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Increasing verbal responsiveness in parents of children with autism: a pilot study

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Abstract

Correlational studies have revealed a positive relationship between parent verbal responsiveness and language outcomes in children with autism. We investigated whether parents of young children on the autism spectrum could learn and implement the specific categories of verbal responsiveness that have been suggested to facilitate language development. Parents were taught to increase their verbal responsiveness in the context of a short-term language intervention that included group parent education sessions, as well as individual and small-group coaching sessions of parent–child play interactions. Parents in the treatment group increased their use of comments that: described their child's focus of attention; interpreted or expanded child communication acts; and prompted child communication. Preliminary treatment effects were also noted in children's prompted and spontaneous communication. These results support the use of parent-mediated interventions targeting verbal responsiveness to facilitate language development and communication in young children with autism.

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The current study investigated whether parents of young children on the autism spectrum could learn to increase their use of specific categories of verbal responsiveness during play-based interactions with their children, and whether this increase in verbal responsiveness exerted positive effects on children's communication. Verbal responsiveness refers broadly to parent comments that follow into a child's object-focused attention or are responsive to children's verbal or nonverbal communication acts (McDuffie and Yoder, 2010). Correlational studies have identified a positive relationship between verbally responsive language input and language outcomes of children with autism, suggesting that certain types of verbal input may facilitate language acquisition in these children (McDuffie and Yoder, 2010; Siller and Sigman, 2002, 2008). Similar associations have been identified in children with developmental delays other than autism (Warren et al., 2010) and in typically developing children (Carpenter et al., 1998), illustrating the universality of these effects.

The motivation for teaching parents to increase verbal responsiveness stems from the transactional model of development (Sameroff and Fiese, 2000), which posits that development occurs through reciprocal interactions between parents and children. Because parent–child dyads jointly create effective language learning contexts in typical development, children generally learn language successfully with little conscious effort on the part of parents to exhibit verbally responsive behaviors. Unfortunately, children with developmental delays often do not experience such ease of language acquisition, which potentially increases their dependence on the manner and amount of useful language input they receive (Landry et al., 2006). The transactional model thus supports the use of parent-mediated language interventions that target change in one part of the system (parent verbal behaviors) to facilitate change in another part of the system (child language and communication).

Children with autism spectrum disorders (ASD) demonstrate core deficits that may lead to impaired language learning, including limited initiation of and response to joint attention (Charman, 1998) and restricted and repetitive play behaviors (Bruckner and Yoder, 2007). A child who infrequently initiates communication has fewer opportunities to receive contingent verbal language input (Yoder and McDuffie, 2006). Challenges in responding to adult nonverbal social cues (e.g. gaze shifts and points) will disrupt the process of establishing the association between a novel word and its referent (Baron-Cohen et al., 1997). Children who demonstrate limited interest in objects, or who play with objects in a perseverative manner, limit the diversity of language input to which they are exposed (Yoder and McDuffie, 2006). In these situations, the responsibility for creating successful interactions falls more heavily on the parent, who may benefit from learning strategies to increase verbally responsive language input.

Parent verbal responsiveness and child language outcomes

There are well-established predictive associations between parent verbal responsiveness and the later language of typically developing young children (Carpenter et al., 1998; Tamis-LeMonda et al., 2001). Researchers also have begun to explore the relationship between caregiver verbal responsiveness and language outcomes in young children with

ASD. Siller and Sigman (2002) found that children with ASD whose caregivers showed higher levels of verbal responsiveness developed better language skills across several years, and that the outcomes were not explained by initial levels of joint attention, language, or IQ. The best predictor of long-term language gains was parent use of follow-in commenting, defined as utterances that described the child's focus of attention without requiring a change in the child's ongoing activity. Siller and Sigman (2008) confirmed the positive contribution of parent verbal responsiveness as a unique predictor of language outcomes for children with ASD, controlling for initial IQ, mental age, and language level.

McDuffie and Yoder (2010) investigated the short-term effects of parent verbal responsiveness on vocabulary gains for preschoolers with ASD. Both follow-in commenting (comments related to the child's focus of attention) and follow-in directing (follow-in comments that suggested a new action with a toy) predicted spoken vocabulary gains after controlling for child engagement with toys, and neither type of responsiveness accounted for unique variance over and above the other. Parent expansions of child verbal communication acts predicted a small but significant amount of variance in spoken vocabulary after controlling for child talkativeness. In an extension of McDuffie and Yoder (2010), Haebig (2010) found that follow-in comments and follow-in directives for language each uniquely predicted gains in language one year later for minimally verbal toddlers with ASD. An additional correlational study has demonstrated a positive association between a composite measure of parent verbal responsiveness and later language for children with fragile X syndrome (Warren et al., 2010). These findings are highly relevant because children with fragile X syndrome share many behavioral characteristics with children with idiopathic autism.

Interventions targeting parent verbal responsiveness

Considering the growing correlational evidence for the association between parent verbal responsiveness and positive language outcomes for children with ASD, randomized and controlled studies of parent-mediated interventions are important for at least two reasons. First, these studies address the feasibility of teaching parents to increase their use of responsive verbal strategies. If the relationship between verbal responsiveness and child language gains is present but cannot be modified, then previous findings are theoretically interesting but of limited practical importance to families of children with ASD. Second, intervention studies provide evidence that differences in language outcomes are due to increased verbal responsiveness and not to child maturation or other unidentified third variables.

Aldred et al. (2004) found that parents who participated in a social communication intervention had increased their verbal responsiveness one year later, compared to parents in a waitlist control group. Children in the treatment group improved their spoken communication as indicated by a parent report of expressive vocabulary. The comparison group demonstrated an increase in parent redirecting behaviors and a decrease in the number and quality of children's spontaneous communication acts. Green et al. (2010) recently conducted a large-scale examination of a manualized, parent-mediated treatment program aimed at improving the social and communication skills of young children with ASD. Treatment effects included significant increases in overall parent verbal responsiveness, child initiations, and shared attention during play, as well as increases in parent report of language and social communication.

McConachie et al. (2005) conducted a quasi-experimental study of More Than Words: The Hanen Program for Parents of Children with Autism Spectrum Disorder (MTW;

Sussman, 1999), which was adapted for use in the current study. Families were enrolled in either an immediate treatment group or a waitlist control group, depending on service availability. Seven months after recruitment, parents in the treatment group had increased their scores on a global rating scale of verbal responsiveness, including imitations and expansions, turn-taking routines, and simplified language. Children in the treatment group demonstrated gains in parent report of spoken vocabulary. Carter and colleagues (2011) recently conducted the first randomized controlled trial of the MTW program; toddlers with ASD were randomly placed in either a group receiving the MTW intervention or a group receiving treatment as usual. Although this study identified no main effects of the MTW program on parent responsiveness or child communication at either five or nine months following the treatment, the effect sizes of residualized gains in parent responsivity were moderate to large. Interestingly, results also indicated that positive effects of the MTW program depended on pre-treatment child characteristics, such that children with initially *low* levels of object interest who were placed in the MTW group demonstrated increased gains in communication, and children with initially *high* levels of object interest demonstrated attenuated growth.

The current study

This study used a randomized group design to determine whether parents who participated in a short-term intervention increased their use of specific categories of verbal responsiveness during play-based interactions with their young children with ASD. A secondary aim of the study was to examine subsequent changes in child spontaneous and prompted communication acts. The categories of verbal responsiveness selected as intervention targets were theoretically motivated and based on correlational support for the positive contribution of these behaviors to enhanced communication and language outcomes for young children with ASD (Haebig, 2010; McDuffie and Yoder, 2010; Siller and Sigman, 2002, 2008; Warren et al., 2010). The following categories of parent verbal responsiveness were targeted: (a) follow-in commenting; (b) linguistic mapping; (c) expansions; and, (d) prompts for communication acts. A decrease in parent use of redirects was also targeted.

Follow-in commenting represents a useful strategy for children with limited spontaneous communication, because parents can provide this type of verbal language input without requiring intentional communication or attention switching by the child. The temporal link between linguistic input and referential context is more salient when parents follow the child's lead and label objects that represent the child's current focus of attention (Yoder et al., 1998).

Linguistic mapping and expansions are parent verbal responses contingent upon child acts of intentional communication. Linguistic mapping (Yoder and Warren, 2002) involves putting into words the presumed meaning of the child's immediately preceding nonverbal communication act. Parent use of linguistic mapping is associated with increased vocabulary in typically developing children (Goldin-Meadow et al., 2007), although such an association has not yet been demonstrated for children with ASD. Expansions are utterances that repeat and add new semantic or syntactic information to a child's previous utterance. Given their temporal association with the child's communication act and their contextual mapping to the child's focus of attention, expansions may scaffold language learning by allowing children to make a comparison between their own utterances and the developmentally advanced adult model (Yoder et al., 1995). McDuffie and Yoder (2010) found that parent expansions accounted for unique variance in predicting spoken language gains for preschoolers with ASD.

Prompting for communication is an important strategy for parents of children with limited spontaneous communication. Prompted child communication acts provide parents with additional opportunities to use linguistic mapping and expansions, thus increasing the amount of language facilitating input that children receive. In addition, prompting can encourage children to generalize language they initially learned in a different context. Finally, redirects (McCathren et al., 1995) require children to modify their focus of attention to attend to an adult-initiated topic. In general, redirects are not considered to facilitate language development because they require children to disengage and shift their current focus of attention to coincide with the adult's linguistic input.

Conceptually, a parent-mediated intervention approach directly targets proximal changes in parent behaviors to produce more distal changes in child language and communication. Although such changes might be difficult to detect during the short time frame of the current intervention, the ultimate goal of the intervention was to facilitate positive changes in children's language and communication skills.

This study addressed the following research questions: (1) Did parents in the treatment group significantly increase their use of responsive verbal strategies, compared to parents in a delayed treatment group? (2) Did children in the treatment group significantly increase their use of spontaneous or prompted communication acts in excess of changes demonstrated by children in the delayed treatment group? We hypothesized that parents in the treatment group would significantly increase their use of follow-in comments, responses to child communication acts (linguistic mapping and expansions), and prompts, and would significantly decrease their use of redirects. Additionally, we hypothesized that children in the treatment group would increase their number of communication acts following treatment.

Methods

Participants

Fourteen parent–child dyads participated in the study. Thirteen children had community diagnoses of an ASD; the one child without a pre-existing diagnosis was referred to the study by an early interventionist who had concerns about autism. Autism spectrum diagnoses were confirmed at the pre-treatment evaluation. Families were recruited from an ongoing longitudinal study of language development in autism, through early intervention providers, and from the community, and they were informed that the intervention was not meant to replace any services children were currently receiving. The study was approved by the university institutional review board, and parents provided written consent for their child's participation.

Each parent–child dyad was randomly assigned to a treatment group or a delayed treatment group, resulting in two groups containing seven dyads each. All children participated in a pre-treatment baseline assessment and a post-treatment session approximately 10 weeks later. The treatment group started the intervention one to two weeks after the baseline evaluation and the delayed treatment group was offered the intervention after the post-treatment sessions were complete. The current analyses focused solely on the pre- and post-treatment visits completed by all participants.

Assessments

At the pre-treatment evaluation, children were between 28 and 68 months of age (mean age = 41 months). Assessments included language and cognitive testing, confirmation of

Table 1 Descriptive characteristics of the participants

	Mean	SD	Range
Age in months at pre-treatment	41.14	10.40	28–68
ADOS Severity Score	8	2.13	4–10
PLS-4 AC age equivalent (months)	14.79	7.04	6–32
PLS-4 EC age equivalent (months)*	20.21	7.47	12–41
CDI Words Understood (Infant Form)	181.00	143.05	20–396
CDI Words Produced (Infant Form)	108.23	151.00	0–384
CDI Words Produced (Toddler Form)	148.38	223.87	0–657
Mullen VR age equivalent	28.79	13.80	12–60

*Significant group difference at $p < .05$.
ADOS: Autism Diagnostic Observation Scale, PLS-4 AC and EC: Preschool Language Scale, 4th Edition, Auditory Comprehension and Expressive Communication, CDI: Communicative Development Inventory, Mullen VR: Mullen Scales of Early Learning, Visual Reception.

ASD diagnoses, and parent–child free play sessions (see Table 1). The Preschool Language Scale, Fourth Edition (PLS-4; Zimmerman et al., 2004) assessed receptive and expressive language skills, and the Mullen Scales of Early Learning (MSEL; Mullen, 1995) assessed visual reception. Parents completed the Infant and Toddler forms of the MacArthur Communicative Development Inventory (CDI; Fenson et al., 1991), a parent report measure of vocabulary. Raw numbers of words understood and produced were examined in place of standard scores because some children exceeded the age range for which the CDI manual provides normative data.

The Autism Diagnostic Observation Schedule (ADOS; Lord et al., 2000) or the Autism Diagnostic Observation Schedule – Toddler Version (ADOS-T; Luyster et al., 2009) was administered by a trained and reliable examiner. The ADOS modules and modules were selected based on a child's age and expressive language level as instructed in the ADOS manual. The average ADOS total score was 20.64 (range 11–28), which supported children's community diagnoses. To provide a calibrated metric of autism symptom severity, ADOS raw scores were converted to severity scores (see Gotham et al., 2009).

Each parent–child dyad participated in a videotaped 10-minute free play session at pre- and post-treatment. Parents were instructed to play with their child as they typically would at home, using a standard set of toys. Parent and child behaviors during these sessions were coded from video and analyzed for evidence of change.

The intervention

Families participated in an adapted version of the MTW program, a manualized parent training intervention that teaches parents how to better understand their children's communication and adapt their interactions to support language learning. The MTW program is broadly supported by previous research (McConachie et al., 2005), While we did not seek to test its efficacy, per se, we did adopt the MTW framework to address our goal of teaching parents to increase their use of specific types of verbal responsiveness.

The traditional MTW intervention is implemented by a Hanen-certified speech-language pathologist (SLP) and includes eight parent education sessions and three home visits. Our adapted intervention, which was approved by the Hanen Center, included five parent

education sessions (two hours each) and two individual coaching sessions (45 minutes each) led by a Hanen-certified SLP. This adaptation allowed for two intervention cycles during the academic summer session; the sessions were conducted in a research clinic for ease of implementation.

We incorporated an additional small group component that involved clinician coaching of ongoing parent–child play interactions on a twice-weekly basis, in order to strengthen parents' implementation of verbally responsive strategies. Parent–child dyads participated in 14 small group parent–child coaching sessions (one hour each) led by graduate student clinicians and supervised by the Hanen-certified SLP. The parent education meetings, individual coaching sessions, and small group sessions were interspersed across the treatment period. In a typical week, families attended one parent meeting and two small group sessions. In the third and sixth weeks, families attended one small group session and one individual coaching session; no parent education meeting was held on these weeks. Attendance was excellent; families attended all individual sessions, and no family missed more than one parent education session or two small group sessions. Thus, families in the treatment group received a total of eight to 10 hours of parent education, 1.5 hours of individual sessions with the Hanen-certified SLP, and 12 to 14 hours of small group sessions.

One parent in each family was designated as the primary participant (6 mothers, 1 father). This parent attended all sessions and participated in both parent–child play samples. Given the goals of the study, parents were taught to be verbally responsive by talking about their children's play (follow-in commenting) and responding to their children's communication acts using linguistic mapping and expansions. As in the traditional MTW program, parents were taught strategies to engage children in play (e.g., establishing play routines and supporting object-focused engagement) to set the occasion for follow-in commenting. Parents were taught to prompt communication (e.g., by arranging the environment with favored items in sight but out of reach, providing choices, giving pieces of toys bit by bit, and inserting pauses during familiar verbal routines) to set the occasion for using interpreting and expanding. Parents also learned how to establish interactive 'people games' that provided children with predictable social turn-taking routines. Given the difficulty that children with ASD have in shifting their attentional focus, parents learned to decrease their redirects of the child's attention away from a toy of interest. Readers are invited to contact the second author for further information regarding the content of the parent education sessions; the adapted program curriculum was submitted in full and was accepted by the Hanen Center.

The small group component provided parents with opportunities to implement newly learned strategies and receive feedback, modeling, and coaching from graduate clinicians. Each group included two to three parent–child dyads and one lead graduate clinician, as well as additional graduate clinicians in a supporting role. Graduate clinicians suggested and demonstrated activities likely to elicit and maintain child engagement and coached parents on the targeted strategies. During the two individual sessions, the Hanen-certified SLP provided parents with additional suggestions to improve their social interaction and communication with their children, with a focus on increasing use of verbally responsive strategies.

Treatment fidelity

To ensure that the treatment was implemented as intended, 28 small-group sessions were randomly selected and coded for specific therapeutic techniques outlined in a measure of

treatment fidelity; each technique was evaluated on a scale from one (poor implementation) to five (good implementation). The treatment fidelity measure assessed two areas: clinicians' modeling of target behaviors, and clinicians' ability to provide opportunities and feedback to parents. Fidelity for clinician modeling behaviors ranged from 4.79 to 4.96, and included (1) following the child's lead, (2) prompting communication, (3) responding appropriately to child communication acts, (4) modeling positive affect and engaging in face-to-face interaction with the child, (5) using follow-in language, and (6) modeling synchronized play actions. Fidelity scores for (7) providing parents with opportunities for interaction and (8) providing parents with constructive feedback were 4.93 and 4.07, respectively; overall, these scores indicate that the treatment was administered as was intended.

Parent and child behaviors

Parent–child play sessions at pre- and post-treatment were transcribed using Systematic Analysis of Language Transcripts (SALT; Miller and Iglesias, 2006), and the number of occurrences of each targeted behavior was recorded. Given staffing constraints, observational coding and reliability coding were conducted by two of the graduate student clinicians; thus, it was not possible to maintain blindness to treatment group assignment. The parent behaviors that were coded were: follow-in commenting, linguistic mapping, expansions, prompts, and redirects. The child behaviors were: prompted communication acts, spontaneous verbal communication acts, and spontaneous nonverbal communication acts (see Table 2).

Reliability

Reliability coding of parent and child variables was completed on 20% of the pre- and post-treatment session data by two independent coders, both of whom were trained by the second author. All parent behaviors and child behaviors were coded separately, and correlation coefficients were calculated for each variable. The average intraclass correlation coefficient for the coded summary level variables was 0.96 and ranged from 0.86 for redirects to 0.99 for follow-in comments.

Results

Analysis

We first examined the baseline abilities of the treatment group and the delayed treatment group; although randomization theoretically ensures group equivalency, the current study requires further attention to baseline skills because of its limited sample size. Wilcoxon rank-sum tests revealed that the treatment and delayed treatment groups did not differ in terms of ADOS severity, PLS-4 Auditory Comprehension, Mullen Visual Reception, parent report of vocabulary, and chronological age (all $ps > .10$). However, the delayed treatment group scored significantly higher on the PLS-4 Expressive Communication subscale ($p < .05$). Clinical observation also confirmed that, while spontaneous communication acts were infrequent in both groups, most of the children in the treatment group were not yet communicating verbally.

Differences in a child's mode of communication (i.e., verbal or nonverbal) would influence a parent's options to respond. For example, a parent has the option to provide an expansion

Table 2 Definition and examples of parent and child behaviors

Parent behavior	Definition	Example
Follow-in commenting	Parent talking that described the child's focus of object-directed attention (e.g. what the child was currently looking at or playing with) and did not signal a change in current action with the toy	Child looks at Potatohead's nose. Parent: 'A funny nose!' Child puts a ball down a slide. Parent: 'You rolled the ball down.' Child drives car on the floor. Parent: 'The car is driving.'
Responsiveness to Child Communication Acts	Linguistic mapping: interpreting a nonverbal communication act by putting its presumed meaning into words	Linguistic Mapping
Linguistic mapping		Child reaches for a ball. Parent: 'You want the ball!'
Expansions	Expansions: repeating a child's utterance and adding new semantic or syntactic information. Both occurred within three seconds of a child communication act	Expansion Child: 'Cow.' Parent: 'A baby cow!'
Prompts	Parent verbal or nonverbal behaviors that encouraged communication but were not necessarily followed by child communication acts (e.g. providing children with choices, inserting pauses into an utterance or familiar routine, or holding a toy out of reach.	Parent: 'Do you want the red ball or the green ball?' Parent: 'Ready, set. . .' Parent: 'I have more crackers!'
Redirects	Attempts by the parent to direct the child's focus of attention from the toy or activity he or she was currently interested in. Redirects did not include addition of new pieces or introducing a new way to play with a toy	Child is stacking blocks. Parent: 'Let's play with the people now.' Child is looking at a ball. Parent: 'I see some picnic food over there.'
Child behavior	**Definition**	**Example**
Prompted communication act	Nonverbal or verbal communication act produced within four seconds after a parent prompt	Parent holds up a ball and child reaches for it. Parent: 'Ready, set. . .' Child: 'Go!'
Spontaneous verbal communication act	Non-imitative words and phrases produced spontaneously (i.e. did not follow a parent prompt for communication)	Child: 'I want the cow.' Child: 'More.'
Spontaneous nonverbal communication act	Non-imitative nonverbal communication produced spontaneously, including reaching, giving, vocalizing + eye gaze, pointing, and showing. Conventional signs were included here	Child reaches for a ball. Child vocalizes and looks at the parent.

of a child's verbal communication act, but it is not possible to use expansions when a child is communicating exclusively through nonverbal means; in the latter case, linguistic mapping of the nonverbal communication act can be appropriate. Because of the effects these differences in baseline expressive language would have on parent use of linguistic mapping and expansions, we created a composite variable, parent responsiveness to child communication acts, by summing linguistic mapping and expansions.

Given that outcome data were not normally distributed, nonparametric tests were used for all analyses; these tests are robust to small sample sizes and non-normal distributions and are less influenced by extreme data points. One-tailed p values are reported for all tests because there was an expected direction of change (i.e., that all parent and child behaviors should increase with the exception of parent redirects, which should decrease). An alpha of .05 was retained for all analyses.

Parent behaviors

Descriptive statistics of the parent variables are presented in Table 3. To address our first research question, we compared the proportion of parents who increased their use of follow-in comments, prompts, and responses to child communication acts and decreased their use of redirects from pre- to post-treatment. Multiplicative binomial tests were conducted to compare the proportion of parents who improved, to the proportion of those who did not improve (see Table 4). As expected, more parents in the treatment group than the delayed treatment group increased their use of follow-in commenting ($p < .04$) and their use of prompts ($p < .01$). Group differences in the proportion of parents who increased their responsiveness to child communication acts or decreased their use of redirects approached significance ($ps < .07$).

We also examined the magnitude of improvements using Wilcoxon rank-sum tests to compare gain scores from pre- to post-treatment for each of the target parent variables (see Table 5). Consistent with earlier findings regarding group proportions, parents in the treatment group demonstrated greater gains than the delayed treatment group in use of follow-in comments ($p < .03$) and use of prompts ($p < .01$). Contrary to results regarding proportions, parents in the treatment group made greater increases than the delayed treatment group in their responsiveness to child communication acts ($p < .03$) and greater decreases in their use of redirects ($p < .01$). Thus, in terms of the magnitude of improvement, there was a significantly greater change for all four targeted behaviors for parents in the treatment group relative to parents in the delayed treatment group. Although group comparisons were conducted on the basis of ranked sums, numeric means are presented in Figures 1–4 for purposes of visual display and ease of interpretation.

Child behaviors

Descriptive statistics of the child variables are presented in Table 3. Our second research question pertained to emerging differences in children's communication at post-treatment. We expected that striking changes might be evident only after parents have implemented the intervention strategies over a more extended period of time, but we hypothesized that children in the treatment group might show emerging increases in spontaneous and prompted communication.

Table 3 Descriptive statistics of parent and child variables

	Pre-treatment mean (SD)	Range	Post-treatment mean (SD)	Range
Parent variables				
Follow-in commenting				
Treatment	53.43 (24.35)	14–75	74.57 (33.51)	31–111
Delayed treatment	73.86 (25.91)	42–125	73.00 (19.04)	47–100
Linguistic mapping + expansions				
Treatment	0.14 (0.38)	0–1	7.57 (7.37)	0–21
Delayed treatment	0.71 (0.76)	0–2	1.57 (1.81)	0–5
Prompts				
Treatment	1.14 (1.46)	0–4	13.43 (11.91)	0–32
Delayed treatment	3.14 (3.29)	0–8	1.43 (2.30)	0–6
Redirects				
Treatment	14.00 (8.58)	2–28	4.29 (3.35)	1–10
Delayed treatment	12.29 (10.00)	3–32	14.29 (15.39)	0–45
Child variables				
Prompted				
Communication acts				
Treatment	0.29 (0.49)	0–1	9.71 (14.08)	0–40
Delayed treatment	2.00 (2.24)	0–6	1.86 (2.67)	0–7
Spontaneous Verbal Communication				
Acts				
Treatment	1.29 (3.40)	0–9	4.71 (6.13)	0–15
Delayed Treatment	11.71 (13.70)	0–34	12.57 (19.81)	0–54
Spontaneous Nonverbal				
Communication Acts				
Treatment	0.57 (0.79)	0–2	2.43 (3.15)	0–9
Delayed Treatment	0.57 (0.53)	0–1	2.14 (2.73)	0–7

Table 4 Proportions of parents and children who improved

	χ^2	p	No. increased
Follow-in commenting			
Treatment	3.82	.037*	7
Delayed treatment			4
Linguistic mapping + expansions			
Treatment	2.80	.070	6
Delayed treatment			3
Prompts			
Treatment	7.14	.007*	6
Delayed treatment			1
Redirects			
Treatment	2.80	.070	6
Delayed treatment			3
Prompted communication acts			
Treatment	4.67	.022*	5
Delayed treatment			1
Spontaneous verbal communication acts			
Treatment	1.17	.172	5
Delayed treatment			3
Spontaneous nonverbal communication acts			
Treatment	1.17	.172	5
Delayed treatment			3

*$p < .05$ for a one-tailed test.

Table 5 Group comparisons of parent and child variables

	Median gain score	*Tw*	*p* (one-tailed)
Parent variables			
Follow-in commenting			
Treatment	17	67.5	.029*
Delayed treatment	9		
Linguistic mapping + expansions			
Treatment	6	68	.025*
Delayed treatment	0		
Prompts			
Treatment	12	74	.002*
Delayed treatment	−1		
Redirects			
Treatment	−7	32.5	.004*
Delayed treatment	1		
Child variables			
Prompted communication acts			
Treatment	4	71	.007*
Delayed treatment	−1		
Spontaneous verbal communication acts			
Treatment	1	59.5	.196
Delayed treatment	0		
Spontaneous nonverbal communication acts			
Treatment	1	56.5	.320
Delayed treatment	0		

*$p < .05$ for a one-tailed test.

Multiplicative binomial tests were used to compare the proportion of children who increased their prompted and spontaneous communication (see Table 4). More children in the treatment group than in the delayed treatment group increased their production of prompted communication acts ($p < .03$). The proportion of children in the treatment group and the delayed treatment group who increased their use of spontaneous verbal or nonverbal communication acts did not differ ($ps > .17$). We also examined the magnitude of group differences in child communication acts using Wilcoxon rank-sum tests (see Table 5). Children in the treatment group again made a significantly greater gain in the number of prompted communication acts than the delayed treatment group ($p < .01$). There were no significant group differences in spontaneous verbal or spontaneous nonverbal communication acts ($ps > .19$).

Because we did not expect changes in children's communication to be as robust as changes in parent behaviors due to the abbreviated length of the study, we also examined child behaviors using a less conservative analysis of within-group differences to determine whether any changes in spontaneous communication occurred within the treatment and delayed treatment groups, independently. Wilcoxon signed-rank tests revealed a significant increase at post-treatment in the number of prompted communication acts produced by the treatment group ($p < .01$) but not the delayed treatment group ($p > .23$). Changes in children's spontaneous verbal communication acts were nonsignificant for the treatment group ($p = .08$) and for the delayed treatment group ($p > .17$), although the marginally significant results for the treatment group suggests that changes may have been emerging.

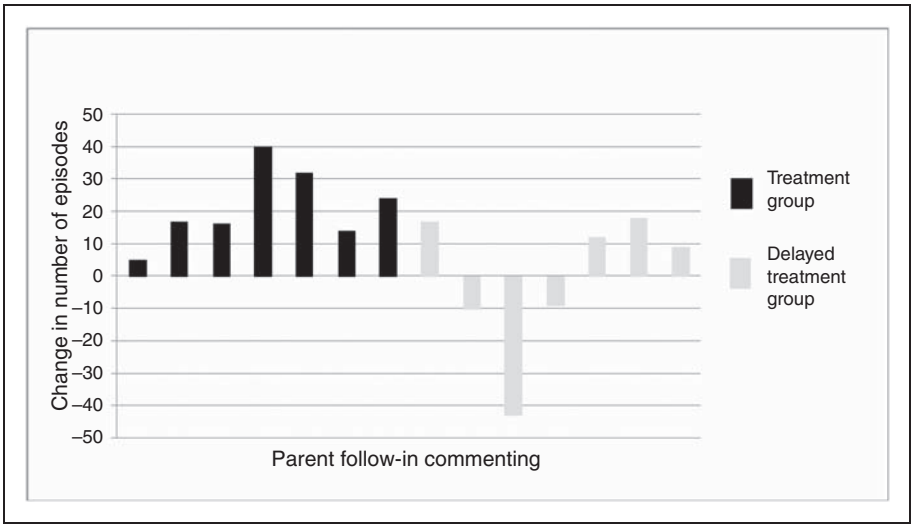

Figure 1 Changes in parent follow-in commenting.

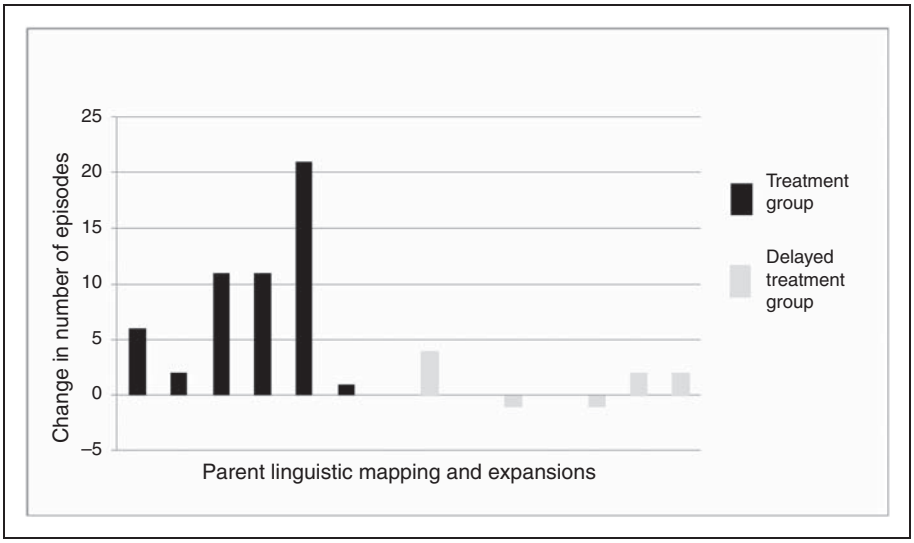

Figure 2 Changes in parent responsiveness to child communication acts.

Children in the treatment group demonstrated a significant increase in spontaneous nonverbal communication acts at post-treatment ($p < .05$), whereas children in the delayed treatment group did so at a level that approached significance ($p = .08$). Although these changes in nonverbal communication may have been due to maturation in both groups, the findings are suggestive of a treatment effect and should be examined in future studies.

Parent attitudes toward the intervention

As a measure of social validity, each parent who took part in the intervention anonymously completed a questionnaire assessing their satisfaction with the program. Parents answered

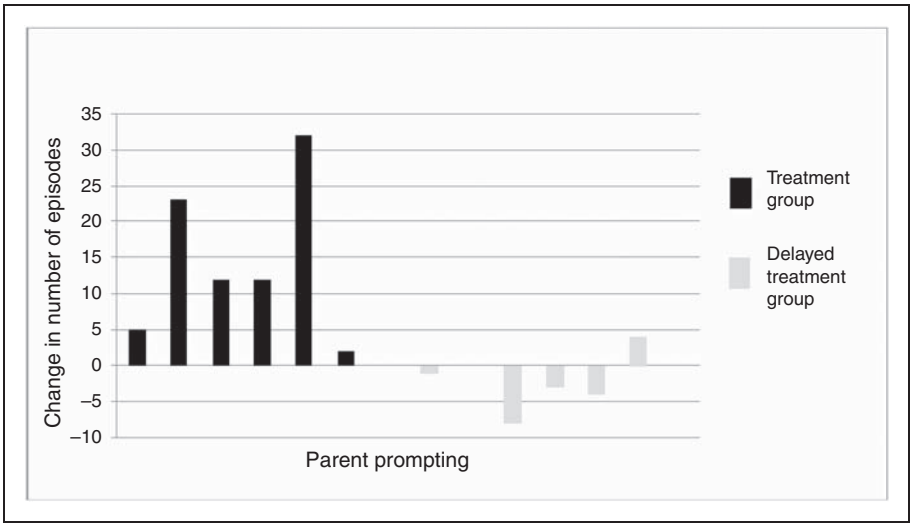

Figure 3 Changes in parent prompts.

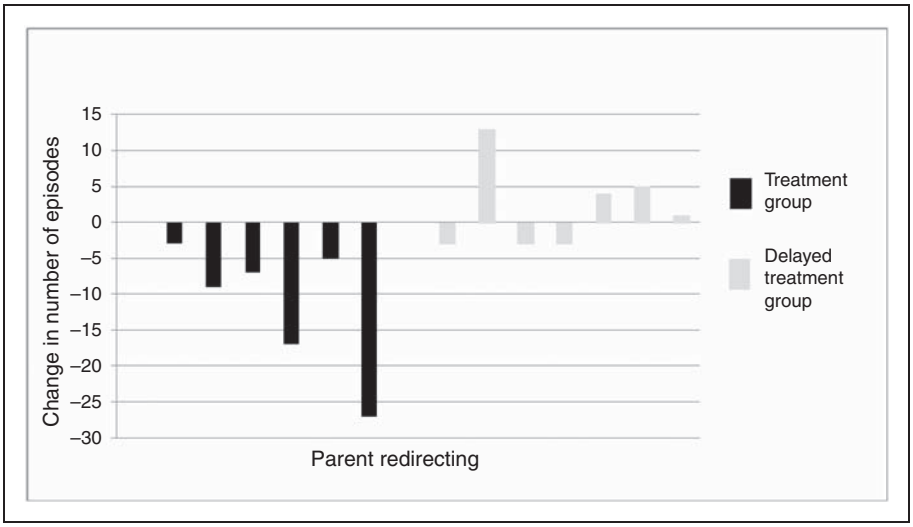

Figure 4 Changes in parent redirects.

questions about the overall program, teaching format, and specific techniques on a Likert scale (1 = negative reaction, 7 = positive reaction). Overall results indicated that the children's challenges that prompted the parent to sign up for the intervention were better following intervention (mean = 5.56); that the approach used in the intervention was useful (mean = 6.56); that parents would recommend this program to other families of children with ASD (mean = 6.89); and that parents valued the program overall (mean = 6.89). Although these results were not tested statistically nor compared with parent attitudes in the delayed treatment group, they represent an aspect of intervention that is vitally important for parent-mediated treatment approaches – the acceptance of the treatment to families.

Discussion

Transactional theory posits that language development occurs through a process of reciprocal interaction between parent and child. When children face language-learning challenges, parents may need to modify the ways in which they provide linguistic input to scaffold child language acquisition. Recent correlational studies have revealed that responsive verbal utterances that follow the child's lead and provide contingent and positive responses to child acts of play and communication may facilitate early language learning in children with ASD (McDuffie and Yoder, 2010; Siller and Sigman, 2002, 2008). When parents of children with autism provide responsive input, the mapping between new words and their referents is made more explicit, and children are exposed to a greater quantity of language input that they can process and from which they can learn.

The goal of the current pilot intervention study was to teach parents of young children with ASD to use the types of responsive verbal input that previous studies have suggested will support language development in this group of children. Parent education sessions focused on several strategies: providing follow-in comments that describe children's ongoing activity, prompting, and responding to child communication acts using linguistic mapping or expansions, and decreasing the use of redirects. As hypothesized, parents in the treatment group demonstrated greater gains for all verbally responsive behaviors than parents in the delayed treatment group. In addition to these empirical findings, it was promising that parent attitudes toward the intervention were positive. Anecdotally, parents seemed to benefit highly from the social support provided by the intervention as well as the teaching and coaching of specific techniques. Future studies should quantitatively measure the effects of parent-mediated interventions on changes in parent psychological well-being, anxiety, and stress.

While we did not expect to observe extensive changes in children's behaviors following such a brief intervention, our second research question addressed treatment effects on child prompted and spontaneous communication. Although changes in parent behaviors are an initial indicator of treatment effects, the ultimate determination of success would be increases in child communication acts. Children in the treatment group demonstrated a greater gain in prompted communication acts, a direct result of the increased use of prompts by parents in this group. Future studies on larger groups of children should use parametric analyses to more directly examine the contributions of increases in parent prompts on gains in child prompted communication. For children who demonstrate limited intentional communication, prompted communication acts set the occasion for parents to provide additional linguistic input by using linguistic mapping and expansions. In this type of reciprocal interaction, a parent behavior facilitates a child behavior, which in turn provides the parent with an additional opportunity to provide language facilitating verbal input to the child. Providing parents with strategies to establish just these types of interactions helps to address the challenge of creating rich social language learning environments for young children with ASD.

Although children in the treatment group did not make greater gains in their frequency of spontaneous communication acts, it is important to remember that these children demonstrated limited verbal communication at baseline. A less conservative analysis of within-group change revealed that children in the treatment group but not the delayed treatment group produced more nonverbal spontaneous communication acts at post-treatment, which is a positive finding that might strengthen its effect as parents have more opportunities to implement the newly-learned strategies. Although baseline language differences are unfortunate, it is likely that the greater language abilities in the delayed

treatment group actually resulted in a more conservative test of our hypotheses and limited the likelihood of false positive results.

Critically, we do not propose that less responsive parenting styles *cause* the deficits in social communication demonstrated by children with ASD. Indeed, parents in our study produced a range of responsive behaviors prior to the intervention. Instead, we believe that a child's inherent difficulties with spontaneous communication and joint attention may necessitate compensation by another part of the transactional system, namely increases in parent verbal responsiveness. Research has suggested that, for children whose parents do not participate in treatment, continued experience with unsuccessful parent–child interactions may lead to decreases in the frequency and quality of child communication and increases in parent use of redirecting statements (Aldred et al., 2004). These findings underscore the importance of establishing effective interaction strategies early in a child's life.

This study provides the first evidence that parents of children with ASD can learn specific categories of parent verbal responsiveness associated with positive child language outcomes, and that use of these strategies may facilitate child communication. Previous intervention studies have reported results in terms of broader composite variables (e.g. Green et al., 2010) or global metrics of responsiveness (e.g., McConachie et al., 2005) thereby precluding support for the types of behaviors identified in previous correlational studies. On one hand, focusing on global composite variables might obscure significant findings; on the other hand, it might inadvertently provide support for strategies that do not truly drive language gains. Providing empirical support for discrete subtypes of parent verbal responsiveness is a necessary step in making autism language interventions more effective and more efficient in facilitating language growth. The effectiveness of certain categories of verbal responsiveness may depend on children's pre-treatment characteristics; for example, linguistic mapping may be most appropriate for children with limited verbal communication acts, and less effective for children who produce more spoken language.

Additionally, previous larger-scale studies of parent-mediated interventions have focused solely on parent education and video review of parent–child play, and not on online coaching and modeling (Aldred et al., 2004; Carter et al., 2011; Green et al., 2010; McConachie et al., 2005). Though it was not our aim to quantify the effects of the additional parent-child coaching component, it appeared that providing parents with frequent opportunities to interact with their child and a skilled clinician facilitated their mastery of the target strategies. It would be clinically informative for future work to explore the differential contributions of each individual treatment component; a sequential study design would address whether, for example, parent education sessions or individual play sessions have a stronger effect on therapeutic outcomes.

Critically, Kaiser et al. (2007) suggest that the most consistent changes in parent and child behaviors occur when parents receive individualized sessions that include coaching, feedback, and specific targeting of child goals. The small group component in the current study offered parents the chance to observe trained clinicians modeling target strategies that were effective for working with their child. This component also provided parents with additional opportunities for implementing strategies and immediately incorporating clinician feedback, 'in the moment'. Given the modest impact of the traditional MTW program in their investigation, Carter et al. (2011) also recommended the incorporation of additional individualized sessions in which parents receive feedback on their implementation of strategies, which would increase the intensity of the standard MTW intervention.

This pilot study had several limitations, one of which was the small sample size; however, we used statistical tests that are robust to small sample sizes and non-normal distributions.

As noted, it was also a limitation that video samples were coded by an individual who was not blinded to group membership, due to staffing constraints. Future studies will incorporate blind coding to ensure the integrity of findings. The parent–child coaching sessions were planned as small group sessions due to space and personnel availability. It was noted, however, that the children participating in the study were not yet able to benefit highly from peer interactions, and it was sometimes challenging for the clinicians to meet the needs of all of the parent–child dyads within one session. Thus, it is our suggestion that future parent-mediated interventions offer online coaching and modeling during individual sessions and assess the efficacy of this particular component of the intervention.

The length of this study was abbreviated, and outcome variables were examined immediately following the completion of the intervention, which limited the extent to which we could observe changes in more distal child communication outcomes and the extent to which we could examine parents' maintenance of their newly acquired skills. It is recommended that future studies of parent-mediated interventions examine immediate and longer-term effects to provide information about early and subsequent gains. Examination of longer-term effects would also allow for follow-up assessment of expressive language skills using a standardized measure; because our study was limited in length, we did not feel it was appropriate to re-administer the PLS-4 only 10 weeks after the original evaluation. Although the post-treatment play sessions were conducted in a different room from the intervention, and with different toys, studies that examine play interactions in the home setting would provide further information about the generalization of treatment effects.

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