Short Report

Social–communicative effects of the Picture Exchange Communication System (PECS) in Autism Spectrum Disorders

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Abstract

Background: The Picture Exchange Communication System (PECS) is a common treatment choice for non-verbal children with autism. However, little empirical evidence is available on the usefulness of PECS in treating social–communication impairments in autism.

Aims: To test the effects of PECS on social–communicative skills in children with autism, concurrently taking into account standardized psychometric data, standardized functional assessment of adaptive behaviour, and information on social–communicative variables coded in an unstructured setting.

Methods & Procedures: Eighteen preschool children (mean age = 38.78 months) were assigned to two intervention approaches, i.e. PECS and Conventional Language Therapy (CLT). Both PECS (Phases I–IV) and CLT were delivered three times per week, in 30-min sessions, for 6 months. Outcome measures were the following: Autism Diagnostic Observation Schedule (ADOS) domain scores for Communication and Reciprocal Social Interaction; Language and Personal–Social subscales of the Griffiths' Mental Developmental Scales (GMDS); Communication and Social Abilities domains of the Vineland Adaptive Behavior Scales (VABS); and several social–communicative variables coded in an unstructured setting.

Outcomes & Results: Results demonstrated that the two groups did not differ at Time 1 (pre-treatment assessment), whereas at Time 2 (post-test) the PECS group showed a significant improvement with respect to the CLT group on the VABS social domain score and on almost all the social–communicative abilities coded in the unstructured setting (i.e. joint attention, request, initiation, cooperative play, but not eye contact).

Conclusions & Implications: These findings showed that PECS intervention (Phases I–IV) can improve social–communicative skills in children with autism. This improvement is especially evident in standardized measures of adaptive behaviour and measures derived from the observation of children in an unstructured setting.

Keywords: Picture Exchange Communication System (PECS), autism, intervention, social and communicative skills.

What is already known on this subject

The Picture Exchange Communication System (PECS) is an augmentative communication system frequently used with non-verbal children with autism. PECS can facilitate functional communication, improve severe impairments of functional speech, decrease the behaviors problem. Only a small number of studies suggest positive effects in the social domain.

What this study adds

This paper shows the possibility of using PECS for improving socio-communicative skills in autistic children. An experimentally controlled group investigation was conducted using data collected with formalized measures of communication and social functioning and with behaviour observation of participants in an unstructured setting. Outcomes measures after PECS training suggest that this intervention (based on the “physical exchange” within an interactive context) can represent an effective tool for promoting improvement of social-communicative skills.
Communication and social impairments appearing early in life and persisting into adulthood are core features of Autism Spectrum Disorders (ASD; American Psychiatric Association (APA) 2000, Howlin et al. 2004). In the past, rehabilitation interventions aimed at improving language and communication in children with ASD mainly focused on verbal production through response training, while neglecting that, unlike non-verbal training, this method did not influence communication skills (Howlin 1998). At present, successful rehabilitation strategies of non-verbal autism are centred on functional spontaneous communication. This has favoured implementation of Alternative Augmentative Communication (AAC) systems devoted to the development of non-verbal communication by using signs, pictures and symbols (Howlin 1998, Howlin et al. 2007, Mirenda 2003, Schuler et al. 1997). Various forms of AAC have been devised. These include the use of manual signs, voice output communication devices and various picture-based systems (for a recent meta-analysis on AAC in ASD, see Ganz et al. 2011). The Picture Exchange Communication System (PECS), originally developed by Bondy and Frost (1994), is a picture-based AAC system that was specifically designed for non-verbal children with ASD (for recent reviews, see Flippin et al. 2010, and Ganz et al. 2011). PECS uses basic behavioural principles, particularly reinforcement techniques, to teach children to use functional communication in a social interaction context (Bondy and Frost 1994, 1998).

The PECS protocol includes six instructional phases (Bondy and Frost 1998): Phases I and II include teaching the student to exchange pictures for preferred items and activities (Phase II expands on Phase I by teaching generalization across distance, communicative partners and a variety of items and pictures); in Phase III students learn to discriminate between preferred and non-preferred pictures and eventually between a variety of preferred items; in Phase IV students are taught to make requests using complete sentences; Phase V involves instruction in answering questions; and in the final phase, Phase VI, students learn to make a variety of comments. Thus, the first four phases focus on teaching the child to use a symbol to make a request, while the final two phases expand the range of communicative functions used by the child.

Despite the fact that PECS is a popular communication-training programme for non-verbal children with autism (Flippin et al. 2010, Howlin et al. 2007), only a few empirical studies are available on its efficacy in treating social–communicative impairments in autism. More precisely, while several investigations indicated that PECS can provide a viable means to facilitate communication and to improve severe impairments of functional speech (Flippin et al. 2010), only a small number of studies suggest positive effects in the social domain (Preston and Carter 2009).

In a study on three individuals with autism, Charlop-Christy et al. (2002) demonstrated positive treatment-related increases in speech and different social–communicative behaviours, especially initiations, requests and joint attention. Accordingly, in a single case study Kravits et al. (2002) reported some increase in duration of social interaction with peers and provided a demonstration of the effectiveness of PECS in increasing spontaneous communication skills.

In a randomized control study, Yoder and Stone (2006) compared the effect of PECS with that of another communicative intervention (i.e. Responsive Education and Prelinguistic Milieu Teaching—RPMT), on initiating joint attention, requesting and turn-taking, and found that RPMT facilitated the frequency of generalized turn-taking and generalized initiating joint attention more than the PECS did, whereas the PECS had a superior effect to generalized request in children with initially low rates of initiating joint attention. Carr and Felce (2007) focused on spontaneous communicative initiation following PECS training and found significant increases in initiation and dyadic interaction between children with autism and their teachers. Analogously, in another randomized control study Howlin et al. (2007) investigated potential effects of PECS training on spontaneous communication of children with ASD in a school setting and found that rates of communicative initiations and PECS usage were significantly increased immediately following intervention (also Gordon et al. 2011). The authors also examined ADOS-G (Lord et al. 2000) domain scores for communication and reciprocal social interaction, and only observed a specific decrease in the severity score for reciprocal social interaction at the 10-month follow-up.

This review shows that only three group studies are available on social–communicative effects of PECS training in ASD. In two studies a specific analysis was performed on behavioural measures derived from observation of participants in an unstructured setting, without providing a systematic assessment with standardized tests (Carr and Felce 2007, Yoder and Stone 2006). In the third study, a less deep behavioural observation has been combined with standardized tests specifically assessing language and only one measure of social–communicative abilities (i.e. ADOS Communication and Reciprocal Social Interaction domains; Howlin et al. 2007). Recently, Preston and Carter (2009) claimed that investigations on social–communicative effects of PECS training should concurrently take into account standardized psychometric data, standardized functional assessment of adaptive behaviour, and
information on social–communicative variables coded in an unstructured setting. On this basis, in the present study we conducted an experimentally controlled group investigation to test the effects of the first four PECS phases on social–communicative behaviours of children with ASD. To this aim, we collected psychometric data and functional measures of adaptive behaviour by means of standardized tasks, and evaluated social–communicative skills in an unstructured setting through observation of children’s free-play interactions with an adult.

**Methods**

**Participants**

The participants were all recruited from ‘Eugenio Medea’ Scientific Institute, Regional Branch of Ostuni (BR), Italy; an institute for diagnosis and rehabilitation of developmental disorders. For inclusion in the study each child was required: (1) to have a diagnosis of autism; (2) to be aged between 18 and 60 months; (3) to have little or no functional language (spontaneous use of fewer than five words according to parent report, defined on the basis of clinical observation and the MacArthur Communicative Development Inventory; Fenson et al. 1993), (4) not to be using PECS or other ACC systems, and (5) to have no evidence of severe sensory, motor deficits or of known co-morbid medical conditions. Diagnosis of autism was based on the following criteria: (a) a formal clinical diagnosis made by a child psychiatrist and a clinical psychologist according to the criteria of the DSM-IV; and (b) results from the Autism Diagnostic Observation Schedule (ADOS; Lord et al. 1999) administered by trained and certified examiners.

Thirty children were screened for participation in the study between September 2010 and February 2011, and 18 children fitted the inclusion criteria, so that the total sample size was 18. All children were from southern Italy; 17 male and one female. The mean non-verbal IQ (based on level performance of Griffiths’ Mental Developmental Scales) was 71.1 (SD = 17.2) and ranged from 44 to 98 points. Mean production score on the MacArthur Communicative Development Inventory was 1.72 (SD = 2.26), and total score on the ADOS was 16.52 (SD = 3.76). The mean formal educational level of the primary parent was 12.7 years (SD = 2.7) for mother and 11.1 (SD = 3.5) for father.

Participants were assigned either to the experimental or to the control group after parents had provided written informed consent. However, parents were unaware of the precise goals of the study and of the specific children’s skills that were targets of the intervention. The experimental group received PECS intervention, whereas the control group received a Conventional Language Therapy (CLT). The two groups were defined by territory, that is a 30–50-mile limit was set as a viable distance for the parents to travel to reach the ‘Eugenio Medea’ Institute where PECS training was implemented. Therefore, all the children in this area who met the inclusion criteria for participation were included in the intervention group, whereas children outside the 30–50-mile limit who met inclusion criteria were recruited for the control group. The control group received CLT training in other rehabilitation structures accredited with the Italian National Health System placed within a short distance from their home.

All pre-test measurements were given to participants before the intervention sessions were initiated. Table 1 presents descriptive information of the sample, separately for the two groups.

**Procedure**

At entry into the study (Time 1), children received four pre-treatment assessments (see the Outcome Measures section below). The treatment phase lasted 6 months, and at the end of this period the four pre-treatment measures were repeated (Time 2). All assessment procedures at both time points were conducted by examiners who were blind to the purpose of the study and to group assignment of the participants. Evaluation took place in a building that was different from the therapy building, and used materials and activities that were not used in therapy sessions.

**Outcome measures**

The efficacy of treatment was assessed via a battery of standardized assessments of social–communicative abilities. In addition, several behavioural measures were derived from observation of a free-play session with an examiner. The following measures were included.

- **Griffiths’ Mental Developmental Scales** (GMDS; Griffiths 1984): language subscale,
Table 2. Dependent measures and operational definitions for behaviours observed in the UFPE

<table>
<thead>
<tr>
<th>Dependent measure</th>
<th>Operational definition</th>
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<tbody>
<tr>
<td>Cooperative play</td>
<td>Child engaged in the same activity (e.g. basketball, puzzles, board games) with the therapist for at least 10 s</td>
</tr>
<tr>
<td>Eye contact</td>
<td>Child looked into therapist’s eyes for 2 s</td>
</tr>
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| Joint attention   | (a) Observing same object for 5 s  
(a) Referential look between therapist and an object  
(c) Established common attention focus with therapist |
| Requests          | Labelling object while pointing or reaching for it, handing the therapist PECS cards, verbal requests |
| Initiation        | Independent approach to therapist with vocal or non-vocal attempt to engage in conversation or play (e.g. pulling on therapist’s shirt to get attention, play, handing therapist a toy) |

receptive and expressive language, and personal–social subscale, assessing proficiency in the activities of daily living, level of independence and interaction with other children, were employed as outcome measures.

- **Autism Diagnostic Observation Scale** (ADOS; Lord et al. 1999). Communication and Reciprocal Social Interaction domain scores were used to assess change over time.

- **Vineland Adaptive Behavior Scales, Second Edition** (VABS; Sparrow et al. 2005). VABS were used to gather parent report of child communication and social abilities at home and in the community.

- **Unstructured Free-Play with Examiner** (UFPE). Following previous studies on social–communicative effects of PECS (Charlop-Christy et al. 2002, Yoder and Stone 2006) a 15-min session of UFPE was planned in order to collect data on specific variables, i.e. cooperative play, eye contact, joint attention, requests and initiation. The operational definition of these variables was based on Charlop-Christy et al’s (2002) criteria (table 2). UFPE was conducted in a room with a variety of age appropriate toys or objects (i.e. bubbles, balloons, stuffed and rubber animals, female baby doll, building blocks, wind up car, electronic toys, a small table and two chairs) accessible to the children. The PECS book was present in pre- and post-treatment and both groups had the possibility to use it. The examiner played with the same or similar toy as the child by imitating the child’s play. If the child did not attend to any toy for 10 s, then the examiner selected an interesting object and used it in a way that was suitable to the cognitive level of the child. Examiners verbally commented on the child’s or their own actions, but they were instructed not to use any type of communication prompt, such as time delays, questions or gestural prompts.

Social–communicative behaviours coded during the UFPE session were derived from videotaped records of the free-play session using the Observer Video Pro (version XT.7; Noldus Information Technology 2007) software package to transform a standard computer keyboard into a point and state events recorder. The point events were behaviours that only take an instant in time, or whose duration was not important, i.e. joint attention, requests and initiation; these variables were coded in terms of frequency. The state events were behaviours that take a period of time and therefore have a duration, i.e. cooperative play, eye contact; these variables were coded in seconds. The duration of the session was exactly 15 min for all children; therefore no correction for the length of the observation was necessary.

Reliability of coded variables was analysed on independently coded and randomly selected samples. Two independent observers were trained to use the coding system developed for the purposes of this study. Each of the observers had a Master’s degree in clinical or developmental psychology and received training by an experienced clinician using video samples of children not involved in the study. The observers (coders) were blind to the purposes of the study and the treatment assignment. Inter-rater reliability was determined by double coding of 20% of the observations and was very good (Kappa = 0.87).

**Treatments**

PECS and CLT were implemented within a psycho-education rehabilitation programme based on the TEACCH methodology (Mesibov et al. 2004). All children followed a structured teaching for a total 12 h a week; children were taught skills including attention, basic discrimination, language and spontaneous communication, daily living, socialization, play, fine and gross motor control and pre-academics (Watson et al. 1989). A semi-structured setting was also implemented, using incidental teaching techniques, to enhance generalization, increase motivation, develop social skills and to decrease problem behaviours.

Treatments sessions took place in a therapeutic room equipped with small desks, chairs, familiar and unfamiliar objects and toys; children were offered 30-
Experts leading both PECS and CLT were specialists in speech–language pathology with extensive expertise with ASD. As specifically regards PECS, the trainer attended two workshops about PECS basic and advanced training provided by an expert consultant of Pyramid Educational Consultants UK, following the highly prescribed format of the training manual (Frost and Bondy 2002), and received a certificate of attendance at the conclusion of each workshop.

Phases I–IV of PECS were implemented according to the standard procedures devised by Bondy and Frost (1998); table 3 provides a brief description of each the four PECS phases. Before beginning of the training, parents were required to record their children’s favourite food and toys on a card in order to make picture cards to be included in the communication book, according to the standard procedure.

The percentage of correct requests per session and the number of sessions per criterion were measured for each of the four PECS phases. Observations were carried out independently by two autism specialists, speech-and-language therapists, one of which was the PECS trainer. There was 100% agreement regarding the PECS level between the two assessors. The criterion for advancement within a phase was set at 80% independent on symbol exchanges made during PECS instruction. Training within each phase of PECS was continued until all children were able to demonstrate independently a correct response score of 80% or higher for a minimum of three consecutive sessions, in accordance with the criteria outlined in the PECS training manual (Bondy and Frost 1994). The mean number of PECS sessions for each phase was 6.3 (SD = 2.3); within these sessions, children were provided with a mean number of 91 (SD = 38.9) individual trials.

Conventional Language Therapy (CLT) is a language training based on a systematic, step-by-step teaching technique using prompts and useful reinforcements. In Italy it represents one of the most widely employed methods to treat language and communicative disorders in developmental disabilities in accordance with the guidelines of the Italian National Health System. CLT employs a variety of largely operant approaches to language intervention implemented in accordance with discrete trial training formats (Goldstein 2002, Lovaas 1981, 2002): the child is taught to attend to adults and respond to simple instructions (receptive language training); she/he has to first imitate manual, oral-motor and vocal behaviour, and then to imitate speech. Association learning is used for teaching increasingly sophisticated expressive language skills, and motivation is favoured through use of various external rewards. CLT uses didactic, adult-directed instructions in a one-to-one interaction: each session begins by presenting the child with his own preferred items. If the child shows motivation to obtain the item (e.g. reaching for it), the therapist waits for a few seconds to provide the opportunity for the child to say the word independently. If the child does not produce the word, the therapist repeats the name of the object three times with time delay. When the child spontaneously names or imitates the name, or produces a word approximation, she/he receives the desired item.

### Results

**Standardized test assessment**

We investigated group differences before treatment. To this aim, a MANOVA was performed with demographic characteristics and mean standard scores on formalized tests at Time 1 (tables 1 and 4) as dependent variables and group as independent variable. Results showed that there were no significant group differences in demographic data and Time 1 formalized tests scores (all $p > 0.05$), thus demonstrating that the two groups were well matched with respect to pre-treatment measures and that no covariate was needed to analyse group differences on Time 2 measures.
A MANOVA was performed with mean standard scores on formalized outcome measures at Time 2 (table 4) as dependent variables and group as independent variable. Results showed significant group differences on VABS—Social, \( F(1, 16) = 10.519, p = 0.005, \eta^2_p = 0.397 \), but not on all the other Time 2 measures (all \( p > 0.05 \)).

A within-group comparison between Times 1 and 2 scores was performed separately in PECS and CLT group. As regards the PECS group, paired \( t \)-tests showed a significant improvement of scores on both VABS—Communication \( (t(8) = -2.484, p = 0.038) \) and VABS—Social \( (t(8) = -3.331, p = 0.010) \) domains, but not on the other measures (all \( p > 0.05 \)). The same analysis performed on the CLT group did not reveal significant difference on any of the considered measures (all \( p > 0.05 \)).

### Unstructured free-play session

A MANOVA was performed with behavioural outcome measures coded during free-play at Time 1 (table 5) as dependent variables and group as independent variable. Results showed that at Time 1 there were no significant group differences in the behavioural measures coded during free-play (all \( p > 0.05 \)). In contrast, the MANOVA performed on Time 2 measures showed significant group differences in cooperative play, \( F(1, 16) = 7.648, p = 0.014, \eta^2_p = 0.323 \), joint attention, \( F(1, 16) = 7.993, p = 0.012, \eta^2_p = 0.333 \), requests, \( F(1, 16) = 4.797, p = 0.045, \eta^2_p = 0.231 \), and initiation, \( t(8) = -2.369, p = 0.012, \eta^2_p = 0.321 \). The same analysis performed on the CLT group did not reveal significant difference on any of the considered measures (all \( p > 0.05 \)).

### Discussion

The present study investigated the effects of PECS on social–communicative abilities of children with ASD by collecting data from formalized measures of communication and social functioning and from observation of participants’ behaviour in an unstructured setting. A group of children with ASD receiving PECS were...
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compared with another group of children receiving CLT. The two groups were well matched on demographic and pre-treatment outcome measures, thus allowing to relate post-treatment differences to the specificity of group intervention. Between group comparisons performed on formalized tests scores at Time 2 showed that children receiving PECS gained significantly higher scores than the CLT group on the VABS social domain. The between group comparison on social–communicative measures coded during free-play revealed that frequency of joint attention, requests and initiation, and duration of cooperative play but not of eye contact were significantly higher in the PECS than the CLT group. These results were confirmed by within-group comparisons between Times 1 and 2 showing in the PECS group, but not in the CLT group, significant improvements on VABS communication and social domains, and in all the measures coded during free-play. These results provide support to the existence of a close relationship between communication and social skills (Charlop-Christy et al. 2002).

Several lines of evidence suggest that improvement in the frequency of requests might trigger an increase of joint attention (Tomasello et al. 2007). In a recent meta-analysis reviewing data on PECS effects on communication and speech in children with ASD, Flippin et al. (2010) underlined that one of the main potential pre-treatment identifiers of a child with autism who is likely to respond to PECS intervention is limited joint attention. Accordingly, Yoder and Stone (2006) suggested the PECS may be a communication intervention more effective in children with initially low rates of joint attention. The authors performed an exploratory analysis of pre-treatment variables and found that initial rates of joint attention were a strong predictor of whether a child made greater communication (i.e. requesting) gains. Joint attention also emerged as a potentially influential pre-treatment characteristic in a single-subject study by Charlop-Christy et al. (2002) which documented that the largest amelioration was observed in the youngest participant, who took part to the study with no spontaneous speech, weak joint attention, eye contact and toy play. Although analysis of pre-treatment characteristics of children undergoing PECS intervention was outside the aims of the present study, the findings are in line with data from literature reviewed above and strengthen the idea that PECS is a valuable tool for enhancing social–communicative skills of children with ASD. It is possible to suggest that the ‘physical exchange’ (i.e. the communicative act to receive a concrete item) within an interactive context (to establish a physical contact with a partner prior to emitting a referential communicative; Bondy and Frost 1994) is a key feature of PECS intervention favouring children’s communication and social interaction. An important consideration is that the children with autism are less motivated by social effects of communication, such as praise, shared attention or dyadic interaction, than they are to its concrete effects, such as obtaining a desired item (e.g. Bondy and Frost 1998). Motivation to initiate social–communicative skills could occur in response to internal signals of interest or positive affect, so there is reason to believe that children can learn new communicative behaviours, such as requesting or turn taking (Yoder and Stone 2006), and later generalize them to social–communicative skills such as initiating joint attention. Starting from the concept of physical exchange within an interactive context (Bondy and Frost 1994), we speculated that motivation to interact with a partner could be first triggered in the children by the activation of the desire to reach for a concrete target by means of a social interaction and, only subsequently, by the desire to share an experience related to objects with a social partner (e.g. to carry out a game).

It remains to be elucidated why in the PECS group only one social–communicative variable coded in free-play, i.e. eye contact, did not improve from pre- to post-treatment. Although at first sight this finding seems at odds with improvement of the PECS group in joint attention, it could be explained by taking into account the distinction between two different kinds of joint attention. The child’s ability to follow gaze direction, head turns and/or pointing gesture of another individual may be referred to as responding joint attention, whereas the child’s ability in using eye contact and/or deictic gestures (e.g. pointing or showing) to initiate spontaneously coordinated attention with a social partner may be referred to as initiating joint attention (Mundy 2003). In this respect, the variable we labelled here as joint attention corresponded to responding joint attention, whereas eye contact corresponded to initiating joint attention. These two aspects of joint attention can dissociate between each other, because they reflect different processes of social and emotional functioning (Mundy et al. 2000). Actually, initiating joint attention reflects the tendency to initiate spontaneously a social interaction, whereas responding joint attention is a measure of the tendency to respond to another person’s signal to shift attention. It has been demonstrated that initiating joint attention can be affected by executive and motivation defects more than responding joint attention (Mundy et al. 2000). In particular, initiating joint attention seems to involve the tendency to initiate spontaneously episodes of sharing affective experience related to objects or events with a social partner (Mundy et al. 1992); in this sense, a difficulty with initiating joint attention represents a core symptom of autism (Mundy 2003). Results from the present study showing a dissociation between PECS-related effects on eye contact and joint attention closely
fit the distinction between these two types of joint attention, revealing that PECS intervention can specifically influence responding joint attention.

One strength of the present study is represented by our assessing children in both structured and unstructured settings. This allowed us to verify whether a best outcome measure is available to detect PECS-related changes in the child’s behaviour and to verify the presence of possible relationships between different measures. We found that while almost all variables coded in free-play reflected the positive effects of PECS treatment, among the formalized measures only the VABS social domain score demonstrated an advantage for the PECS group. A specific consideration should be made on the difference between communicative and social abilities assessed with the VABS, and communicative and social disabilities measured with the ADOS. The ADOS quantifies social and communicative behaviours that are relevant to the diagnosis of autism; the ‘algorithm’ for the specific domains of the ADOS has been commonly used for characterization of the level of autistic symptomatology (Lord et al. 1999, Klin et al. 2007). The VABS in contrast represents a measure of personal and social self-sufficiency obtained through a semi-structured interview with the person’s parents or caregivers, and it examines the adaptive functioning in everyday life. The data underlining a dissociation between abilities (VABS) and disabilities (ADOS) in the communication and social domains are fully consistent with these differences between the two measures (Klin et al. 2007). Therefore, we did not find any relationship between higher levels of adaptive skills and lower levels of symptomatology; thus, adaptive skills (abilities) and symptomatology (disabilities) might have to be conceived, at least partially, as independent domains of intervention. As Klin et al. (2007) suggested, factors mediating the acquisition of adaptive skills may be different from factors mediating the expression of autistic symptomatology. Related to this difference between abilities and disabilities assessed by VABS and ADOS, respectively, is the tentative explanation of another aspect of the present findings, namely that the severity of symptomatology measured by ADOS remained stable after 6 months, in contrast to the improvement of socio-communicative abilities after PECS training measured by VABS. One could suggest that VABS are sensitive to day-by-day improvement over a short-term period of 6 months, while the ADOS detects more global changes over a longer period. This would be consistent with Howlin et al.’s (2007) results showing that rates of communicative initiations and PECS usage were significantly increased after PECS training, whereas the authors did not find significant changes immediately following treatment on ADOS-G domain scores for communication and reciprocal social interaction. However, a specific decrease in the severity score for reciprocal social interaction was reported at the 10-month follow-up. Therefore, it could be useful in future randomized trials with larger sample sizes, do not undermine reliability of the results. Moreover, we did not collect observational data on dyadic interactions between the children and the adults in their everyday environment. While this is a post-hoc consideration prompted by the fact that the results revealed a major improvement of children’s social–communicative skills in an ecological context, it would be useful to investigate further this aspect following data of recent research (Carr and Felce 2007, Howlin et al. 2007). For instance, Carr and Felce (2007) demonstrated significant PECS-related improvements in the dyadic patterns of communication between children and teachers in the classroom. Finally, another aspect that merits comment regards the effect of PECS on language abilities. Although the present study did not demonstrate any increase in children’s language abilities, this negative result could be related to the nature of measures employed here; we mainly focused interest on social–communicative functioning rather than on language abilities (for instance, in free-play no language assessment was performed).

In conclusion, the present results showed a significant effect of PECS (Phases I–IV) on social–communicative abilities of children with ASD which underwent extensive assessment including formalized tests and observation during free-play. Outcomes measures demonstrated that the first four phases of the PECS intervention can represent an effective tool for promoting improvement of several social–communicative skills.

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