Long-term effects of PECS on social–communicative skills of children with autism spectrum disorders: a follow-up study

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Abstract

Background: The Picture Exchange Communication System (PECS) is a popular augmentative communication system frequently used with ‘nonverbal’ children with autism. Several studies suggested that PECS could represent an effective tool for promoting improvement of several social–communicative skills. Only sparse evidence is instead available on the long-term effectiveness of this treatment system.

Aims: To test the long-term effects of PECS, for which a follow-up study was conducted by assessing social–communicative skills in nonverbal preschool children with autism after 12 months from treatment completion.

Methods & Procedures: Two groups of children (N = 14) were assessed; one group had completed the PECS training and the other conventional language therapy (CLT). At follow-up all children received the same pre- and post-treatment assessment. Outcome measures were the following: Communication and Social domains of Autism Diagnostic Observation Schedule (ADOS); 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: The PECS group showed significant improvements compared with the CLT group on ADOS severity scores (Communication, Social and Total), on GMDS Social domain and on VABS Communication and Social domains. PECS-related gains on the VABS Social domain and on specific social–communicative measures coded during free-play, i.e. frequency of joint attention and initiation, and duration of cooperative play, were stable after 1-year follow-up. Cooperative play continued to improve on follow-up with respect to both post- and pre-treatment assessment.

Conclusions & Implications: These findings demonstrated that PECS training can promote long-term enhancement of specific socio-communicative skills in children with autism.

Keywords: Picture Exchange Communication System (PECS), autism spectrum disorders, long-term effects, social and communicative skills.

What this paper adds?

What is already known on this subject?
The Picture Exchange Communication System (PECS) is an augmentative communication system designed to teach individuals to communicate by exchanging picture symbols. Recent studies suggested that PECS can enhance social–communication skills in autism spectrum disorders. In the literature only a few studies are available on the long-term effects of PECS training on social–communicative skills in autism.

What this study adds?
The study investigated the long-term effects of PECS training on social–communicative skills of children with autism spectrum disorders by assessing participants both in structured and unstructured settings 1 year after treatment ended. Results demonstrated that post-treatment PECS-related gains on the VABS Social domain and on several social–communicative measures coded during free-play were stable on follow-up, and children’s cooperative play showed a progressive improvement from pre-treatment to follow-up.
Introduction

Deficits of social and communication skills are core and prognostic indicators of autism spectrum disorders (ASD) (Howlin and Moore 1997). Social–communicative impairments distinguishing ASD from typical development and developmental delay include abnormality in initiation of communication, reciprocity in interaction, social/affective signalling, joint attention, symbolic behaviour, motor imitation, language understanding and conventional use of gestures (Landa et al. 2011, Rogers et al. 2003, Wetherby et al. 2007). Over the past decade, comprehensive early intervention programmes have focused on treating deficits of joint attention, imitation and play skills in young children, proving to be successful at ameliorating these social and communication impairments (Greenspan et al. 1998, Rogers and Dawson 2010); without effective interventions, instead, these deficits tend to persist and may also lead to poor long-term outcomes and/or to internalizing (e.g., anxiety, depression and somatic complaints) and externalizing (attentional difficulties and aggressive conduct) problematic behaviours (Hartley et al. 2008).

Recent evidence showing social and language improvements following early interventions for ASD highlighted the importance of designing therapeutic opportunities to practise joint processing of self-other experiences within social communicative exchanges (Klin et al. 2002, Koegel et al. 2001, Lerna et al. 2012). According to Mundy et al. (2009), joint processing of one’s own and others’ actions and objects of attention gives way to an automaticity that is likely fundamental to symbolic and social cognitive learning. Thus, early interventions directly targeting socially engaged imitation, joint attention and affect sharing could have strong effects on later development of language, communication and social skills (Bono et al. 2004, Sigman and Ruskin 1999, Toth et al. 2006).

The Picture Exchange Communication System (PECS), originally developed by Bondy and Frost (1994), has proven to be a key intervention to enhance social and communicative skills (e.g., initiations, requests, joint attention, social interaction with peers and turn-taking) in ‘nonverbal’ children with autism (for a recent review, see Preston and Carter 2009). However, only a few studies provided evidence of long-term effects of PECS intervention (Preston and Carter 2009), and the only two randomized control trials including data on maintenance reported mixed results. Yoder and Stone (2006a) compared the efficacy of PECS and Responsive Education and Prelinguistic Milieu Teaching (RPMT) on spoken communication in 36 preschoolers with ASD. Results showed that PECS was more successful than RPMT in increasing the number of non-imitative spoken communication acts and the number of different non-imitative words used at the post-treatment period. However, when considering outcome measures across pre-treatment, post-treatment and 6-month follow-up, increase of non-imitative words was faster in the PECS group for children who began treatment with high object exploration; on the contrary, increase was faster in the RPMT group for children who began treatment with relatively low object exploration. Howlin et al. (2007) demonstrated in a group of 26 children with autism that increased rate of communicative initiations and PECS usage after the training was not maintained on a 10-month follow-up.

Recently, Lerna et al. (2012) investigated effects of PECS on social–communicative skills of nonverbal children with ASD by means of formalized measures (standardized psychometric data and standardized functional assessment of adaptive behaviour) and social–communicative outcome variables coded in an unstructured setting. Results showed a significant improvement of the PECS group with respect to the control group (which underwent to a conventional language therapy) on the Social domain score of the Vineland Adaptive Behavior Scales (VABS) and on several social–communicative abilities, such as joint attention, request, initiation and cooperative play. In the present study, we aimed at testing long-term effects of PECS intervention on social–communicative skills in a subsample of the nonverbal children with ASD recruited for the Lerna et al.’s study: to this aim, the same social–communicative abilities measured in the previous study were assessed after 12 months from treatment completion.

Following Howlin et al.’s (2007) evidence showing an improvement of Communication and Reciprocal Social Interaction domains of the Autism Diagnostic Observation Schedule—Generic (ADOS-G; Lord et al. 2000) after a 10-month follow-up, we hypothesized that ADOS could detect more global changes after PECS intervention over a longer period. On the contrary, no clear-cut data are available on adaptive behaviour assessed by the VABS. Actually, in a longitudinal study on high-functioning autism, Szatmari et al. (2003) showed that VABS Socialization score decreased over time, whereas the Communication score remained more stable. Klin et al. (2007), instead, demonstrated that both VABS Communication and Socialization scores decreased significantly with age in high-functioning autism. On these bases, no straightforward prediction can be made on how VABS scores can change over time. Analogously, although several structured observational procedures have been developed to assess children’s early social–communication skills, the few data available in literature (Charlop-Christy et al. 2002, Yoder and Stone 2006b) do not allow to build specific predictions on possible changes over time of social–communication skills.
measured in an unstructured setting (i.e., a free play interaction of the child with an adult).

Method

Participants
Participants were a subsample \((n = 14)\) of children from the Lerna et al.’s (2012) study conducted at the ‘Eugenio Medea’ Scientific Institute, Regional Branch of Ostuni (BR), Italy, an institute for diagnosis and rehabilitation of developmental disorders. All children were originally selected according to the following inclusion criteria: (1) a formal clinical diagnosis of autism made by a child psychiatrist and a clinical psychologist according to the criteria of the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV; American Psychiatric Association 2000) and to results from ADOS (Lord et al. 1999); (2) to be aged between 18 and 60 months; (3) to have little or no functional language; (4) not to be using PECS or other alternative augmentative communication systems (Schuler et al. 1997); and (5) to have no evidence of severe sensory, motor deficits or of known co-morbid medical conditions. Children were assigned either to the PECS group \((n = 7);\) mean chronological age = 71.1 months, SD = 11.9) or to the Conventional Language Therapy (CLT) group \((n = 7);\) mean age = 66.2 months, SD = 11.8) after parents had provided written informed consent (for further details regarding inclusion criteria and sampling procedures, see Lerna et al. 2012).

Procedure
Families of the 18 participants in the Lerna et al.’s (2012) study were recontacted 12 months after treatment completion (the actual period of the follow-up ranged from 12.1 to 12.6 months); four out of 18 families participating in the original study dropped out the follow-up due to familial reasons; more precisely, three participants moved with their families to northern Italy and one participant suffered a family bereavement. All the 14 participants were assessed at three time points: at baseline (pre-treatment; time 1), immediately after 6 months of PECS training (post-treatment; time 2) and 1 year after treatment completion (follow-up; time 3). The same dependent variables (Outcome Measures) were measured at baseline, post-treatment and follow-up by examiners who were blinded to child assignment and to the purposes of the study.

Outcome measures
The main outcome measures were standardized assessments of social–communicative abilities and several behavioural measures derived from observation of a free-play session with an examiner.

Griffiths’ Mental Developmental Scales (GMDS; Griffiths 1984)
Language subscale (assessing receptive and expressive language), Personal–Social subscale (assessing proficiency in the activities of daily living, level of independence and interaction with other children) and Nonverbal IQ were employed as outcome measures.

Autism Diagnostic Observation Scale (ADOS; Lord et al. 1999)
Communication, Reciprocal Social Interaction and Total scores were used to assess change over time. ADOS Module 1 or 2 was used depending on the child’s expressive language abilities.

The VABS were specifically used to gather parent report of the child’s Communication and Social abilities at home and in the community.

Unstructured Free-Play with Examiner (UFPE)
Social–communicative measures (i.e., joint attention, verbal and nonverbal requests, initiation, cooperative play and eye contact) and their operational definitions were based on Charlop-Christy et al.’s (2002) criteria. In particular, in Lerna et al.’s study the operational definition of requests was the following: ‘labelling object while pointing or reaching for it, handing the therapist PECS cards, and verbal requests’. In the present study, the operational definition was the same, but during the coding phase we decided to distinguish between verbal and nonverbal requests (i.e., pointing or reaching for object and PECS cards exchange). The rationale behind this choice was to try to highlight changes that parents reported to occur during the study in the expressive vocabulary of the children.

Data were collected during observation of a 15-min free-play session (UFPE) with an examiner. UFPE was conducted in the same room, with the same set of toys and using materials and activities that the examiner used, during all the three time points (for further details on materials employed during UFPE sessions, see Lerna et al. 2012). Social–communicative variables were derived from videotaped records of the free-play session using the Observer Video Pro software package (Version XT.7; Noldus Information Technology, Wageningen,
the Netherlands, 2007) to transform a standard computer keyboard into point and state events recorders. The point events were behaviours that only took an instant in time, or whose duration was not important, i.e. joint attention, verbal and nonverbal requests, and initiation; these variables were coded in terms of frequency. The state events were behaviours that took a period of time and therefore had 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; 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 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 = 0.85).

**Treatments**

PECS and CLT were implemented within a psychoeducation rehabilitation programme based on the TEACCH methodology (Mesibov et al. 2004). All the children followed a structured teaching for a total of 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.

All children were offered 30 min individual therapy sessions (PECS or CLT) three times a week for 6 months (i.e. 72 sessions). Experts leading both PECS and CLT were specialists in speech–language pathology with extensive expertise with ASD.

Phases I–IV of PECS training were implemented according to the standard procedures devised by Bondy and Frost (1994, 1998). Before starting 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. During the training the children were taught physical exchange (phase I), increasing distance (phase II), picture discrimination (phase III) and sentence structure (phase IV).

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), using didactic, adult directed instructions in a one-to-one interaction (for a complete description of PECS and CLT programmes, see Lerna et al. 2012). After 6 months of treatment the children interrupted both PECS and CLT training and only continued the psychoeducation rehabilitation programme with the TEACCH methodology.

**Results**

**Standardized test assessment**

We first performed a preliminary analysis to verify whether the two groups differed between each other on the standardized measures collected at time 1 (table 1). Results confirmed Lerna et al.’s (2012) data showing that there were no significant group differences at the pre-treatment assessment (all \( p > 0.05 \)). Then, a MANOVA was performed with mean standard scores on formalized outcome measures as dependent variables, and group (PECS or CLT) and time point (time 1, 2 or 3) as independent variables. Results showed a significant main effect of group on ADOS Communication, Social and Total scores, revealing a decrease of all the three severity scores in the PECS with respect to the CLT group; the effect of group was also significant on GMDS Personal–Social and on both VABS Communication and Social domain scores, always showing a better performance of the PECS than the CLT group (table 1). Results also showed on VABS Social domain score a significant main effect of time point, \( F(2,36) = 4.023, p = 0.026, \eta^2_p = 0.183 \), and, more relevant here, a significant group by time point interaction, \( F(2,36) = 3.295, p = 0.049, \eta^2_p = 0.155 \). No other significant main effect or interaction was found on all the remaining formalized outcome measures (all \( p > 0.05 \)).

Post-hoc comparisons (paired \( t \)-tests) on the significant effect of the time point on VABS Social domain score showed that, with respect to pre-treatment assessment (time 1; mean = 61, SD = 5.9), the children’s score was significantly higher on both post-treatment (time 2: mean = 72.6, SD = 19.7; \( t(13) = -2.737, p = 0.017 \)) and follow-up (time 3; mean = 66.9, SD = 8; \( t(13) = -3.389, p = 0.005 \)), whereas the difference between time 2 and 3 was not significant (\( t(13) = 1.224, p = 0.243 \)). This effect of time point on VABS Social domain score was further specified by the significant group by time point interaction; actually, post-hoc comparisons
Long-term effects of PECS in autism

Table 1. Means (SDs) of standard scores on formalized outcome measures at times 1–3, separately for the two groups. MANOVA values of the main effect of group on formalized outcome measures

<table>
<thead>
<tr>
<th></th>
<th>PECS</th>
<th></th>
<th>CLT</th>
<th></th>
<th>F(1,36)</th>
<th>p</th>
<th>η²_p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time 1</td>
<td>Time 2</td>
<td>Time 3</td>
<td>Time 1</td>
<td>Time 2</td>
<td>Time 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GMDS Language</td>
<td>34.9 (9.2)</td>
<td>42.3 (14.5)</td>
<td>50.6 (22.1)</td>
<td>35.4 (9.8)</td>
<td>33.6 (12.4)</td>
<td>37 (19.5)</td>
<td>2.33</td>
</tr>
<tr>
<td>Personal–Social</td>
<td>65.0 (9.9)</td>
<td>66.0 (6.9)</td>
<td>59.6 (15.1)</td>
<td>50.7 (14.6)</td>
<td>56.9 (11.6)</td>
<td>50.3 (9.5)</td>
<td>9.95</td>
</tr>
<tr>
<td>Non-verbal IQ</td>
<td>78.4 (17.5)</td>
<td>72.7 (13.2)</td>
<td>65.3 (23.1)</td>
<td>68.0 (15.6)</td>
<td>73.7 (21.9)</td>
<td>58.3 (19.6)</td>
<td>0.89</td>
</tr>
<tr>
<td>ADOS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Communication</td>
<td>5.9 (1.2)</td>
<td>4.3 (1.3)</td>
<td>3.9 (2.3)</td>
<td>6.4 (1.8)</td>
<td>6.4 (1.5)</td>
<td>6.9 (0.9)</td>
<td>15.34</td>
</tr>
<tr>
<td>Social</td>
<td>9.3 (1.9)</td>
<td>7.3 (3.2)</td>
<td>5.7 (3.2)</td>
<td>10 (1.9)</td>
<td>9.6 (1.5)</td>
<td>9.9 (3.6)</td>
<td>8.41</td>
</tr>
<tr>
<td>Total score</td>
<td>15.0 (2.6)</td>
<td>11.6 (3.7)</td>
<td>9.6 (5.1)</td>
<td>16.4 (3.4)</td>
<td>16.0 (2.9)</td>
<td>16.7 (3.8)</td>
<td>14.59</td>
</tr>
<tr>
<td>VABS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Communication</td>
<td>54.8 (14.2)</td>
<td>64.4 (6.8)</td>
<td>70.6 (15.2)</td>
<td>52.6 (5.9)</td>
<td>55.5 (5.8)</td>
<td>57.8 (13.9)</td>
<td>5.38</td>
</tr>
<tr>
<td>Social</td>
<td>63.3 (7.5)</td>
<td>84.4 (22.5)</td>
<td>70.6 (8.5)</td>
<td>58.8 (2.9)</td>
<td>60.7 (3.6)</td>
<td>63.3 (5.9)</td>
<td>12.73</td>
</tr>
</tbody>
</table>

Note: Significant values are shown in bold.

(paired t-tests) showed that in the PECS group children gained significant higher scores on post-treatment (time 2: mean = 84.4, SD = 22.5; t(6) = -3.249, p = 0.017) and follow-up (time 3; mean = 70.6, SD = 8.5; t(6) = -2.610, p = 0.041) with respect to pre-treatment (time 1; mean = 63.3, SD = 7.5), whereas the difference between time 2 and 3 was not significant (t(6) = 1.720, p = 0.136). On the contrary, in the CLT group, there were no significant differences among the three time points (time 1: mean = 58.9, SD = 2.9; time 2: mean = 60.7, SD = 3.5; time 3: mean = 63.2, SD = 5.9; all p > 0.05).

Unstructured free-play session

The preliminary MANOVA, with behavioural outcome measures coded during free-play at time 1 (table 2) as dependent variables and group as independent variable, confirmed Lerna et al.’s (2012) data showing that there were no significant group differences at the pre-test assessment (all p > 0.05). Then, a MANOVA was performed with mean scores on behavioural outcome measures as dependent variables, and group (PECS or CLT) and time point (time 1, 2 or 3) as independent variables. Results showed a significant main effect of group on cooperative play, joint attention and initiation, but not on eye contact and nonverbal requests (all p > 0.05). Post-hoc comparisons (paired t-tests) performed to clarify the significant main effect of the time point showed that cooperative play significantly improved from time 1 (mean = 36.9, SD = 32.9) to both time 2 (mean = 159.5, SD = 129.4; t(13) = -3.625, p = 0.003) and time 3 (mean = 304.6, SD = 238.1; t(13) = -4.538, p = 0.001), and from time 2 to time 3 (t(13) = -2.985, p = 0.011). Joint attention did not show significant changes from time 1 (mean = 0.79, SD = 1.1) to time 2 (mean = 2.4, SD = 3.6; t(13) = -1.981, p = 0.069), and from time 2 to time 3 (mean = 4.2, SD = 4; t(13) = -2.037, p = 0.063), whereas it significantly improved from time 1 to time 3 (t(13) = -2.966, p = 0.011). Nonverbal requests improved from time 1 (mean = 0) to both time 2 (mean = 0.3, SD = 0.5; t(13) = -2.280, p = 0.040) and time 3 (mean = 2, SD = 1.8; t(13) = -3.978, p = 0.002), and from time 2 to time 3 (t(13) = -3.433, p = 0.004). Initiation did not significantly changed across time points (time 1: mean = 0.5, SD = 1.2; time 2: mean = 2.4, SD = 3.6; time 3: mean = 4.5, SD = 5.5; all p > 0.05). Post-hoc comparisons (paired t-tests) on the significant group by time point interaction showed that in the PECS group cooperative play significantly improved from time 1 to both time 2 (t(6) = -3.837, p = 0.009) and time 3 (t(6) = -6.577, p = 0.001), and from time 2 to time 3 (t(6) = -5.792, p = 0.001). Joint attention significantly improved from time 1 to both time 2 (t(6) = -2.521, p = 0.045) and time 3 (t(6) = -3.816, p = 0.009), whereas it did not significantly changed from time 2 to time 3 (t(6) = -1.782, p = 0.125). Verbal requests significantly improved from time 1 to time 3 (t(6) = -2.951, p = 0.026), whereas time 1 vs. time 2 and time
Table 2. Means (SDs) of behavioural outcome measures coded during free-play at times 1–3, separately for the two groups. MANOVA values of the main effect of group on behavioural outcome measures

<table>
<thead>
<tr>
<th>Measure</th>
<th>PECS Measure</th>
<th>Time 1</th>
<th>Time 2</th>
<th>Time 3</th>
<th>CLT</th>
<th>Time 1</th>
<th>Time 2</th>
<th>Time 3</th>
<th>F(1,36)</th>
<th>p</th>
<th>$\eta^2_p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooperative play</td>
<td>Duration</td>
<td>43.7</td>
<td>25.0</td>
<td>41.9</td>
<td>44.4</td>
<td>25.0</td>
<td>41.9</td>
<td>41.9</td>
<td>11.1</td>
<td>17.923</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td>(29.4)</td>
<td>(20.6)</td>
<td>(24.8)</td>
<td>(4.5)</td>
<td>(29.4)</td>
<td>(20.6)</td>
<td>(24.8)</td>
<td>(24.8)</td>
<td>(18.1)</td>
<td>(61.1)</td>
<td>0.025</td>
</tr>
<tr>
<td>Eye contact</td>
<td>Duration</td>
<td>0.6</td>
<td>0.4</td>
<td>1.1</td>
<td>0.6</td>
<td>0.4</td>
<td>1.1</td>
<td>1.1</td>
<td>17.923</td>
<td>0.001</td>
<td>0.332</td>
</tr>
<tr>
<td></td>
<td>(4.5)</td>
<td>(20.6)</td>
<td>(61.1)</td>
<td>(37.2)</td>
<td>(20.6)</td>
<td>(61.1)</td>
<td>(37.2)</td>
<td>(37.2)</td>
<td>(18.1)</td>
<td>(44.6)</td>
<td>0.025</td>
</tr>
<tr>
<td>Joint attention</td>
<td>Frequency</td>
<td>1.9</td>
<td>6.6</td>
<td>7.4</td>
<td>1.9</td>
<td>6.6</td>
<td>7.4</td>
<td>7.4</td>
<td>4.3</td>
<td>3.786</td>
<td>0.060</td>
</tr>
<tr>
<td>Verbal requests</td>
<td>Frequency</td>
<td>0.6</td>
<td>0.4</td>
<td>1.1</td>
<td>0.6</td>
<td>0.4</td>
<td>1.1</td>
<td>1.1</td>
<td>17.923</td>
<td>0.001</td>
<td>0.332</td>
</tr>
<tr>
<td>Nonverbal requests</td>
<td>Frequency</td>
<td>0.6</td>
<td>0.4</td>
<td>1.1</td>
<td>0.6</td>
<td>0.4</td>
<td>1.1</td>
<td>1.1</td>
<td>17.923</td>
<td>0.001</td>
<td>0.332</td>
</tr>
<tr>
<td>Initiation</td>
<td>Frequency</td>
<td>0.9</td>
<td>0.4</td>
<td>1.1</td>
<td>0.9</td>
<td>0.4</td>
<td>1.1</td>
<td>1.1</td>
<td>17.923</td>
<td>0.001</td>
<td>0.332</td>
</tr>
<tr>
<td></td>
<td>(0.4)</td>
<td>(3.9)</td>
<td>(6.3)</td>
<td>(1.6)</td>
<td>(1.4)</td>
<td>(1.6)</td>
<td>(1.4)</td>
<td>(1.4)</td>
<td>(1.4)</td>
<td>(1.4)</td>
<td>0.025</td>
</tr>
</tbody>
</table>

Note: Significant values are shown in bold.

2 vs. time 3 comparisons were not statistically significant ($p > 0.05$). Initiation significantly improved from time 1 to both time 2 ($t(6) = −2.97, p = 0.024$) and time 3 ($t(6) = −3.156, p = 0.020$), whereas it did not significantly changed from time 2 to time 3 ($t(6) = −1.567, p = 0.168$). The same post-hoc analyses performed on the CLT group did not reveal significant improvements across the three time points (all $p > 0.05$).

Discussion

In the present study we tested whether the effects of PECS training on social–communicative skills of children with ASD (Lerna et al. 2012) could be detected at a 12-month follow-up. To this aim, we collected psychometric data and functional measures of adaptive behaviour by means of standardized tasks, and assessed social–communicative variables in an unstructured setting through observation of children's free-play interactions with an adult. Results from analysis on formalized outcome measures showed lower ADOS severity scores (Communication, Social and Total) in the PECS than in the CLT group, together with higher scores on GMDS Social and VABS Communication and Social scores. On VABS, children in the PECS group gained significant higher scores on post-treatment (time 2) and follow-up (time 3) with respect to pre-treatment assessment (time 1), thus revealing that improvements on VABS domains were retained 1 year from training completion. Analysis on social–communicative measures coded during free-play showed that frequency of joint attention and initiation, and duration of cooperative play were significantly higher in the PECS than in the CLT group, confirming previous data (Lerna et al. 2012). Relevant here, although the time point significantly influenced cooperative play, joint attention, nonverbal requests and initiation independently from the kind of treatment (PECS or CLT), analysis of the time point by group interaction showed that in the CLT group there were no significant effects of the time point on the social–communicative variables. On the contrary, in the PECS group cooperative play continued to improve significantly on follow-up with respect to both post- and pre-treatment, joint attention and initiation remained stable from post-test to follow-up, and verbal requests improved in a significant way only when comparing follow-up with pre-treatment.

Charlop-Christy et al. (2002) observed that spontaneous speech and socio-communicative behaviours had been maintained or continued to increase for one participant followed up 10 months from PECS training. Yokoyama et al. (2006) demonstrated in three participants with ASD maintenance of PECS effects on frequency and intelligibility of vocalizations both in the training room and at home, 6–8 months after training. In a single case study on a deaf child with autism, Malandraki and Okalidou (2007) reported maintenance of spontaneous PECS usage 6 months after intervention. On the contrary, Yoder and Stone (2006a) found that differences in speech variables were not maintained 6 months post-intervention. In the same vein, Howlin et al. (2007) showed that for the children assessed at a 10-month follow-up, the increased rate of communicative initiations and PECS usage found immediately post-intervention was not maintained.

The present results are consistent with the findings reported above showing positive effects of PECS on social–communicative skills. It is worth underlining here that in the PECS group cooperative play progressively improved across the three time points. Kasari et al. (2012) underlined the importance of early socio-communicative skills, such as joint attention, initiation and cooperative play for later outcomes and development of higher-order skills, such as speech. Accordingly,
previous evidence by Mundy et al. (1990) demonstrated that responding to joint attention at age 3–5 years predicted better language outcomes 1 year later (also Sigman and Ruskin 1999). Despite earlier claims that PECS can enhance children’s use of speech, the present study did not reveal any increase on the Language domain of GMDS, whereas verbal requests coded in an unstructured setting improved when comparing follow-up with pre-treatment assessment. Recently, Boesch et al. (2013) compared PECS training and a speech-generating device (SGD) in a multiple baseline, alternating treatment design on three children with severe autism. Results showed that although relatively little difference was observed between PECS and SGD treatments, PECS training (in particular phase II) proved to be helpful in encouraging social–communicative skills. Data for speech outcomes, instead, did not reveal any increase across participants, and no differences between treatment conditions were observed. On this basis, the PECS-related ‘delayed treatment effect’ we found here on verbal requests calls for future investigation to test specifically whether extending the training over longer periods can differently affect verbal abilities.

Limitations of the present study include the lack of randomization of treatments and the relatively sample size which, however, although encourage in-depth analyses with larger sample sizes, do not undermine reliability of the results. Moreover, since we assessed outcome variables by means of parent report and examiner-led measures, we did not take into account measures truly representative of the children’s real everyday environment. Finally, Boesch et al. (2013) showed that social–communicative behaviours occurred more frequently in phase II and less frequently in phases I and III of the PECS training. The authors speculated that opportunities to make eye contact with the communicative partner increased during phase II with respect to phases I and III because in phase II participants had to scan the room to locate the communicative partner prior to engaging in the communicative exchange. This speculation fits both our present and previous results (Lerna et al. 2012) revealing that among the social–communicative variables assessed during free-play (cooperative play, eye contact, joint attention, requests and initiation) eye contact only did not show any post-treatment or follow-up improvement. On these bases, we can suggest that future studies should directly assess whether each of the six phases of PECS training can best affect a specific social–communicative skill.

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References


