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The Impact of the Implementation of the Picture Exchange Communication System – PECS on Understanding Instructions in Children with Autism Spectrum Disorders

O impacto da implementação do Picture Exchange Communication System - PECS na compreensão de instruções em crianças com Transtorno do Espectro do Autismo

ABSTRACT

Purpose: The purpose of this study was to analyze the impact of the implementation of the Picture Exchange Communication System (PECS) on the comprehension of instructions by children with Autism Spectrum Disorder (ASD). **Methods:** This is a longitudinal study (N° 0809/2018). The sample consisted of 20 children with nonverbal ASDs, 15 boys and 5 girls, aged 6 to 12 years, evaluated and diagnosed by a multidisciplinary team according to the DSM-5. For assessment of the comprehension of instructions, we used eight visual instructions and eight oral instructions, which were applied at two points in the PECS Implementation Program: early phases II and IV. The program consisted of 24 individual speech therapy sessions with the presence of a family member and followed the six phases originally proposed by the PECS Training Manual. **Results:** There was an expressive increase in the comprehension of all instructions, in the comparison between the two moments of the study; and this increase was statistically significant in six of the oral instructions (p=0.001) and five of the visual ones (p=0.002). **Conclusion:** It was possible to observe the positive impact of the use of PECS in the comprehension of both visual and oral instructions, showing that this system not only provides an augmentative or alternative communication tool for the children to express themselves but also promotes significant improvement in the understanding of contextual information.

RESUMO

Objetivo: O objetivo deste estudo foi analisar o impacto da implementação do *Picture Exchange Communication System* – PECS na compreensão de instruções de crianças com Transtorno do Espectro do Autismo (TEA). **Método:** Trata-se de estudo longitudinal. A amostra foi constituída por 20 crianças com TEA não verbais, sendo 15 meninos e 5 meninas, na faixa etária de 6 a 12 anos, avaliadas e diagnosticadas por equipe multidisciplinar, segundo os critérios do DSM-5. Para avaliação da compreensão de instruções foram aplicadas 8 instruções visuais e 8 instruções orais, em dois momentos do Programa de Implementação do PECS: no início das fases II e IV. O programa foi composto por 24 sessões de terapia fonoaudiológica individual com a presença do familiar e obedeceu às seis fases propostas originalmente pelo Manual de Treinamento do PECS. **Resultados:** Houve aumento expressivo na compreensão de todas as instruções, na comparação entre os dois momentos do estudo; sendo que em seis das instruções orais (p=0,001) e cinco das instruções visuais (p=0,002), esse aumento foi estatisticamente significante. **Conclusão:** Foi possível observar o impacto positivo do uso do PECS na compreensão de instruções tanto visuais quanto orais, mostrando que esse sistema não apenas fornece uma ferramenta de comunicação aumentativa ou alternativa para a criança se expressar, mas também promove melhora significativa na compreensão das informações contextuais.

INTRODUCTION

The main manifestations of Autistic Spectrum Disorder (ASD) are the presence of persistent deficits in communication and social interaction, and restricted and repetitive patterns of interests and behaviors[1-4].

About one-third of children affected by ASD are considered non-verbal or exhibit minimal verbalization[2,3]. Therefore, these children need an alternative communicative resource to initiate, sustain and expand the dialogical situation that, in a complementary way, considers their shared attention and gaze direction disabilities and their lack of intentionality[2-6].

PECS (the Picture Exchange Communication System) is currently one of the most used communication programs worldwide for non-verbal autistic children. This system uses figures/photographs selected according to the lexical repertoire of each individual and not only involves the replacement of speech by figures but also encourages expression of needs and desires[5-10].

Experienced speech-language therapists trained in PECS implement their training in six phases described briefly below. In phase I (Physical exchange: how to communicate), the child is encouraged to use the cards to request/show their desire for an object that is attractive to them. In phase II (Distance and persistence), the child effectively needs to understand the importance of using the cards and persist in using them in any communicative situation. In phase III (Discrimination of figures), the child is encouraged to select a target figure among several options. They must discriminate the cards and give the communication partner the one appropriate to the situation. At this point, the child is already able to demonstrate their intentionality through the autonomous choice of their reinforcer. In phase IV (Sentence structure), the child learns to form sentences with cards using action verbs (for example, to want) and attributes of objects (for example, color, size). At this stage, the functional vocabulary is considerably expanded. In phase V (Responding to 'what do you want?'), the child is encouraged to answer the question "What do you want?" through simple phrases with the cards. In phase VI (Commenting), the child answers questions such as "What are you seeing?"; "What are you listening to?"; "What is this?", and asks and comments spontaneously on situations/events using simple phrases created with the cards[6].

Thus, PECS provides the possibility of learning the basic rules of communication and allows children with non-verbal ASD or with minimal verbalization to participate in the dynamics of social communication[6-10].

This study aimed to analyze the impact of implementation of PECS on the understanding of instructions by children with ASD.

It hypothesized that the use of PECS will have a positive effect on the understanding of instructions since it will provide children with greater communicative and social engagement.

METHODS

Study design: This is a longitudinal study.

All parents or guardians were aware of the study's methodological procedures and signed the Informed Consent Term approved by the Institution's Research Ethics Committee (Opinion 0809/2018).

Sample: Comprised 20 children, 15 boys (75%) and five girls (25%), in the age group between six and 12 years old (mean = 7 years old, SD = 2.1), attended and diagnosed with ASD by a multidisciplinary team, according to the diagnostic criteria of DSM 5[1].

All children were enrolled in regular schools according to the Brazilian policy of school inclusion, on average for forty-three months (SD = 23.0) and had already been exposed to previous speech-language therapy intervention in different assistance services, for at least six months to ensure that the communicative profile was characterized as non-verbal or of minimal verbalization.

According to the socioeconomic classification of ABEP[11], eight (40%) families belonged to classes A/B (high) and twelve (60%) to classes C/D (medium-low).

The mothers were 41 years old on average (SD = 7.99). Twelve of them had completed higher education (60%) and eight (40%) had high school level.

The inclusion criteria were the diagnosis of ASD, age group, absence of verbal communication or minimal verbalization, the child's enrollment in educational institutions and availability of the family to participate in speech therapy sessions with a minimum adherence of 75%.

The exclusion criteria were the presence of neurological changes (structural and/or functional impairment of the Central Nervous System); malformations and/or known genetic syndromes; physical, auditory/visual, and/or motor disabilities.

Procedures

All children were evaluated clinically by a multidisciplinary team, composed of childhood and adolescent psychiatrists, neuropsychologists, and speech-language therapists. We applied the following instruments:

- Autism Behavior Checklist[12,13]: a list of 57 non-adaptive behaviors divided into five areas: sensory, use of body and object, relational, language, and personal-social, which measures the level of severity of autistic behaviors through interviews with parents.

- SON-R 2½-7 [a][14]: non-verbal intelligence test, applied to children individually by the team's neuropsychologists.

- Vineland Adaptive Behavior Scale[15], which aims to investigate the set of social, practical, and conceptual skills acquired by the child or adolescent to respond to day-to-day demands. Applied through an interview with the parents.

To check the children's verbal production, the average extension parameter of the Vocal Behavior Assessment[12] was used. During the speech-language therapy assessment session with the presence of a family adult, we recorded and later transcribed 50 spontaneous emissions produced by the child during an average period of 45 minutes. We obtained the average duration by balancing the number of babbling and total words produced by the child. In this study, we

considered the following classification: non-verbal production (emission of babbling and/or vocalizations) and minimum verbal production: emission of isolated words or juxtaposition (with no use of verbs).

To analyze comprehension of instructions, we created eight instructions especially for this study: "go get ..."; "give me ..."; "keep ..."; "put ...", "go to..."; "sit down"; "come...'; "stop", offered to the child in two formats: visually (through cards) and orally (without gesture support), in different and subsequent assessment sessions, always at the beginning of phases II and IV.

We selected this time interval to ensure that the child had the opportunity to understand the function of the cards (phase I) and to be able to discriminate them visually in a satisfactory way (phase III). Besides that, as the PECS[6] Training Manual also recommends, this interval was used for the teaching of various communication skills: request for help, request for a break, response to "wait", following functional instructions, setting up agreements and visual reinforcement systems; we believe that this time allows for the satisfactory appropriation of the PECS system by children. The sessions for applying the instructions were individual and carried out by the speech-language therapists at the same location where all the sessions of the PECS Implementation Program took place and in the presence of each child's family member. Like all sessions of the program, we also filmed these assessments and recorded the children's performances according to a specific protocol.

We classified the responses to both visual and oral instructions as appropriate or not appropriate.

The PECS Implementation Program

The Program consisted of 24 sessions of individual speech-language therapy with the presence of the family member. Each session lasted 45 minutes and sessions were held weekly at the Center for Speech and Language Research of Children and Adolescents in Autism Spectrum Disorder - *NIFLINC-TEA* of the Department of Speech-Language Therapy at UNIFESP. All speech-language therapists involved were professionals trained and certified by PECS[6].

The program followed the six stages proposed in the PECS Training Manual[6]:

Statistical method

Initially, we performed descriptive analyzes of all variables of interest in the study. We used the Mc Nemar test to measure the changes between the two moments of the study. We considered a significance level of 0.05.

RESULTS

Table 1 shows the characterization of the sample of children according to age, school level, atypical behaviors, intellectual quotient, and adaptive behavior.

Regarding verbal production, 17 children (85%) showed non-verbal production (emission of babbling and/or vocalizations), and three children (15%) showed minimal verbal production: emission of isolated words or juxtaposition (with no use of verbs).

Figure 1 shows the children's performance by PECS phase during the period of 24 sessions for implementation of the program.

Figures 2 and 3 show the comparison of responses to oral and visual instructions, respectively, in the two moments of the study.

DISCUSSION

Sample characterization

Regarding the characterization of the sample, we evaluated 20 children, 15 boys and five girls. This 4:1 ratio of boys to girls is recurrent and has been described in epidemiological studies[1-4].

The age group of the sample was from six to 12 years old, with an average of seven years old. Most studies with PECS were carried out with participants in the age group between five and seven years old, although there are surveys with children over or underage, showing that the child's age does not interfere in learning and that all children can benefit from the use of this alternative or augmentative communication system[5-10,16-20].

Regarding maternal education, complete higher education (60%) predominated over the high school level (40%). These data are quite promising since there is a consensus in the literature that the level of maternal education is a child development protective factor, as it favors understanding of the importance of identifying and treating language impairments in children. In this study, maternal education may have positively influenced implementation and management of the alternative and augmentative communication system[6,16-20].
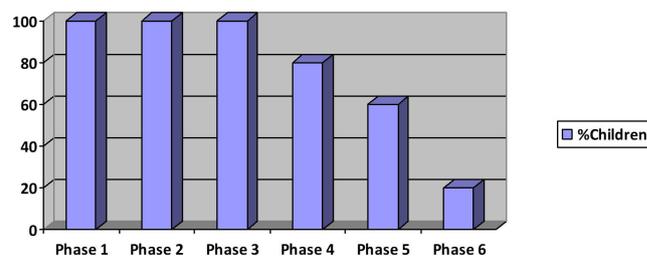

Figure 1. Children's performance in PECS phases

Table 1. Sample characterization data

	Age of the Child	School level of the Child (months)	ABC	IQ	Vineland
Mean	7,0	43.1	85.9	51.1	28.3
Median	7,0	36.0	86.0	50.0	28.0
SD	2,1	23.0	16.8	9.6	9.6
N	20	20	20	20	20
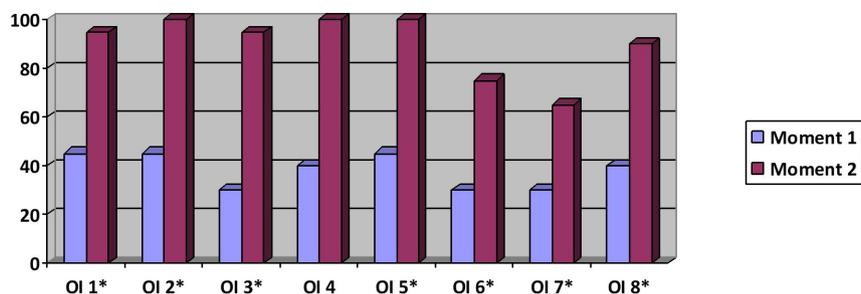
Legend: IO = Oral Instruction (*) Statistical significance
Figure 2. Comparison of responses to oral instructions at the two moments of the study
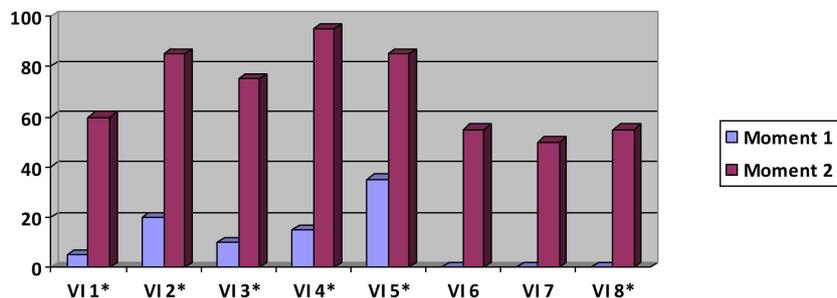
Legend: IV = Visual Statement (*) Statistical significance
Figure 3. Comparison of responses to visual instructions in the two moments of the study

The economic level distribution showed a predominance of 60% of families in classes C/D (medium-low) and 40% in classes A/B (high), an evidence that there was some representativeness of the sample in all social classes.

In about 85% of the children, oral emission was restricted to the production of vocalizations, and in 15% to the minimum verbalization of isolated words. On average, one-third of the population diagnosed with ASD does not develop functional discourse[2-5,16-20]. These data reaffirm that children with ASD have marked impairments in communication and can benefit from the use of alternative and augmentative communication systems such as the Picture Exchange Communication System - PECS.

Application of the Autism Behavior Checklist (ABC) also showed high rates of atypical behavior of the children in the sample, both in their total score and in the areas assessed by the instrument: sensory, relational, use of the body and object, language, personal-social[1-5].

To evaluate the cognitive profile, we applied SON-R 2 ½– 7 [a][14]. The distribution of intellectual quotient values was concentrated in the lower range. Some studies with PECS have shown that the cognitive capacity of autistic children does not directly interfere during implementation of the system, even if the child is extremely intellectually impaired[6,7,10].

The Vineland Adaptive Behavior Scale[15] showed a predominance of adaptive impairment. It is consensual that ASD entails losses in social development and communicative capacity and that there are also inabilities to integrate information, which compromises social adaptation of individuals affected by this condition[1-5,16-20].

The PECS Implementation Program

When analyzing the children's performance over the 24-session period for implementing the PECS Program, we verified that all children were able to discriminate and select the target card and hand it over to the interlocutor intentionally and autonomously. Therefore, there was no difficulty in reaching the first three phases of the system.

About 80% of the children reached the next phase (phase IV) and started to build phrases using action verb cards and perceptual attributes, showing an important increase in the lexical repertoire.

Phase V was reached by about 60% of children, as they became able to answer questions such as "what do you want?" using the cards. Only 20% of the sample reached stage VI (Comments). This decrease in the performance of phases V and VI is most likely related to the complexity of the task and the resulting limitation of the children in understanding and executing the steps required in each of these phases[6,17-20]. This is another factor that may also have contributed to these results is the duration stipulated for the implementation of the program (24 sessions), although less relevant.

The results showed an increase in responses in all oral instructions, when comparing the data found in the initial period (phase II) and the second moment (phase IV) of the PECS program; in six out of eight instructions, this improvement in children's performance was statistically significant. The PECS program provides the child with two ways to process information: visual and auditory-verbal, so the sensory stimuli could be complemented, facilitating the child's understanding. Several authors have highlighted the positive effect of the use of PECS on communication skills, especially in verbal comprehension, since the system promotes greater social engagement and allows for more effective communicative exchanges[5-10,16-20].

We also observed a significant increase in responses to visual instructions, since, at time 1, some instructions such as IV6, IV7,

IV8 were not even answered by the children. In five of the eight instructions, there was statistical significance in the comparison between the two times. These results confirm the descriptions of the positive impact of the PECS in understanding information, as it is a system based on images and because it values the ability of visual perception of individuals with ASD[6-10,16-20].

Study limitations

We suggest further studies on the impact of PECS on the communicative competence of its patients, both in the comprehension skills and verbal production, especially with larger population samples since the sample size of this study may have limited statistical data treatment. We also consider as a study limitation the 24-session duration of the PECS Implementation Program. Therefore, we recommend the design of more longitudinal studies so that we can evaluate the positive impact of using PECS over longer periods. Finally, the production of double-blind clinical trials is also strongly recommended.

CONCLUSIONS

We have confirmed the positive impact of the implementation of the Picture Exchange Communication System - PECS in the understanding of information by the children in the sample, since there was a significant increase in responses to both oral and visual instructions throughout the program.

PECS proved to be a very efficient alternative and augmentative communication system for children with non-verbal ASD or with minimal verbalization, since it promoted a significant improvement in the understanding of instructions and more effective communicative exchanges.

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Author's contributions

PAS was responsible for the collection, tabulation of data, and preparation of the article; DB, MS, GRCA, SCC, CSP, and JP collaborated with the final elaboration of the manuscript; ACT supervised the data collection, collaborated with the data analysis and was responsible for the design of the study and general guidance on the stages of execution and final elaboration of the manuscript.