Critical Review:
For Minimally Verbal Children with Autism Spectrum Disorder (ASD), is the Picture Exchange Communication System (PECS) or Sign Language the More Suitable Method of Augmentative and Alternative Communication (AAC)?

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This critical review examines the literature on the efficacy of PECS and sign language as methods of communication for minimally verbal children with ASD in an attempt to determine if either AAC system yields better communication outcomes than the other. A literature search yielded six articles: a mixed methods design; two alternating-treatment designs; a two group experimental design; a case study; and a literature review. Overall, the findings from the studies suggest that both PECS and sign language yield positive communication outcomes for children with ASD; evidence remains mixed regarding whether one AAC system provides better communication outcomes than the other. Individual factors should be considered when deciding which AAC system is best for a particular child, including child and caregiver preference, individual characteristics, fine and gross motor skills, and level of overall function.

Introduction

Autism Spectrum Disorder (ASD) is a highly pervasive disorder characterized by repetitive and restrictive behaviours and difficulties with social communication and social interaction (American Psychiatric Association, 2013). With an estimated 1 in 59 children having an ASD diagnosis in the United States (Centre for Disease Control, 2018), it is important to consider the heterogeneity among this large, growing population. ASD is described as a spectrum disorder, as the types and severities of behaviours that an individual may experience vary greatly. Language abilities are among these highly variable characteristics in children with ASD. (Groen, Zwiers, van der Gaag, & Buitelaar, 2008). Research suggests that 25 to 61% of children with ASD will use little or no functional speech to communicate (Schlosser & Wendt, 2008), making it of the utmost importance to find alternate methods of communication for these children so that they can participate socially.

Augmentative and Alternative Communication (AAC) can serve to supplement or replace spoken language and is an effective and often necessary way to build functional communication for children on the autism spectrum. With the many AAC options that are available, Speech-Language Pathologists (SLP) need to be aware of the AAC systems that will be most beneficial for their clients.

Two of the most widely used AAC options for children with ASD include manual sign language and the Picture Exchange Communication System (PECS) (Bondy & Frost, 1994), both of which have been shown to be effective methods of increasing communication in children with ASD (Flippin, Reszka, & Watson, 2010; Bonvillian, Nelson, & Rhyne, 1981). PECS is an AAC system that allows an individual to communicate by teaching them to select a picture or series of pictures that corresponds with their message (PECS, n.d), while sign language is a language in which messages are conveyed through manual signing (Autism Canada, 2020). The following review aims to compare the ability of PECS and sign language to increase communication in children with ASD.

Objectives

The primary objective of this review is to evaluate the literature in an effort to determine if there is evidence that children with ASD will benefit more from PECS or from manual signing.

Methods

Search Strategy
Computerized databases including PubMed and PsycINFO were searched using the following terms: (autism) OR (ASD) AND (picture exchange communication system) OR (PECS) AND (sign language) AND (communication). The search was

limited to articles written in English and published after the year 2000.

Selection Criteria
The articles included in this review were required to include (a) a child with an ASD diagnosis, (b) a direct comparison of PECS and sign language, and (c) children that were under the age of 18 years.

Data Collection
Results of this literature search yielded six articles including: a mixed method designs; an alternating-treatment design; a two group experimental design; a case study; and a literature review.

Results

Mixed Methods: Single Subject, Alternating Treatment, Multiple Baseline Probe Design
A single subject design was appropriate to meet this goal of evaluating individual difference in performance; each subject was able to act as their own control. This study also combined a multiple baseline probe with an alternating treatment design. A multiple baseline probe design provides an analysis of the relationship between an independent variable and the acquisition of a particular outcome. An alternating treatment design is used when two treatments are implemented across individuals and progress across treatments is measured.

Anderson, A. E. (2002) conducted a single subject, alternating treatment, multiple baseline probe design to look at the differences in acquisition, maintenance, and generalization of PECS and sign language in six children with a diagnosis of either ASD (n=5) or Pervasive Developmental Disorder Not Otherwise Specified (PDD-NOS) (n=1). Participants were six children between the ages of two and four years old recruited from the Autism Research Laboratory at the University of California, San Diego.

Participants received a pre-treatment assessment, followed by a baseline period, a 10 week treatment period in which the children received training in both PECS and sign language, and finally a post-treatment assessment. Outcome measures included child characteristics (including joint attention, imitation abilities, play skills, vocal abilities, and motor abilities), standardized assessment scores,

rates of acquisition of both AAC systems, behavioural preferences, and skill development during pre- and post- treatment assessments.

It was found that all six children had higher rates of acquisition for PECS than sign language; however, three children showed a preference for PECS while the other three showed a preference for sign language. It was also found that generalization to multiple partners was good with both PECS and sign language. The higher rate of acquisition of PECS was found to be associated with higher levels of proto-imperative joint attention at pre-treatment assessment, while acquisition of sign language was associated with comprehension of proto-declarative joint attention, motor imitation, and functional play. Data analysis consisted of observational scoring of behaviour, communication, and individual child characteristics; data was examined visually for possible patterns or relationships.

Strengths of this study included well-defined inclusion criteria that ensured participants were matched in terms of prior training in PECS or sign language and mental-age. Treatment settings were also well-controlled, with treatment being administered to each participant in identical settings to limit extraneous factors. Small sample size remains a limitation of the present study (n=6), making the results difficult to generalize to this population. Overall, results of this study are compelling that children with ASD acquire PECS more readily than sign language, but that individual AAC preference may vary.

Alternating-Treatment Design
This type of design allowed the researchers of the following studies to train students in both PECS and sign language. They received training in alternating treatment sessions and the acquisition of both was measured post-treatment.

Tincani, M. (2004) used an alternating treatment design with an initial baseline phase and final "best treatment" phase to compare the effects of PECS and sign language on the acquisition of requests in students with ASD. The researcher also looked at how pre-existing imitation abilities affected AAC acquisition and the effects of each AAC modality on vocal behavior. Participants included two

children between the ages of five and seven who were enrolled in a classroom for children with disabilities. One child had ASD while the other child had PDD-NOS.

Prior to the baseline period, an imitation assessment was conducted to assess any relationship between pre-existing imitation skills and ability to acquire sign language or PECS. Following the initial baseline phase, participants received training in both PECS and sign language concurrently, with variables such as time of day and day of the week being counterbalanced to minimize the effect of interfering variables. In the final "best treatment" phase, the participants received additional training in their preferred AAC modality only.

Results revealed that sign language increased requesting in the participant with ASD, while PECS increased requesting in the participant with PDD-NOS. Additionally, both children attempted vocalization more during sign language training than PECS training. Outcome measures included motor imitation, requests, and word vocalizations. All data was measured using event recording and was collected by the author. Visual data analysis involved calculating percentage of correct responses during treatment.

Limitations of this study include small sample size (n=2) making it difficult to conclude what makes one AAC system more preferable over the other. Additionally, participants received treatment in their own classrooms with no environmental controls in place, providing a threat to internal validity. Strengths of this study included high inter-rater agreement (97%) and counterbalancing of treatment presentation. Overall, this study provides suggestive evidence that children with ASD may benefit from both PECS and sign language to increase requesting.

Barlow, K. E., Tiger, J. H., Slocum, S. K., & Miller, S. J. (2013) used an alternating treatment design to compare the acquisition of picture exchange systems and manual signs for requesting (i.e. mands) in children with ASD. Each participant was trained in both picture exchange based mands and manual sign based mands. Participants included three children between the ages of two

and seven with a diagnosis of ASD who had little to no vocal-verbal behavior and little prior experience to sign language or PECS.

Prior to implementation of either AAC system, the author conducted three baseline sessions to assess pre-instruction level of responding and elicit both topography based (sign language) and selection based (PECS) responses. This was followed by a mand-instruction comparison phase that involved teaching a response in sign language and in PECS for the same reinforcer in alternating sessions.

It was found that all three students showed a preference for picture exchange systems for requesting items. Participants met mastery criterion for and were able to effectively use PECS to request items after an average of nine sessions, while none of the three participants were able to independently use sign language for requesting after 17 sessions. The outcome measure being studied was frequency of requesting. Data was collected manually by recording responses on a trial-by-trial basis and specified responses as either occurring independently or following a prompt.

The small sample size (n=3) was a limitation of this study, making the results difficult to generalize. Additionally, training was administered in the participants' home or therapy setting, making external variables difficult to control for. Strengths of this study include a detailed description of treatment procedures that are easily replicable. Overall, this study provides suggestive evidence that children with ASD are able to request using PECS more easily than they would using sign language.

Two Group Experimental Design
In a this design, participants are selected to be in one of two experimental groups and outcomes of each group are compared. In the following study, students were selected to receive training either in PECS or in sign language and group outcomes were evaluated.

Moodie-Ramdeen, T. (2009) used a two group experimental design to compare the rate of acquisition of mands (requests) and tacts (labels) using both sign language and PECS in children with ASD. The author also looked at how these

skills generalized across environments. Participants included six children between three and five years of age with a diagnosis of ASD who were minimally verbal. Participants were placed into either a group receiving sign language training or a group receiving PECS training based on their level of functioning as evaluated prior to the onset of the study.

Participants in both groups received intensive training in their respective AAC system for eight weeks. Data was collected in the form of parent and teacher questionnaires to gather information on the children's developmental abilities; tally counters to track the use of mands and tacts; parent and teacher interviews; and consistent participant observation. The data was then analyzed and graphed using triangulation. The dependent variables in this study were the rate of language acquisition and the generalization of these skills.

It was found that children that received training in PECS acquired language at a faster rate than those who were trained in sign language; however, they concluded that both methods of AAC improved communication among the participants.

This study design provides a high level of clinical evidence that results are reliable, however it may not have been the most appropriate study design to address this research question as it is difficult to compare outcomes among such a heterogenous population; it may have been more suitable for each child to serve as their own control. Both the sign language training sessions and PECS training sessions occurred in similar settings for the same amount of time, and inter-rate agreement was high among observers in both groups. Overall, this study provides suggestive evidence that both PECS and sign language have positive communicative outcomes for children with ASD.

Case Study
Case studies are non-experimental research that follow a small cohort of individuals who have undergone particular treatments in order to analyze the effectiveness of these treatments.

Spencer, T. D., Petersen, D. B., & Gillam, S. L. (2008) discussed the cases of three children with ASD between four and seven years of age and

went through an evidence-based decision making process to decide which AAC system would be most suitable for each student. This article aimed to demonstrate the importance of making evidence-based decisions when choosing which of the two AAC systems (PECS or sign language) to use for students with ASD. All three cases looked at how PECS or sign language training improved communication among the students with ASD. After conducting clearly defined literature searches to evaluate the current research on the topic and considering each child's individual abilities, it was concluded that each student would benefit from different approaches to AAC based on family, individual, teacher, and school factors.

The authors thoroughly went through the available evidence on the effects of PECS and sign language in children with ASD and described the factors they considered in their decision making process for each of the three case studies (including family, individual, teacher, and school factors). Although case studies are non-experimental and provide low level evidence for causal outcomes, the aim of the present article was to provide examples of evidence-based decisions with regards to selecting appropriate treatment methods. Given the thorough integration of evidence, this study provides suggestive evidence that individual factors play an important role in selecting which AAC system is best suited for children with ASD.

Literature Review
This design aims to summarize available research on a particular topic in an effort to find an answer to a research question.

Mirenda, P. (2003) aimed to summarize research that looked at whether unaided AAC systems, such as manual signing, or aided AAC systems, such as picture exchange systems, were more preferable for increasing communication in students with ASD. After a review of the current literature, it was concluded that evidence is mixed for which AAC option students prefer, with individual characteristics, fine motor skills, and communicative function being noted as factors that influence success with either AAC system. Data collected from several studies suggested that individuals with more refined fine motor skills and good motor verbal imitation skills may benefit

more from sign language rather than PECS. Additionally, other studies suggested that the acquisition of PECS requires less cognitive demand, making it a more suitable option for children with lower cognitive skills.

Strengths of this study included a thorough review of the available research with results outlined in a descriptive manner. However, the author stated that stringent criteria to evaluate validity of the research were not used in the present review; rather, studies reviewed were assumed to be internally valid and empirically sound. This method of evaluating research may have led to subjective conclusions, and therefore the results of this literature review should only be viewed cautiously. Overall, this literature review provides equivocal evidence that individual differences affect how children with ASD acquire PECS or sign language, but serves as an adequate summary of the available literature.

Discussion

The primary goal of this paper was to evaluate the available research to determine if evidence exists to suggest if PECS or sign language yield better language outcomes for children with ASD. The current review evaluated six studies that collectively provide suggestive evidence that PECS and sign language provide comparable positive outcomes for children with ASD. Evidence remains mixed regarding whether either AAC system provides better communication outcomes than the other, with individual factors such as child and caregiver preference, individual characteristics, fine and gross motor skills, and level of overall function being noted as important factors to consider when choosing an AAC system for a child with ASD.

Small sample size proved to be a limitation for all of the research evaluated in this review, making the results of each study less generalizable. Additionally, lack of long-term follow up was another limitation of each study; without knowing how the children in this review fared with their AAC systems long-term, it is difficult to know how beneficial the AAC systems really were in improving their overall communication. Finally, a third limitation of the studies in this review was a

lack of reporting on parental involvement. Children spend the majority of their time with their parents, and therefore their parents would play a large role in whether or not they used and benefited from these AAC systems.

Additional research is suggested to address the aforementioned limitations and improve the evidence base for this topic. The following recommendations should be considered:

I.   Utilize larger sample sizes to enhance overall validity and generalizability.
II. Follow participants long term to assess whether these AAC systems are practical for this population, how often they are used in their daily living to enhance communication, and whether or not skills have generalized and been maintained following the intervention period.
III. Include parental involvement as an independent variable to evaluate how PECS and sign language impact communication with varying amounts of parental participation.

Clinical Implications

From this review, it can be concluded that both PECS and sign language result in increased communication for minimally verbal children with ASD. When SLPs are tasked with implementing AAC systems for these children, it will be important to have a general idea of which AAC system might work best for a child. The research suggests that children with ASD who demonstrate more developed fine motor skills, vocal and motor imitation skills, proto-declarative joint attention skills, and functional play skills may be more appropriate candidates for sign language, while children who demonstrate proto-imperative joint attention skills and lower cognitive functioning may be more appropriate candidates for PECS. Coupling these considerations with child and caregiver preferences, SLPs may have a more evidence-based starting point for AAC use among this population; however, given the suggestive nature of this review, clinicians should still try a variety of AAC systems to determine what works best for their clients.

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