

Critical Review:

In non-verbal children with Autism Spectrum Disorder (ASD), is verbal output increased for those who engage in the picture exchange communication System (PECS)?

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The following appraisal examined the evidence for increased verbal output in non-verbal children with Autism Spectrum Disorder (ASD) after engaging in the picture exchange communication system (PECS). An electronic literature search resulted in seven studies which met inclusion criteria. Overall, findings indicate that there is evidence for increased verbal output in children with ASD who have engaged in PECS training and no evidence that PECS inhibits the development of speech.

Introduction

Autism Spectrum Disorder (ASD) is a developmental disorder characterized by persistent difficulties using communication for social and functional purposes (American Psychiatric Association, 2013). One of the hallmark features of children with ASD is delayed speech and language skills (Charlop & Haymes, 1994). The American Psychiatric Association (2009) estimated that 25% of the individuals living with ASD are nonverbal, indicating that they do not use their own voice to communicate.

Various interventions, such as incidental teaching and pivotal response training have been trialed to increase speech, however more than 50% of children remain nonverbal (Charlop & Haymes, 1994). Augmentative communication systems (AAC) have proven to be successful language intervention strategies for non-verbal children (Zangari, C., Lloyd, L. L., & Vicker, B. (1994). The Picture Exchange Communication System (PECS) has become a popular strategy for children with ASD. PECS was developed on the basis of Skinner's Verbal Behaviour (1957), suggesting that functional communication involves behaviour directed towards another person who will, in turn, provide a reward. PECS differs from other picture-based systems because it requires children to direct their attention to their communication partners, rather than to a picture. This is accomplished by using various behavioural principles including reinforcement and transfer of stimulus control. The transfer of stimulus control is used via delay with pictures as the communicative referent (Charlop-Christy et. al., 2002). Pictures are kept with the child in a notebook and have Velcro that allows them to select and remove the pictures. Children are taught to select pictures and deliver the cards to their communicative partner to indicate their wants and needs. The picture symbols in a child's notebook

vary depending on the child's interests and daily activities. They often include food items, personal needs such as 'bathroom', and personal items such as 'iPad'. Verbal models of language are provided with use of the picture exchange to promote oral language. These principles emphasize a more naturalistic approach by requiring the child to initiate communication and highlight the importance of initiation, responding and making comments when communicating with others.

Objectives

The objective of this paper is to critically evaluate the existing literature on PECS training to determine if it is effective in increasing verbal communication in non-verbal children with ASD.

Methods

Search Strategy

Articles related to the topic of interest were found using the following electronic databases: PubMed, Scholars Portal, Research Gate and PsychNET. Studies were limited to articles available in English and published after 1990.

Selection Criteria

To meet inclusion, studies must have included (a) participants 18 years and younger (b) an ASD diagnosis (c) a non-verbal communication profile (zero to ten spoken words) (d) PECS training (e) outcome measures that included verbal output and other communication functions.

Data Collection

Results of the literature search yielded two multiple baseline designs, two single subject designs with changing criterion, one randomized clinical trial, one non-randomized clinical trial and one qualitative research design.

Results

Bondy (2001) examined the rationale for PECS and described the training sequence. He highlights common problems and potential solutions as well as the relationship between PECS and the co-development of speech and its impact upon other behaviours.

Bondy (2001) states that PECS was developed to teach children to direct their communication to a partner rather than a picture like other picture-based systems. The goal of PECS was to develop a functional communication response that could be rapidly acquired, introduce reinforcers, and teach the child to exchange a picture with their partner. The training sequence of PECS first involves using a prompt to get the child to pick up a desired picture (e.g. "What do you want?"), the child will then pick up the desired picture and exchange it with the communication partner. The partner will then model the response and reinforce the imitation by providing the desired item. The next steps include building persistence, increasing distance from the desired item, increasing the number of communicative partners, increasing the range of reinforcers, and eliminating prompts that may have accidentally come to serve as prompts to communicate. Some of the potential problems highlighted by Bondy (2011) were losing pictures, seeking to communicate about something not in the system, and having too many pictures in the system. However, PECS has advantages such as it is readily understood and requires minimal training. Bondy (2011) reported that PECS has positive impacts on the development of speech and that there is no evidence that using PECS inhibits the development or use of speech.

Multiple baseline design is a design that utilizes measurements before and after intervention. This creates a baseline and allows for comparison of behaviours after intervention to the baseline behaviours before intervention.

Charlop-Christy, Carpenter, Le, LeBlanc, & Kellet (2002) used a multiple baseline design to examine the acquisition of PECS on three children (boys) with ASD. Specifically, they looked at the effects of PECS on emergence of speech in play and

academic settings. The three boys participated in biweekly PECS training sessions. Length of the session time was not stated. Free play and academic sessions (ten-minute interactions) occurred once per week for each week before, during, and following the completion of PECS training in a room with a one-way observation mirror. Each participant had a three-ring binder that contained "I see", "I want", and "yes/no" pictures. Follow-up sessions were conducted at 10 months after the last session for three consecutive weeks. The main variable collected was the responses during the speech opportunities. Other variables measured included Mean Length of Utterance (MLU), joint attention, initiations, and eye contact. MLU is referred to as the average number of morphemes per utterance. Results indicated that each participant's spontaneous speech and imitation increased during post training. On average, there was a 60.3% increase in spontaneous speech and 55% increase in imitation. At a one-year follow-up session, each participant had maintained 100% of their spontaneous speech gains. All participants also experienced an increase in MLU when making spontaneous requests. Not only did these children have increases in their spontaneous verbal output, but they also showed improvements in their ability to engage in joint attention.

Overall, this study provided compelling evidence that the use of PECS does contribute to the emergence of spontaneous speech in children with ASD who are non-verbal.

Kravits, Kamps, Kemmerer, & Potecuk (2002) used a multiple baseline study to examine the effects of PECS on the spontaneous communication skills of a 6-year-old girl with ASD across home and school environments. Pre-treatment, the participant communicated using one-word utterances that were difficult to understand. She also used gestures and eye contact to communicate. PECS was implemented with the goal of increasing her spontaneous initiations and interactions with others in her environment. PECS was implemented during leisure and snack time at home and during play time at school. Language samples were collected at least once every session (3x per week) and measurements of spontaneous requests, comments, or expansions were recorded. Experimental conditions (home and school) were compared to baseline conditions. Baseline conditions consisted of observations at home and school. Measurements of the frequency of the participant's spontaneous language and social interactions were recorded. Results indicated that the frequency of spontaneous language increased when PECS was implemented. Effects remained consistent

between both environments and different communication partners (mom and teacher). Spontaneous verbalizations also increased at home and during play sessions at school.

Overall, these findings provided compelling evidence that spontaneous language verbalizations and icon use increase in both home and school settings with the use of PECS. However, there are several limitations that should be noted. The participant did not increase their range of spoken vocabulary. Authors also indicated that the length of the intervention did not provide the participant sufficient time in the PECS program.

Single subject design with changing criterion is used to determine the effects of an independent variable on a targeted behaviour. Experimental control is demonstrated by the repeated changes in the dependent measure. The design eliminates the necessity of withdrawing the intervention, and includes several intervention sub-phases (Ganz and Simpson, 2004).

Ganz and Simpson (2004) used a single-subject design to examine the role of PECS in improving the number of words spoken, increasing the complexity and length of phrases, and decreasing the non-word vocalizations of three young children with ASD and developmental delays (DD) with related characteristics.

The training completed followed the PECS protocol outlined by Frost and Bondy (1994). The children participated in two to five PECS training sessions per week, for 15 trials per session until the first four phases of PECS was mastered (80%). Each phase of PECS training was continued for a minimum of five weeks, even if criterion was achieved, to ensure all participants had adequate time to practice. The three variables measured during PECS trainings sessions were proficiency relative to the PECS phase criteria, how the child performed the response (independently, prompting, etc.), and the number of intelligible words produced. Single-subject data were plotted graphically to determine if there was a relationship between PECS and improvement in the number of words spoken. Analysis indicated that all three participants mastered the program rapidly (average of 23 sessions). As well, all three participants demonstrated increases in average intelligible words spoken and were using high levels of words per trial with greater complexity of phrases. The most significant growth of spoken words occurred during phases three for two participants and during phase

four for one participant. In addition to increased number of spoken words, each of the participants used longer and more complex phrases compared to phase one.

Ganz and Simpson (2004) provided compelling evidence that PECS does have an effective role in improving the number of words spoken in children with ASD. Although the study design did not include baseline data, authors reported that they chose the single-subject design because it adhered closely to the PECS protocol.

Jurgens, Anderson, & Moore (2009) used a single-subject design with changing criterion to assess the acquisition of PECS with a boy aged three years seven months with ASD. The main objective of the study was to determine the changes in spoken language, social-communication behaviours and functional play. Training included a baseline phase and followed protocols highlighted by the PECS training manual. All training and free-play observations were conducted in the participants home. During the four baseline observation sessions the following behaviours were recorded: PECS mands, verbal mands, verbal initiations and play. PECS training sessions occurred between three and five times per week for approximately 20 minutes, followed by a 15-minute free play observation session. Data was presented visually to determine the relationship between PECS and the observed behaviours. Results of the study indicated that the number of verbal mands increased as the intervention progressed (Baseline phase- 0, Phase 4- 2.6). As well, there was an overall increase in the number of verbal initiations as PECS training progressed. The participants engagement in functional play increased from 57.% to 81.2% of the time on phase four of treatment. As well, the participant used more morphemes with increased length as the intervention progressed.

The current study provided compelling evidence that PECS can have a positive impact on spoken language in children with ASD. A strength of the current study was that Jurgens, Anderson, & Moore (2009) provided social validity of the PECS training by having the participants mom, teacher, and speech therapist fill out a questionnaire. Each rater agreed that it appeared to increase the participants communications skills. Another strength of the study was the observation reliability (88% average agreement). A limitation to the study included the small sample size. Overall, the authors provided

compelling clinical importance of PECS training on the verbal output in non-verbal children with ASD.

Non-randomized group experiment is a design that follows specific groups (e.g. treatment groups) over time to examine the specific outcomes of each. Participants are already assigned to groups prior to the study and therefore, it is non-randomized.

Lerna, Esposito, Conson & Massagli (2014) conducted a study that aimed to test the long-term effects of PECS in nonverbal preschool children with ASD. They conducted a randomized clinical control trial with two groups of children 12 months after receiving PECS training or conventional language therapy (CLT). Conventional language therapy is a language training base on a systematic, step-by step teaching technique using prompts and reinforcements. Training consisted of 30-minute individual sessions three times a week for six months. They used standardized assessments of social, behavioural, expressive and receptive language to measure the outcomes of the participants and assessed social-communicative variables in unstructured settings through observation of free-play. Results showed lower ADOS severity scores in the PECS group compared to the CLT group. As well, the PECS group had higher scores on the GMDS Social and VABS Communication and Social scores. Children in the PECS group had higher significantly higher scores on the post-treatment time and follow up compared to the pre-treatment. Analysis from the free-play observation sessions concluded that the PECS group showed higher frequency of joint attention and initiations compared to the CLT group. As well, co-operative play continued to improve on follow-up and verbal requests improved significantly compared to pre-treatment.

Overall, Lerna, Esposito, Conson & Massagli (2014) provided compelling evidence that PECS training has positive long-term effects on children with ASD compared to CLT. Not only did these children experience improvements in social and behavioural categories, but they also made gains in receptive and expressive vocabulary and were able to maintain these gains 1-year post treatment. The study provided appropriate analysis that provided compelling validity. Some of the strengths of the study was having a baseline of the children and completing an analysis to ensure no differences between the children in pre-treatment sessions. Limitations of the study included lack of randomization of treatments and a relatively small sample size. As well, authors

did not take into account measures truly representative of the children's real everyday environments.

Randomized group experiment is a design that randomly assigns participants to different treatment groups and compares the behaviours of each group.

Yoder and Stone (2006), conducted a randomized group experiment that compared the efficacy of Prelinguistic Milieu Teaching (RPMT) and PECS. They looked at 36 preschool participants between the ages of 18 and 60 months with ASD. OF the 36 participants, 19 were assigned to the PECS treatment group and 17 were assigned to the RPMT treatment group. Each student participated in treatment for 3 20-minute sessions per week for 6 months. Randomization of treatment was accomplished using a computer program and a random number generator. Results of the study indicated that the children's joint attention increased in both treatments. The children in the RPMT group had more generalized turn taking and initiation than the PECS group. However, the children in the PECS group showed more generalized requests than the children in the RPMT group. PECS also showed a superior effect in children with initially low rates of initiating and joint attention compared to the RPMT group.

The current study offers compelling evidence of the benefits of both RPMT and PECS training. A limitation that should be noted is that the RPMT group was superior to the PECS group only when children began the treatment initially using at least 10 initiation and joint attention acts. As well, after statistical analysis, only a small number of participants fell within the level of significance. Another weakness of the study presented was that the examiners conducting the pre-and post-treatment sessions were also the data coders and therefore, not kept blind to the children's treatment. Overall, the current study provides compelling clinical importance that both RPMT and PECS can be an effective treatment in children with ASD for increasing joint attention, turn taking and initiations.

Discussion

The current evaluation of literature was conducted to examine the effectiveness of PECS training in increasing verbal communication in non-verbal children with ASD. The overall findings suggest that there is compelling evidence that PECS training does

increase verbal communication in non-verbal children with ASD.

Evidence from the literature reviewed indicated many other benefits of PECS training for non-verbal children with ASD other than verbal output. Increases in mean length of utterance (MLU), joint attention, ability to imitate, and decreases in problem behaviour were some of the other common benefits found (Charlop-Christy, Carpenter, Le, LeBlanc, & Kellet, 2002; Jurgens, Anderson, & Moore, 2009; Ganz and Simpson, 2004). Not only did the literature indicate such benefits, there was also a common finding that 100% of PECS gains were maintained. Lerna, Esposito, Conson & Massagli (2014) provided compelling evidence that the gains made during training were maintained 1-year post treatment. Another benefit of PECS training examined in this literature was that PECS training was quick and easy to acquire (Bondy, 2001). This allows PECS to be implemented in a wide variety of settings with a range of participants such as teachers, parents and parents.

One of the limitations of the current literature was the consistent small sample sizes. The literature examined consisted of sample sizes varying from one to 36 participants. Another limitation of the current literature was the range of study designs. Of the seven studies selected to be reviewed for this critical appraisal, only two included baseline measures. As well, one study lacked randomization in their group experiment.

Future research should focus on examining the verbal output in non-verbal children with ASD after PECS training in larger experimental groups.

Conclusion

Overall, the current literature provides compelling evidence that the use of PECS does increase the verbal output in non-verbal children with ASD. PECS also provides many other benefits to communication such as increased joint attention, initiations, and requests.

Clinical Implications

Clinicians working with non-verbal children with ASD should implement PECS training into their practice. It is important to educate caregivers on the potential benefits of PECS and that [the evidence](#) does not [indicate that PECS inhibits](#) the development of speech, as this is a common fear amongst parents.

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