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BRIEF REPORT

Brief Report: Randomized Test of the Efficacy of Picture Exchange Communication System on Highly Generalized Picture Exchanges in Children with ASD

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Abstract A randomized control trial comparing two social-communication interventions in young children with autism examined far-transfer of the use of picture exchange to communicate. Thirty-six children were randomly assigned to one of two treatment conditions, one of which was the Picture Exchange Communication System (PECS). All children had access to picture symbols during assessments. Post-treatment measurement of the number of picture exchanges in a far-transfer, assessment context favored the PECS intervention. These findings were interpreted as support for the hypothesis that the PECS curriculum can successfully teach a generalized means of showing coordinated attention to object and person without requiring eye contact to children with ASD.

Keywords Autism · Communication · PECS · Intervention · Generalization · Generality

The Picture Exchange Communication System (PECS) is a visually-based communication system used extensively with individuals who have language deficits due to a variety of disabilities and disorders, including autism spectrum disorders. One of its greatest assets has received almost no attention in the theoretical or clinical literature. The picture exchange requires that attention be given to the message recipient using a behavior that does not require eye contact. Showing attention to the message recipient as part of the communication act is a critical distinction between intentional action and intentional communication (Bates et al. 1979) and increases the probability that potentially communicative behavior will be responded to by mothers (Yoder and Munson 1995). An essential component of the functional use of a communication system is generality of this system to situations that differ from the training context on multiple dimensions simultaneously.

To provide a framework for the current paper, it is necessary to discriminate between use of the term "generalization" as a *process* and "generality" as a *measurement context*. Direct observation of the *process* of generalization requires the presence of similarities between the training context and measurement context in order to infer that transfer of stimulus control has occurred (Sidman 1960). In contrast, generality as a measurement context requires a demonstration of a trained behavior in an untrained context (Stokes and Baer 1977). We were interested in determining whether children in the current study used PECS to functionally communicate with an adult, applying the latter definition of generality. One important criterion by which to judge whether generalized use of a functional communication skill has occurred is to determine whether training results in use of the taught behavior in a measurement context that is different from the training context on several dimensions (Yoder and Lieberman 2008).

There are several internally-valid studies that show the PECS facilitates picture exchange in treatment contexts or contexts very similar to treatment in children with ASD (e.g., Ganz and Simpson 2004). However, the extent to which the picture exchange generalizes to conditions that are dissimilar to treatment contexts is still unclear. For example, two recent studies did not include formal measures that the trained behavior generalized to a measurement

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context that differed from the training context on at least one dimension (Ganz and Simpson 2004; Ganz et al. 2008). Additionally, three studies reported some measure of this type of generality (Beck et al. 2008; Charlop-Christy et al. 2002; Tincani 2004), but only two examined generality of the picture exchange without lumping it with other communication means (Beck et al. 2008; Tincani 2004). Beck et al. (2008) measured posttreatment generality across two dimensions simultaneously for 50% of participants, while Tincani (2004) altered the generality context from the treatment context by only one dimension—the message recipient. These prior studies do not provide rigorous tests of generality of the PECS across several dimensions simultaneously. To add to what is currently known about generality of the PECS, the research question addressed in the current study was: Does PECS teaching result in far-transfer (i.e., generality) of the picture exchange in children with ASD?

Method

Participants and Procedures

The current sample is drawn from a prior study examining effects of two social-communication interventions in young children with ASD (Yoder and Stone 2006). Thirty-six children between the ages of 18 and 60 months participated. Upon entry into the study, 33 children had a diagnosis of autism and 3 had a diagnosis of pervasive developmental disorder—not otherwise specified. Inclusion criteria were that children be between the ages of 18 and 60 months, use fewer than ten words during communication samples, and pass a hearing screening. See Table 1 for participant information. Yoder and Stone (2006) provides further details regarding the screening process and exclusion criteria for the sample in the current study. Upon entry into the study, four assessments were administered to participants (Time 1), one of which was the *Early Social Communication Scales-Abridged* (ESCS-Abridged; Mundy et al. 1996). The others are discussed in Yoder and Stone. The same assessments were conducted six months later, immediately posttreatment (Time 2). This study was conducted in compliance with the Vanderbilt University Institutional Review Board.

Design

Participants were randomized into one of two treatment conditions: (a) Responsive Education and Prelinguistic Milieu Teaching (RPMT) or (b) PECS. Measures were conducted by examiners who were not involved in treatment and were blind to group assignment. Differential attrition did not occur and attendance to nonproject-treatments did not differ between groups (Yoder and Stone 2006).

Measures

The Early Social Communication Scales-Abridged (*ESCS-Abridged;* Mundy et al. 1996*).* Children were assessed using an adaptation of the ESCS-Abridged at pre- and posttreatment periods as part of a battery of developmental measures reported upon in Yoder and Stone (2006). The ESCS-Abridged uses a standard set of toys, prompts, and contingent reinforcement to elicit and measure early social-communication skills. The degree of familiarity with the measurement context was equal across treatment groups. Further details on the ESCS-Abridged are available in Yoder and Stone (2006). To keep coders blind, symbols were made available to all children during pre- and posttreatment measurement regardless of group assignment. A single symbol was attached to the communication book during each item. The symbol was replaced whenever a new item was introduced by the examiner or requested by the child. New items were within sight, but out of reach, of the child. This adaptation to the ESCS-Abridged was implemented (a) to accommodate the fact that different materials (and thus symbols) were used during the assessment than were used during the treatment and (b) to test for the use of the picture exchange without requiring the child to discriminate a novel symbol from distracter symbols. The ESCS-Abridged constitutes a test of far-transfer because the examiner, setting, activities, and

Table 1 Descriptive statistics for participants on time 1 variables

Variable	PECS ($n = 19$)		RPMT ($n = 17$)	
	M	SD	*M*	SD
Chronological age (in years)	3.1	.8	2.7	.5
ADOS communication algorithm score	5.79	1.18	6.35	1.27
ADOS social algorithm score	10.32	2.36	11.64	1.17
Mullen expressive language standard score	19.47	1.26	21.59	3.36
Mullen receptive language standard score	19.26	.45	19.41	.51
IQ (derived from Mullen)	50.32	5.2	51.76	5.41

materials differed from those of the treatment sessions for both treatment groups. The dependent variable derived from the ESCS was the number of picture exchanges at posttreatment assessment.

Treatments

Nineteen children were assigned to the PECS intervention and 17 children were assigned to the RPMT intervention. Both interventions comprised child and parent components (Yoder and Stone 2006). Therapy involved three 20-min sessions per week for 6 months in a university clinic setting. For further treatment description, see Yoder and Stone (2006). Fidelity of treatment data collection and results are available in Yoder and Stone (2006).

Two interventionists were trained in the use of PECS during a 2-day workshop. The PECS curriculum was implemented as described in the training manual (Bondy and Frost 1994) with the exception that it was implemented three times a week for 20 min, not throughout the day. Picture symbols were Mayer-Johnson line drawings closely resembling objects used during training sessions. The parent component for PECS treatment involved demonstration and discussion of strategies to promote PECS use outside of treatment sessions.

Participants in the RPMT treatment worked with a primary therapist twice a week and a second therapist once a week for six months. RPMT involves the establishment of highly engaging play routines in order to target specific prelinguistic communication behaviors (e.g., gestures, vocalizations, and eye gaze) through the least intrusive prompting procedures. The parent component involved supporting parents in the use of responsive play and communication strategies. (See Yoder and Warren (2002) for details of RPMT).

Results

Equality between groups was tested on nine variables that were thought to potentially affect the dependent variable using an independent samples *t*-test including number of treatment sessions attended, ADOS (Lord et al. 2000) communication and social algorithms, Mullen expressive and receptive language standard scores (Mullen 1995), Mullen composite score, IQ, object imitation, and frequency of PECS use at Time 1. Of the nine pre-treatment variables, significant group differences were found only on the ADOS social algorithm ($t = -2.18$, $p = .038$) and standard score on the Mullen expressive language subscale ($t = -2.45$, $p = .024$). However, further analysis revealed the ADOS social algorithm score ($r = -.18$, $p = .301$) and the Mullen expressive language subscale ($r = -.13$, $p = .453$) were not significantly correlated with the outcome variable. They were therefore not entered as covariates in the final analysis.

There were 0 uses of PECS in all children at Time 1, except for 1 child in each group, who used 1 PECS exchange each. The time main effect was large ($F = 16.22$, $p < .001$, $d = 1.0$). The time x group effect was large and significant ($F = 5.5$, $p < .001$). The interaction was caused by nonsignificant between-group differences between PECS exchanges at Time 1 ($d = .23$) and significant between-group differences at Time 2 ($t = 2.56$; $p = .018$, $d = .81$). The means (and SDs) of picture exchanges for the PECS and RPMT groups were 3.84(4.5) and 1.06(1.3), respectively.

Discussion

Using a research design with strong internal validity, the current study found that young children with autism receiving the PECS training increased the number of picture exchanges more than children receiving the alternative intervention in a far-transfer (i.e., generality) measurement context. The treatment effect size was large.

The present study was able to extend the evidence that PECS can facilitate generalized picture exchange in three ways. First, a randomized control trial of a comparison of PECS with a second social-communication treatment provided an internally-valid examination of the effectiveness of PECS in young children with autism. Second, the dependent variable of interest was generalized PECS use separate from other communication modalities such as gesture, vocalizations, and words. Third, the current study measured use of PECS with a different adult, interactional style, materials, activities, and setting than treatment conditions.

Some readers will consider the way picture exchange was measured in the far-transfer test as a limitation. Because a single symbol was available for use for each item presented during the ESCS, the children did not have to make any discrimination among symbols before making the picture exchange. Although this differs from real-life PECS use, this was done to test whether children had learned to generalize the use of the picture exchange as a means of communication without requiring them to recognize the referent for a novel symbol. In other words, we are in no way claiming that the children recognized the picture as a symbolic representation of the object in front of them, but that they were using the exchange of the picture as a communicative signal to the examiner. We are positing here that it is important to know whether children learned the generalized lesson to exchange a symbol when they wanted something apart from accurately discriminating

among symbols. The rationale for this focus is based on the broader issue of young children with autism establishing coordinated attention between an object and person to communicate. Teaching a generalized picture exchange may be one way to help a child begin to use coordinated attention to object and person to communicate.

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