme, the parents sought out Speech Therapy specialists, who diagnosed him with childhood apraxia of speech.

As for schooling aspects, the child had been attending an inclusive private regular school since two years of age. At the time of the study, he was in the first year of elementary school. He could already identify letters, write his name, and make small textual productions, but had difficulty in activities that involved oral expression and dialogue with other people. He used to interact well with other children and also took futsal and circus classes.

During evaluation, the child appeared to be calm and participative, showing interest and attention to everything that happened in the therapy

room. During the whole period of conversation with his mother, he uttered only a few babblings, which only the mother could understand.

Oral myofunctional assessment showed hypotonia of the lips and cheeks, hypofunctionality of the tongue, mixed dentition in good condition, nasal breathing, and absence of chewing and swallowing changes.

From the evaluation, it became clear that speech therapy should be directed towards improvements in the organization and planning of speech-language movements through speech motor training.

Thus, a therapeutic planning based on tactile/proprioceptive, visual, auditory, and metacognitive cues was set up to stimulate speech production.[13-16] Ten therapeutic sessions were held on a weekly basis, each lasting 30 minutes. During therapy, the patient showed assiduity and good adherence to treatment.

Results

Table 1 compares the results obtained before and after the speech therapy intervention, highlighting movements with more significant changes. In the initial evaluation, the child was unable to perform any command (e.g., rounding the lips) without the therapist's demonstration, always needing a model. After the ten sessions (reassessment), the execution of all movements improved, especially those that the child was unable to perform previously even with the help of the therapist, namely: whistling, licking the lips, rounding the lips, touching the nose with the tip of the tongue, clearing the throat, chattering the teeth, and articulating the sequences Fe/Pe and Fe/Pe/Te without making any sound.

Furthermore, the gains from the speech therapy intervention proposed for CAS were analyzed (Chart 1).

Table 1. Responses obtained in the assessment of nonverbal praxis skills before and after speech therapy

Movement	Pre-therapy response	Post-therapy response
Put your tongue out	2*	1
Show me how you blow	2*	1
Show me your teeth	3*	3
Round your lips	7*	3
Touch your nose with the tip of your tongue	7*	4
Bite your bottom lip	2*	2
Whistle	7*	5
Lick your lips with your tongue	7*	1
Clear your throat	7*	1*
Thrust your tongue out and in	2*	1*
Clench your teeth (bite)	7*	2*
Show me your smile	5*	2*
Click your tongue	5*	2*
Send a kiss	4*	1*
Chatter your teeth as if you were cold	7*	2*
Touch your chin with the tip of your tongue	2*	1
Lateralize your mandible	7*	4*
Show me how you cough	3*	3*
Inflate your cheeks	5*	3*
Lateralize your tongue	3*	3*
Make a pout with your mouth	4*	2*
Switch between pout and smile	5*	3*
Raise and lower your tongue	4*	3*
Put your tongue sideways and then up	4*	4*
Put your tongue out, close your mouth, put your tongue in, and open your mouth	4*	3*
Articulate the Fe/Pe sequence without making any sound	7*	2*
Articulate the Fe/Pe/Te sequence without making any sound	7*	4*

Legend: 1 = correct and immediate response without hesitation 2 = correct response after some errors in previous attempts; 3 = decrease in amplitude, adequacy, and speed of movement; 4 = partial response; 5 = perseverative response; 6 = irrelevant response; 7 = no response; * = response after the therapist's demonstration. The variables in bold stand for the most expressive results.

Chart 1. Therapeutic planning and evolution of speech therapy sessions

Session	Objective	Procedure
Evaluation	1- Conducting an initial interview and assessing verbal and nonverbal praxis skills.	1- An initial interview was performed and the Speech Apraxia Assessment Protocol was applied.
1st session	1- Improving vowel emission.	1.1- Tactile-proprioceptive cues were used through position, location, and movement information. 1.2- Visual cues were used through imitation and mouth figures associated with speech motor training during the production of vowels /a/, /e/, /i/, /o/, and /u/.
2nd session	1- Improving planning and articulatory organization in the production of bilabial phonemes /p/, /b/, /m/.	1.1- Toys whose names start with the target phonemes were named in a playful task. 1.2- The patient was encouraged to articulate the target phonemes through visual and metacognitive cues (articulatory gestures to help the child to think about the movement). 1.3- A drum was used to condition the child in the production of phonemes, which should be associated with the playing of the instrument.
3rd session	1- Improving planning and articulatory organization in the production of bilabial phonemes /p/, /b/, /m/ associated with vowels. 2- Improving speech intelligibility.	1.1- The patient was stimulated to produce the target phonemes through visual cues (images) and metacognitive cues (articulatory gestures). 1.2- A drum was used to condition the child in the production of target phonemes in association with the playing of the instrument. 2- Speech motor training was performed through facilitating gestures.
4th session	1- Improving tone and mobility of extra- and intraoral muscles. 2- Improving planning and articulatory organization in the production of bilabial phonemes /p/ /b/ /m/. 3- Improving speech intelligibility.	1.1- Isometric exercise for lips (sustained protrusion of lips) and stimulation with the aid of a spatula were performed to favor tongue elevation. 1.2- Massages were applied to orofacial muscles. 2.1- The patient was encouraged to verbally produce the target phonemes through visual cues (images) and metacognitive cues (articulatory gestures). 2.2- A drum was used to condition the child in the production of target phonemes in association with the playing of the instrument 3- Speech motor training was carried out through auditory cues, with imitation of monosyllabic and disyllabic words with the target phonemes.
5th session	1- Improving tonus and mobility of orofacial muscles. 2- Improving planning and articulatory organization in the production of labiodental fricative phonemes /f/, /v/. 3- Improving speech intelligibility.	1- Isometric exercise for lips (sustained protrusion of lips) and stimulation with the aid of a spatula were performed to favor tongue elevation. 2.1- The patient was encouraged to verbally produce the target phonemes through visual cues (images) and metacognitive cues (articulatory gestures). 2.2- A flute was used both to condition the child in the production of the target phoneme /f/ in association with the playing of the instrument and to favor proprioception of the articulation point. 3- Auditory cues (auditory bombardment) were used through a narrative containing several words with the target sound, stimulating the melody.
6th session	1- Improving tonus and mobility of orofacial muscles. 2- Improving planning and articulatory organization in the production of labiodental fricative phonemes /f/, /v/. 3- Improving speech intelligibility.	1- Isometric exercise for lips (sustained protrusion of lips) and stimulation with the aid of a spatula were performed to favor tongue elevation. 2.1- The patient was encouraged to verbally produce the target phonemes through visual cues (images) and metacognitive cues (articulatory gestures). 2.2- A flute was used both to condition the child in the production of the target phoneme /f/ in association with the playing of the instrument and to favor proprioception of the articulation point. 3.1- Auditory cues (imitation, training of parts) were used.
7th session	1- Improving tongue functionality. 2- Improving planning and articulatory organization in the production of phonemes /t/, /d/, /l/. 3- Improving speech intelligibility.	1- Isometric exercise for lips (sustained protrusion of lips) and stimulation with the aid of a spatula were performed to favor tongue elevation. 2- The patient was encouraged to verbally produce the target phonemes through visual cues (images) and metacognitive cues (articulatory gestures). 3- Tactile-proprioceptive, visual, and auditory cues were used.
8th session	1- Improving tongue functionality. 2- Improving planning and articulatory organization in the production of phonemes /t/, /d/, /l/. 3- Improving speech intelligibility.	1- Isometric exercise for lips (sustained protrusion of lips) and stimulation with the aid of a spatula were performed to favor tongue elevation. 2- The patient was encouraged to verbally produce the target phonemes through visual cues (images) and metacognitive cues (articulatory gestures). 3- Speech motor training was performed through auditory and visual cues.
9th session	1- Improving tonus and mobility of lip muscles and tongue functionality. 2- Improving planning and articulatory organization in the production of phoneme /h/. 3- Improving speech intelligibility.	1- Isometric exercise for lips (sustained protrusion of lips) and stimulation with the aid of a spatula were performed to favor tongue elevation. 2- The patient was encouraged to verbally produce the target phonemes through visual cues (images) and metacognitive cues (articulatory gestures). 3- Speech motor training was performed through auditory cues, also using the book "The Fox and the Stork" (in Portuguese) to stimulate the retelling of the story.
10th session	1- Improving tonus and mobility of lip muscles and tongue functionality. 2- Improving planning and articulatory organization in the production of phoneme /h/. 3- Improving speech intelligibility.	1- Isometric exercise for lips (sustained protrusion of lips) and stimulation with the aid of a spatula were performed to favor tongue elevation. 2- The patient was encouraged to verbally produce the target phonemes through visual cues (images) and metacognitive cues (articulatory gestures). 3- Speech motor training was performed through tactile-proprioceptive cues.
Reevaluation	1- Reassessing verbal and nonverbal praxis skills.	1- The Speech Apraxia Assessment Protocol was used.

In the initial therapeutic session, vowel emission was used as a starting point. This step considered the skills that the child already had, and the participant corresponded to the stimulation performed. In the work with consonant sounds, applied in the second session, there was a greater need for visual support to carry out the proposed activities. Thenceforth, the insertion of the conditioning element facilitated the performance of activities, leading to greater engagement and the emission of more prolonged sounds, articulated with the playful stimulus.

In the fourth session, the use of isometric exercises improved motor stimulation with phonemes, and for the first time the child was able to emit the word "mother" without distortions. In the fifth session, the use of musical instruments and images helped the child to focus more on therapy, representing a more didactic way of exemplifying the point and manner of articulation. In the sixth session, after the orofacial motricity work, speech training using the target phonemes enabled the child to successfully produce isolated phonemes and monosyllabic words with ease. Notwithstanding, the participant showed more difficulty for disyllables, mainly in syllables with /i/, /u/.

The seventh and eighth sessions included speech exercises, in which the child presented some difficulties to articulate phonemes. The ninth session stimulated the child's verbal expression, emphasizing the emission of /h/. The participant managed to produce the target phoneme in association with facilitating gestures, and retold the story by producing distorted words. Finally, in the tenth session, after the orofacial motricity work, auditory and visual cues helped the patient to successfully articulate disyllables, including speaking the therapist's name for the first time.

Discussion

Considering that our study case involves a child with CAS associated with DS, it is worth mentioning that the chromosomopathy brings specific characteristics and distinct developmental patterns, which can lead to deficits involving several cognitive domains and a co-occurrence of speech and language disorders. These aspects must be considered during therapeutic assessment and intervention.

It thus becomes important to understand cognitive and behavioral functioning in individuals with DS. This functioning usually involves neurocognitive and neurobehavioral aspects that emerge within specific periods of development, with distinct profiles that reflect underlying neuroanatomical characteristics. In early childhood, these individuals present slight deviations from neurotypical development. At school age, delays become pronounced, nonverbal skills remain in development, and verbal deficits emerge and persist.[17] For the volunteer in our study, difficulties in oral expression were more evident at the beginning of schooling, with the increased demand for communication.

Nonverbal learning and memory are strengths in verbal skills. Expressive language lags behind comprehensive language. Deficits in attention and executive functions are present in childhood and become more pronounced with age.[17] These aspects show the relevance of a specialized intervention directed to the patient's needs.

In this sense, a careful evaluation is essential for proper therapy and differential diagnosis. Thus, the present study analyzed the speech therapy evaluation (Table 1) so as to propose objectives and outline procedures for each therapeutic session based on the individual characteristics of the participant.

The child presented difficulties in verbal praxis, with a reduced number of vocalizations, emission of isolated vowels, and severe communicative losses and expressive deficits in speech intelligibility. The literature shows that, in DS, these losses relate to two main aspects: orofacial motor skills and orofacial motor planning. When the main impairment correlates with the strength and movement of the orofacial muscles involved in speech production, structural and functional changes characterize a speech disorder of musculoskeletal origin. In turn, CAS refers to the commitment involving the ability to plan the execution of movements and to combine and sequence the sounds.[5]

Clinical observations showed that children with DS may experience difficulties involving oral motor skills and oral motor planning, or present symptoms of both. A study on 45 adolescents with DS demonstrated an association between low speech intelligibility and reduction in phonemic and phonetic precision, as well as inadequacy

of prosody and voice. The results showed that dysarthria and apraxia had a significant impact in reducing speech intelligibility.[18]

Differential diagnosis of speech disorders in individuals with DS is essential and contributes to better clinical targeting and prognosis. The specific therapy for speech disorders of musculoskeletal origin is based on the multisensory principle, involving tactile, kinesthetic, and visual information. Thereafter, treatment steps are summarized in awareness, proprioception, auditory perception, and myofunctional training strategies.[13] On the other hand, CAS therapy is a slow evolution process based on compensation resources, planned activities, monitoring, early intervention, and motivation.[14]

Speech therapy for CAS must involve the use of motor learning principles. It becomes necessary to reinforce the need for a detailed assessment to analyze the conditions for the acquisition, retention, and transfer of motor skills. Thereafter, speech therapy must be planned individually, respecting the sensory standards and the needs presented by each child. In general, speech therapy in these cases involves some specific parameters, such as the amount of practice (small or large), practice distribution (massive or distributed), practice variability (constant or variable), practice schedule (blocked or random), focus of attention (internal or external), complexity of the target (simple or complex), and feedback variations (regarding type, frequency, and time).[15,16]

In this sense, the speech therapy intervention plan was proposed using the following as strategies: repetition, target choices (respecting the child's repertoire, speech motor hierarchy, and the context of coarticulation), multisensory cues, and feedback from the therapist. The intervention initially worked with vowels, followed by sessions with phonemes stimulated in an isolated and sequential manner, with the aid of tactile/proprioceptive, visual, cognitive, and auditory cues.

The intervention also considered myotherapy since the patient showed difficulties in adjusting phonoarticulatory organs and limitations in some orofacial movements, such as rounding the lips and elevating the tongue. These aspects can be justified by the phonoarticulatory disorders found in individuals with DS, commonly associated with muscle hypotonia, which when accentuated can reduce the movement of speech organs, reflecting in articulatory inaccuracies and sound substitutions or distortions.[19] The aspects are also justified by praxic difficulties, which hinder the proper execution of movements and thus can impair nonverbal orofacial movements, as well as articulatory groping in the search for the point of phonemic articulation.

The greatest difficulties observed in our volunteer took place for sequential rather than isolated phoneme productions. The patient scored worse in sessions targeting sequential phonemes and tongue elevation, which may be associated with the inherent limitations of CAS associated with DS. These limitations are characterized by the difficulty with voluntary programming, combination, organization, and sequencing of speech movements.[5]

To verify the patient's clinical evolution, we compared the results obtained in the tests of nonverbal praxis, performed before and after speech therapy. As seen in Table 1, the patient improved movement performance. These advances were likely due to the proposed speech therapy, which stimulated the tonicity and functionality of orofacial muscles from the execution of tasks with nonverbal praxis aiming to activate the memory of movements and consolidate motor engrams.

Thus, the study showed the importance of speech therapy intervention in CAS associated with DS regarding both verbal (Quadro 1) and nonverbal (Table 1) aspects.

Previous research points out that CAS treatment should establish a complete vowel inventory, reducing vowel omissions and increasing vowel accuracy, as vowel errors have a significant impact on speech intelligibility.[20] Considering these aspects and the skills identified in the participant, it was decided to start the therapeutic planning with vowel exercises.

Another important therapeutic aspect is to provide children with the necessary access to multimodal communication so as to facilitate effective and efficient communication.[20] From this perspective, facilitating strategies (gestural cues) were used in several sessions to encourage the acquisition of phonemes, with these strategies being recommended for the child's daily life.

For the work with consonants, the strategies used included providing auditory, visual, tactile, and proprioceptive feedback so as to maximize the child's ability to process articulatory movement information. Thus, it was suggested the use of exaggerated intonation and slow rhythm when

speaking with the child so that he/she develops a greater awareness of the salient aspects of sounds and words. Moreover, following specialized literature, oral motor exercises associated with speech production were also practiced.[20]

Working closely with families is essential to establish regular home practice opportunities and facilitate the transfer of motor skills learned in treatment to other environments.[20] Thus, intense communication with family members was adopted. At the end of each session, time was set aside for guidance, indication of activities to be carried out at home, and facilitating strategies to be used daily.

It is important to emphasize that the proposed number of sessions must be adequate to the child's needs since the speech therapy intervention for CAS must pass through the stage of skill acquisition and retention.[15,16] However, the possibilities and particularities of the family must also be considered so as to establish the frequency of treatment and ensure adherence. Bearing in mind that DS can affect several domains, the need for multidisciplinary action with these individuals must be considered. This demands an organization of the family routine to meet the needs without generating overload or excessive stimulation of the child, requiring adaptations and flexibility of professionals.

Considering the context of insertion of our volunteer, the frequency used was one weekly session, totaling ten sessions. As explained above, significant advances were observed in this period. The present study reports only the results initially obtained with the proposed intervention. It is noteworthy that the treatment with the patient was continued, aiming at other therapeutic objectives and clinical improvements.

The child obtained good results after stimulation, performing orofacial movements and producing phonemes and words in a way that he could not do before. The best results were obtained for bilabial phonemes /p, b, and m/, and for the glottal phoneme /h/.

Considering the specific characteristics of the syndrome and the peculiarities of the intervention in the area of CAS, it is worth highlighting the benefits achieved with the proposed intervention. Satisfactory results were achieved even in a restricted time interval and with a limited number of sessions, with improvements in oral expression and communication in general.

The results are expected to contribute to clinical practice in the area, opening perspectives for other studies on the theme and enabling advances in speech therapy for CAS. Regarding speech disorders, childhood apraxia of speech (CAS) has one of the most complex interventions, with specific, lasting, and challenging treatment.

It is noteworthy that the proposed therapy and the results achieved in the present study were obtained in a particular context, considering the patient's specificities. Thus, these results make important contributions, but they cannot be generalized, as it is a case study. To reach broader conclusions and obtain significant evidence, it is necessary to carry out research involving larger samples and experimental designs.

Conclusion

Comparing the data before and after speech therapy, the proposed intervention showed satisfactory results, with clinical improvements both in nonverbal apraxia and in speech stimulation. Moreover, important data were made available to assist intervention in these cases, with the description of an individualized therapeutic planning proposal for a case of CAS associated with DS, based on multisensory cues.

References

1. Schwartzman JS. Síndrome de Down. São Paulo: Mackenzie: Memnon; 1999.

2. Frasão Y. Down: uma nova e surpreendente visão. Rev da Soc. Bras. Fonoaudiol. 2007; (72):10-4

3. Andrade RV, Limongi SCO. A emergência da comunicação expressiva na criança com Síndrome de Down. Pró-Fono. 2007; 19(4): 387-92.

4. Ferreira AT, Lamônica DAC. Comparação do léxico de crianças com Síndrome de Down e com desenvolvimento típico de mesma idade mental. Rev. CEFAC. 2012; 14(5): 786-791.

5. Alves GAS, Lima ILB, Lima JAS, Delgado IC. Aspectos da fala na síndrome de Down. In: Delgado IC. (Org.). Contribuições da Fonoaudiologia na síndrome de Down. Ribeirão Preto: BookToy; 2016, c. 14, p. 191-206.

6. Wilson EM, Abbeduto L, Camarata SM, Shriberg LD. Estimates of the prevalence of speech and motor speech disorders in adolescents with Down syndrome, Clin Linguist Phon, 2019; 33(8): 772-789.

7. Shriberg LD, Strand EA, Jakielski KJ, Mabie HL. Estimates of the prevalence of speech and motor speech disorders in persons with complex neurodevelopmental disorders. Clin Linguist Phon. 2019; 33(8): 707-736.

8. Souza TNU, Payão LMC. Apraxia da fala adquirida e desenvolvimental: semelhanças e diferenças. Rev. da Soc. Bras. Fonoaudiol. 2008; 13(2):193- 202.

9. American Speech-Language-Hearing Association. Childhood Apraxia of Speech. 2007.

10. Kumin L. Speech intelligibility and childhood verbal apraxia in children with Down Syndrome. Downs Syndr Res Pract. 2006;10(1);10-22.

11. Gubiani MB, Pagliarin KC, Keske-Soares M. Instrumentos para avaliação de apraxia de fala infantil. CoDAS. 2015; 27(6): 610-615.

12. Martins FC, Ortiz KZ. Proposta de protocolo para avaliação da apraxia de fala. Fono Atual. 2004; 7(30): 53-61.

13. Tomé MC, Oda AL. Intervenção fonoaudiológica nos distúrbios de fala: a origem fonética e a origem neurológica. In: Marchesan IQ, Justino H, Tomé MC. Tratado de especialidades em fonoaudiologia. São Paulo: Guanabara Koogan; 2014.

14. Ortiz KZ. Alterações da fala: disartrias e dispraxias. In: Ferreira LP, Befi-Lopes DM, Limongi SCO. Tratado de fonoaudiologia. São Paulo: Editora Roca; 2004. p. 304-14

15. Schmidt RA, Lee TD. Motor Control and learning: a behavioral emphasis (4th ed.). Champaign: Human Kinetics; 2005.

16. Mass E, Robin DA, Hula SNA, Freedman SE, Wuulf G, Ballard KJ, Schmidt RA. Principles of Motor Learning in Treatment of Motor Speech Disorders.Am J Speech Lang Pathol. 2008;17(3): 277-298.

17. GriecoJ, Pulsifer M, Seligsohn K, Skotko B, Schwartz A. Down Syndrome: Cognitive and Behavioral Functioning Across the Lifespan. Am J Med Genet C Semin Med Genet. 2015; 169 (2): 135-49.

18. Wilson EM, Abbeduto L, Camarata SM, Shriberg LD. Speech and motor speech disorders and intelligibility in adolescents with Down Syndrome.Clin Linguist Phon, 2019; 33(8): 790-814.

19. Barata LF, Branco A. Os Distúrbios Fonoarticulatórios na Síndrome de Down e a Intervenção Precoce. Rev. CEFAC. 2010 Jan-Fev; 12(1): 134-139.

20. Fish M. Here's How to Treat Childhood Apraxia of Speech (2th ed.). San Diego: Plural Publishing; 2016.