Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript

HHS Public Access

Author manuscript

J Autism Dev Disord. Author manuscript; available in PMC 2016 September 01.

Published in final edited form as:

J Autism Dev Disord. 2015 September ; 45(9): 2899–2907. doi:10.1007/s10803-015-2451-4.

A Randomized Clinical Trial Comparison Between Pivotal Response Treatment (PRT) and Adult-Driven Applied Behavior Analysis (ABA) Intervention on Disruptive Behaviors in Public School Children with Autism

Fereshteh Mohammadzaheri[1], **Lynn Kern Koegel**[2], **Mohammad Rezaei**[3], and **Enayatolah Bakhshi**[4]

[1]Faculty of Rehabilitation Sciences, Hamadan University of Medical Sciences and Health Services, Hamadan, Iran

[2]University of California, Santa Barbara

[3]Faculty of Rehabilitation Sciences, Hamadan University of Medical Sciences and Health Services, Hamadan, Iran

[4]Department of Statistics and Computer, University of Social Welfare and Rehabilitation Sciences, Tehran, Iran

Abstract

Children with autism often demonstrate disruptive behaviors during demanding teaching tasks. Language intervention can be particularly difficult as it involves social and communicative areas, which are challenging for this population. The purpose of this study was to compare two intervention conditions, a naturalistic approach, Pivotal Response Treatment (PRT) with a structured ABA approach on disruptive behavior during language intervention in the public schools. A Randomized Clinical Trial (RCT) design was used with two groups of children, matched according to age, sex and mean length of utterance. The data showed that the children demonstrated significantly lower levels of disruptive behavior during the PRT condition. The results are discussed with respect to antecedent manipulations that may be helpful in reducing disruptive behavior.

Keywords

Disruptive Behavior; autism; pivotal response treatment; applied behavior analysis; language intervention

Corresponding author: Lynn Kern Koegel, Koegel Autism Center, CCS Psychology Department, University of California, Santa Barbara, 93106. Lynnk@education.ucsb.edu. Tel: 805-893-3825. Fax: 805-893-2658.
The second author is a partner in the private firm Koegel Autism Consultants, LLC.

Lynn Kern Koegel, Ph.D., Clinical Director, Koegel Autism Center, University of California, Santa Barbara; Mi Na Park, M.A., Clinical, Counseling, and School Psychology, Gevirtz Graduate School of Education, University of California, Santa Barbara; Robert L. Koegel, Ph.D, Director, Koegel Autism Center, Gevirtz Graduate School of Education, University of California, Santa Barbara. Drs. Robert and Lynn Koegel are also partners in the private firm, Koegel Autism Consultants, LLC.

Compliance with Ethical Standards

Informed consent was obtained from all participants in this study. Human subjects IRB approval was obtained for the study.

Author Manuscript Author Manuscript Author Manuscript Author Manuscript

Introduction

Disruptive behaviors manifest themselves across all age groups of individuals diagnosed with autism spectrum disorder (ASD) and are generally correlated with poor communicative and cognitive abilities (Seltzer, Shattuck, Abbeduto, & Greenberg, 2004). In regard to behavioral phenotypes, children with autism are likely to engage in disruptive behaviors for specific communicative functions, such as to gain access to desired items, to avoid unpleasant sensory stimuli (Reese, Richman, Belmont, & Morse, 2005), and to avoid or escape difficult tasks (Carr & Durand, 1985; Carr, Newsom, & Binkoff, 1976). Given the interrelationship between these areas, creating communicative intervention programs that incorporate antecedent procedures shown to decrease disruptive behaviors becomes essential.

Many teaching programs have considered these common causes of disruptive behavior when developing curriculums. For example, early research by Hart & Risley (1968) examined the use of Incidental Teaching with disadvantaged children, wherein unstructured situations were used by an adult to provide child practice for developing a targeted communicative skill. These situations focused on child requests so that the child experienced some type of reward for the use of the targeted communication. Likewise, Conversational-Recasting (Camarata, Nelson, & Camarata, 1994) has been shown to promote acquisition and spontaneous use of communication targets in children with Specific Language Impairment (SLI). This technique focuses on arranging the environment to promote the use of target language structures, then provides opportunities and prompting the child to use the target structure within natural play interactions. Similarly, Milieu language intervention (Kaiser, Yoder, Keetz, 1992) focuses on improving communication in children with developmental delays through dispersed teaching trials, following the child's attentional lead, and implementing intervention during everyday play interactions occurring in the child's natural setting (Warren & Bambara, 1989).

In regard to language intervention for children with autism, the Natural Language Paradigm (NLP) incorporates child choice (Koegel, Dyer, & Bell, 1987), direct and natural rewards (Koegel & Williams, 1980; Williams, Koegel, & Egel, 1981), reinforcing attempts (Koegel, O'Dell, & Dunlap, 1988), task variation (Dunlap, 1984), and interspersal of previously-learned and newly targeted language structures (Dunlap, 1984). These variables are implemented in the context of naturalistic play interactions, and result in faster gains and generalized improvements in the use of first words when compared to a traditional adult-directed Applied Behavior Analysis (ABA) approach (Koegel, O'Dell, Koegel, 1987). Because these strategies are also effective in improving other areas, the procedure was re-named Pivotal Response Treatment (PRT). Specifically, PRT is an intervention approach based on the behavioral principles of ABA. Variables known to improve the pivotal area of "motivation" are measured in terms of responsiveness, rate of responding, and positive affect with improvements in untargeted areas. As a package, including these motivational variables is sometimes more effective than adult-directed ABA approaches that generally present the instruction repeatedly until the child reaches a specified criterion, use a strict shaping paradigm so that each successive approximation is reinforced, and provide

Author Manuscript Author Manuscript Author Manuscript Author Manuscript

consequences (such as child desired treats and items) that are unrelated to the child's response.

As a whole, a body of research shows that naturalistic teaching techniques also indirectly influence disruptive behaviors (Volkmar, Lord, Bailey, Schultz, & Klin 2004). For example, in a single case experimental design Koegel, Koegel & Surratt (1992) showed that children with autism demonstrated lower levels of disruptive behavior during PRT intervention when compared to an adult-directed ABA approach. This single-subjec research suggests optimism for a larger study using an RCT design (Koegel, Koegel, Surratt, 1992; Koegel, O'Dell, & Koegel, 1987; Reichow, Volkmar, & Cicchetti, 2008) that compares PRT with an adult-directed approach. Therefore, the current study examined the effectiveness of PRT compared to a more structured adult-directed ABA approach to assess the effects of the intervention on disruptive behavior during communication treatment in children with autism, ages 6–11 years old using an RCT design.

This study was part of a larger RCT study showing that PRT was more effective in improving targeted language acquisition (Mean Length of Utterance) and also producing gains in untargeted areas as measured by standardized language/social/pragmatic tests compared to the adult-directed ABA group at post intervention (Mohammadzaheri, Koegel, Razaee, & Rafiee, 2014). Thus, the students who had received the PRT intervention outperformed the students in the adult-directed ABA sessions on the targeted behavior and in untargeted pragmatic areas. Based on the research and these previous findings, we hypothesized that because the PRT group showed greater improvements during intervention they would engage in less disruptive behaviors than the adult-directed ABA group. Therefore, the specific question asked in this study was: Within the RCT design, would PRT or the adult-directed ABA result in lower levels of disruptive behavior during language intervention?

Methods

Participants

Thirty elementary school children, 18 boys & 12 girls, ranging in age from 6 to 11 years, participated in this study. Each child was diagnosed with autism by a child psychiatrist according to the DSM-IV-TR (American Psychiatric Association, 2000) and was referred the to the Hamaden University of Medical Sciences and Health Services in Iran for autism intervention services. Each child's diagnosis was confirmed by special education staff at the public school (where the study took place) and the children were placed in self-contained special education classrooms for students with ASD. Prior to the start of the study, the first author screened each child to confirm symptoms of autism. Although few commonly used standardized instruments are available in the Persian language, three different individuals/ agencies independently agreed on the diagnosis of autism. The primary focus of the study targeted improving language, therefore children were required to have the presence of verbal expressive communication with a mean length of utterance (MLU) of at least two words. In addition each child: (1) had no vision or hearing loss; (2) had no other co-morbid psychiatric disorders; and (3) was not bilingual. All of the participants had tested Intelligence Quotients (IQs) of at least 50. To be specific, thirteen children in the adult-directed ABA group had a

Author Manuscript Author Manuscript Author Manuscript Author Manuscript

reported IQ between 50–60 and two children had a reported IQ of 60–70. In the PRT group twelve children had a reported IQ between 50–60 and three had a reported IQ between 60–70. Thus, the groups were quite similar in regard to cognitive ability. Participant information is listed in Table 1.

Randomization. Prior to the start of intervention, teachers were asked to nominate students that fit the predetermined list of criteria that was necessary for inclusion in the study. Based on this list, a total of 15 dyads were matched by age, sex, and MLU. Each participant in each dyad was then randomly assigned to one of the two treatment groups. This resulted in 15 participants being randomly assigned to the adult-directed ABA treatment group and their matched counterparts assigned to the PRT treatment group. In order to decrease the likelihood of bias throughout the study, teachers, parents, and individuals who scored the tests and evaluated the children were not aware of the purpose of the study, the intervention approach to which the children were assigned, nor did they have access to the randomization list.

Implementer Training and Setting—All intervention sessions were conducted on the public school campus in a 10′ by 15′ room using a one-to-one teacher-child format. The treatment rooms contained a table, chairs, and stimulus materials. The treatment providers in each condition were speech/language specialists (SLPs) who held master's degrees and had at least 5 years of experience teaching children with autism as well as advanced graduate students in speech and hearing sciences. Prior to the start of the study, the implementers contacted individuals with experience in the interventions and were provided with specific methodologies for their respective condition. Since adult-directed ABA was being used, treatment continued as usual but procedures were discussed to assure that Fidelity of Implementation (FoI) would be met. One MA level SLP and three graduate students implemented these sessions. For the PRT session, the clinicians were taught to incorporate motivational strategies into the intervention. One MA level SLP and two graduate students implemented these sessions. Training manuals were used in both conditions; How to teach pivotal behaviors to children with autism: A training manual (1989) was read by the PRT clinicians and the Lovaas eBook (1981) was read by the adult-directed ABA clinicians. In addition, consultation was provided via email approximately once weekly by consultants in California who had expertise in each methodology and provided input on the use of the procedures with target behaviors for the specific children participating in the study. Throughout the study, each child was observed at least four times and was scored for FoI by the first author. FoI was scored for a total of ten minutes in one-minute intervals, and each of the 7 points were scored as correct (+) or incorrect (−) according to each of the variables outlined in Table 2 and in accordance with previous publications (Bryson, Koegel, Koegel, Openden, Smith, & Nefdt, 2007). As noted in Table 2, in both conditions the teacher had to obtain the child's attention, provide a clear opportunity, and provide contingent consequences. Four areas differentiated the two conditions, relating to the selection of stimulus materials, presentation of tasks, the way in which the reinforcer was provided to the child, and whether or not attempts were reinforced versus a strict shaping paradigm. FoI for treatment providers ranged from 80% to 90% and never fell below the required 80%.

Author Manuscript Author Manuscript Author Manuscript Author Manuscript

Target Behavior and Materials—Improving expressive verbal communication was targeted for all children, by expanding the child's Mean Length of Utterance (MLU). For children participating in the adult-directed ABA intervention task materials included commercially purchased picture cards. In addition, each child's favorite foods, toys, and other desired activities were provided for rewards. For the children participating in the PRT intervention, a variety of child chosen toys, foods, and activities (equal to the rewards in the adult-directed ABA condition) were used as stimulus items and provided as natural rewards. The target behavior was consistent and equal in difficulty level across conditions.

Procedures

The present study was implemented during summer school that the children attended 2 hours per day. Treatment sessions were conducted twice weekly for 60 minutes per session over a three month period for a total of 24 hours of intervention. The students spent the remaining hours previewing materials that would be presented during the upcoming school year. The target behavior addressed in the sessions was MLU and not disruptive behavior. No punishment procedures were used in the study and the SLPs redirected the students back to the task if disruptive behavior occurred. Parents and teachers were informed that their children/students would receive speech and language services, but were naïve to the target behavior and the intervention condition to which their child was assigned. Parents and teachers did not attend the sessions. An outside treatment record indicated the children received no other additional interventions during the entirety of this study. For all children, the target behaviors were the same and involved expanding the children's MLU using recast procedures (Nelson, Camarata, Welsh, Butkovsky, & Camarata, 1996).

Intervention—During both conditions the SLPs required the child to be attending, provided a clear opportunity for the target behavior, and provided contingent consequences. The target behaviors were consistent across conditions and controlled for difficulty level, and recasting was used with both groups, but the manner in which the trials were presented differed. Four treatment procedures distinguished the two conditions, as follows. First, the materials in the adult-directed ABA condition consisted of teacher chosen materials (commercial pre-printed picture cards). In contrast, the materials in the PRT condition were specifically chosen based on the child's preferences. Child-chosen items, treats, and activities were used as stimulus items. For both groups these rewards were based on asking the parents/teachers what items, activities, and treats the children preferred. In addition, a variety of rewards (toys, stickers, activities, candy, fruits, and drinks) were available each session from which the children could choose. Second, in the adult-directed ABA sessions target behaviors were worked on exclusively, while in the PRT sessions target behaviors were interspersed with previously mastered (maintenance) tasks. Third, in the adult-directed ABA condition rewards were provided contingent upon correct responses, along with verbal praise. These rewards were child-preferred and selected according to the children's requests, but were unrelated to the target behavior. In the PRT condition natural rewards that were inherently connected to the target behavior were provided. For example, if the child requested a stuffed animal, the natural reward of being given the stuffed animal was provided contingent upon the longer utterance (or attempt). Fourth, in the adult-directed ABA condition, reinforcement was provided based on a shaping paradigm wherein each

Author Manuscript Author Manuscript Author Manuscript Author Manuscript

response was required to be as good or better than the previous response. For example, if a child had previously responded with three word utterances shorter utterances (e.g., two word) were not rewarded. In the PRT sessions all attempts at multiple word utterances were rewarded. Thus, children were rewarded for successively longer utterances in the adult-directed ABA condition and the length of their responses had to be at least as long as the previous response prior to being provided with a reward. In the PRT condition the child was rewarded for both longer utterances in addition to shorter utterances, as long as the children's behaviors were goal directed and the child was attempting to use a longer utterance.

Adult-directed ABA Condition: The adult-directed ABA intervention was based on the procedures described in Koegel, O'Dell, & Koegel (1987). During the adult-directed ABA stimulus materials were chosen by the clinician and consisted of a variety of commercially printed cards depicting various age-appropriate vocabulary items. Trials consisted of attempting to evoke responses through the use of successive trials, with each item presented serially by the clinician. Correct responses or successive approximations were reinforced. Edible reinforcers paired with social reinforcers were provided contingent upon a correct response or successive approximation.

PRT condition: The PRT treatment condition was based on the manual, Pivotal Response Treatment: Using Motivation as a Pivotal Response (Koegel, Schreibman, Good, Cerniglia, Murphy, & Koegel, 1989) and described in Koegel, O'Dell, & Koegel (1987). In this condition instead of the clinician arbitrarily selecting a stimulus item, items were selected according to the child's preference. The task was varied so that the reward was provided both for responses that had previously been mastered (in this case, shorter utterances) interspersed with rewards for acquisition tasks (in this case, longer utterances). The reinforcement contingency was broadened so that if the child produced either the correct response or a successive approximation, or made any clear verbal attempt to respond with a longer utterance, the child was reinforced. Instead of the child being reinforced with edibles and praise, the child was reinforced with the instructional stimulus, paired with verbal praise.

Data Collection and Dependent Measure

Data were collected on disruptive behavior. In order to obtain a representative sample of each child's disruptive behavior, the first and final intervention sessions were videotaped. Twenty-four minutes of each session were scored for disruptive behavior (the first, middle, and last eight minutes). For each observation one-minute intervals were scored for the occurrence of disruptive behavior with a plus (+) or the nonoccurrence of disruptive behavior with a minus (−). Partial interval recording was used so that disruptive behavior in any part of the interval was recorded with a plus. Then, the percentage of disruptive behavior was calculated for each child by dividing the minutes of occurrences of disruptive behavior by the total number of one-minute intervals. To facilitate the recording of data, the pause button was used and the tapes were rewound as often as necessary. Videotapes were randomly presented and scored by two SLPs who were unaware the hypothesis of the study and were not provided with information regarding the child's experimental condition.

Author Manuscript Author Manuscript Author Manuscript Author Manuscript

Disruptive behavior was operationally defined as any behavior that caused a disruption in the session. Specifically, disruptive behaviors included crying, yelling, echolalia or repetitive verbal vocalizations that were unrelated to the task and were loud enough to mask the therapist's instructions, turning the head or body away from the therapist/task, slapping, hitting, grabbing, hand-flapping for more than 2 seconds, sweeping hands across the table to knock stimuli off of the table, covering face/mouth with hands to avoid the task, laying down on seat or table, and getting up out of seat and attempting to leave the area.

Reliability—Two observers independently recorded disruptive behaviors for all of the sessions in this experiment. Percentage agreement between the two observers was calculated for each child using the formula, agreements divided by agreements plus disagreements. An agreement was defined for disruptive behavior as the two observers recording the same response during the same interval, and a disagreement was defined as one observer recording the occurrence of disruptive behavior and the other observer recording the non-occurrence of disruptive behavior for the same interval. The average percentage agreement for recording disruptive behavior in the first PRT sessions was 91% (range 88% to 96%) and 91% (range 88% to 92%) for the adult-directed ABA sessions. The average percentage agreement for recording occurrences of disruptive behavior in the final PRT sessions was 94% (range 92% to 96%) and for the adult-directed ABA sessions was 89% (range 88% to 92%).

Results

Analyses of both demographic and outcome data were conducted to assess for possible differences between participants in the adult-directed ABA and PRT groups. An independent samples *t*-test indicated that there was no significant difference between the two groups in regard to age ($t(28) = 0.03$, $p = .97$) and MLU ($t(28) = 0.02$, $p = .98$) prior to the start of intervention (see Table 1 for all quantitative results). Further, each group was balanced with regard to the sex of the children, with 60% boys and 40% girls in each condition. In regard to the targeted behavior (MLU), pre-intervention analysis showed no significant differences between the two groups prior to the start of intervention, $p > .05$.

The present study focused on the question of whether the intervention might have had an indirect effect on untreated disruptive behavior during the sessions. Disruptive behavior was not targeted and was not considered in the matching. When compared with the adult-directed ABA group, the PRT group had marginally higher levels of disruptive behavior during the first session. On average, the number of minutes with disruptive behavior during the first adult-directed ABA session was 9.6 (range 8 – 11) and the average number of minutes with disruptive behavior during the first PRT session was 11.5 (range 10 – 12). Results of the two sample (equal variance[1]) t-test indicated that the groups differed by statistically significant amount, with the PRT group showing higher levels of disruptive behavior during the first session ($t=4.85$, $p<0.001$). This result does suggest that matching on covariates did not completely eliminate pre-existing differences between groups.

[1]The assumption of equal variances here is well founded given the randomized nature of the study. However, a t-test relaxing this assumption was also performed with no difference in the statistical significance of any of the findings.

Author Manuscript Author Manuscript Author Manuscript Author Manuscript

However, two key facts argue for the validity of the following results. First, we conducted a robustness check on the results performing the analysis in several different ways (dependent t-test on change, regression using pre-test as covariate, regression testing the interaction between pre-test and intervention[2]) all of which resulted in the same finding in significance and magnitude. Second, the effect is so large and apparent, even when viewing the raw data, that the findings are extremely unlikely to have occurred due to a random process or be attributed to the relatively small difference in disruptive behaviors during the first session. This is particularly true since the PRT group on average had more average minutes of disruption than the ABA group.

With respect to improvement by group, the results of the t-tests by intervention type indicate that while the adult-directed ABA group did show a statistically significant change in disruptive behavior over time (t=4.5, p<0.001) the magnitude of those changes was quite small (1.2 minutes), while the PRT group showed statistically significant (t=30, p<0.0001) and large decreases in levels of disruptive behavior over time (9.9 minutes). That is, after three months of intervention, on average, the children in the adult-directed ABA group engaged in disruptive behaviors for 8.4 minutes per session (range 7 – 9) compared to their baselines of 9.6 (range 8–11) – a decrease of 1.2 minutes, while the PRT group showed a mean of 1.6 minutes of disruptive behavior per session (range 1 – 2) compared to their baselines of 11.5 (range 10–12).

Overall, these changes appear to be quite large for the PRT participants (particularly when compared with their adult-directed ABA group peers). The observed decrease of 9.9 minutes between the first and last PRT session occurred during a 24 minute session indicating that, on average, students who were assigned to PRT experienced a 41% increase in the session time free from disruptive behaviors while their adult-directed ABA group peers experienced only a 5% increase in disruption-free session time over that same period. This difference is likely to create therapy sessions that are qualitatively different and may provide more time for engagement and learning rather than the constant addressing of disruptive behaviors.

Discussion

The question we asked in this study was whether PRT or adult-directed ABA would result in lower levels of disruptive behavior during intervention for communication using a randomized clinical trial design. Overall, the results of this study and our previous study, using the same data set, showed that the children who participated in the PRT condition demonstrated greater gains in the targeted area (MLU) and in non-targeted verbal interaction, pragmatics, social relationships, and nonverbal skills, as well as showing greater decreases in disruptive behavior than the adult-directed ABA condition. These results are consistent with previous single case experimental design studies showing that when motivational components are included into the intervention disruptive behaviors are lower and targeted gains are greater (Koegel, Koegel, & Surratt, 1992; Koegel, Singh, & Koegel, 2010).

[2]We have chosen to report only the results of the paired dependent t-test because they are the most easily accessible finding, and because they are consistent with all the other findings. The results of the other analyses are available from the authors by request.

Author Manuscript Author Manuscript Author Manuscript Author Manuscript

There are several possible reasons why the PRT intervention may have been more effective than the adult-directed ABA intervention. First, the use of preferred stimulus items and activities, rather than artificial stimuli (picture cards commonly available to SLPs) and the presentation of the teaching within the context of natural (play) interactions during the PRT sessions may have created more interest in the teaching sessions, thereby resulting in lower levels of disruptive behavior that served escape or avoidance functions. Many pre-fabricated materials are available for SLPs, but this study suggests that this manipulating this variable may result in improved outcomes for students. Perhaps most importantly, the children engaged in more communicative behaviors suggesting that the intervention fostered communication and provided them with a context for being able to express themselves with meaningful outcomes, which may have provided opportunities to appropriately self-advocate. As well, many programs implement drill-type exercises (such as the adult-directed ABA sessions in this study) until the child reaches a pre-determined criterion, which may also result in increases in escape and avoidance behaviors (Carr & Durand, 1985; Carr et al., 1976; Koegel, Singh, & Koegel, 2010). The present study showed that the method in which the same target behavior was taught differed as measured by FoI.

Other variables, such as task variation and interspersing maintenance tasks have also been shown to improve child responsiveness (Carr et al., 1976; Dunlap, 1984; Koegel & Koegel, 1986; Neef et al., 1980). As well, reinforcing attempts at the target behavior (Koegel et al., 1988), and the use of natural reinforcers (Williams, Koegel, & Egel, 1981) have been shown to improve responsiveness in children with autism. As a package, combining the aforementioned motivational variables may be especially effective in creating a high rate of responding through behavioral momentum, (Matson, Benavidez, Compton, Paclawskyj & Baglio, 1996) thereby resulting in fewer opportunities for disruptive behavior (Skiba & Peterson, 2000). Further, with reduced difficulty, reduced failure, and greatly increased reward value in the PRT condition, there may be little reward value in escape-motivated behaviors.

This study was unique in that the training was conducted entirely through the Internet with infrequent contact. Thus, advanced level graduate students and SLPs may be able to improve their services in a cost-efficient manner through such distance learning procedures. As well, the interventionists met FoI in a short period of time with excellent child outcomes. The use of technology to provide coaching to geographically remote areas may be useful for educators who lack mentors within the school site, who wish to update their implementation of evidenced-based strategies and receive feedback on their teaching, or who may need assistance in developing programs with behaviors for which they have little experience (Israel, Carnahan, Snyder, & Williamson, 2012). There is great need for empirically supported interventions globally and this type of remote technological training may offer a method for improvement of services in distant areas.

There are several limitations of the present research. First, the intervention was relatively short, taking place only during summer school. The effects of the intervention for a longer period of time would be interesting. As well, parents were not incorporated into the intervention. We intentionally did not include the parents in the intervention or inform them of the target behavior or condition so that we could assess the effects of the intervention

Author Manuscript Author Manuscript Author Manuscript Author Manuscript

without the possibility of treatment interference. However, parents are a critical component of effective intervention (National Research Council, 2001) and can increase treatment intensity (Steiner, Koegel, Koegel, & Ence, 2012). As well, maintenance and generalization are improved when parents are involved in the intervention (Steiner, et. al, 2012). Future studies that incorporate the parents are likely to have even greater positive effects and studies that have a seamless implementation of goals across school and home warrant further research. Similarly, the intervention was not coordinated across the child's school day, but was implemented in a setting outside of the classroom. Again, the purpose of this was to limit the possibility of treatment interference (Lord, et. al., 2005). However, the effects of the intervention may have been greater with coordination across environments (Dunlap, Koegel, & Kern, 1984). Another concern is that although the adult-directed ABA SLPs were receiving active feedback from an organization in California, which included the use of systematic prompting and prompt fading, may have been outdated. However, these were the available services available in Iran, where children with ASD are under-served relative to many children in the United States. Further, while a formal or informal assessment of the function of the behavior would be recommended (e.g., National Research Council, 2001), our goal was to assess whether the target behaviors could be implemented using an antecedent intervention, and to assess the effects of the intervention on disruptive behavior. For this reason, the first researcher sought to compare what their SLPs were doing in comparison to PRT. Thus, between-group differences could reflect quality of instruction, and suggest that by manipulating specific variables in the adult driven ABA intervention, it is possible to improve learning and decrease disruptive behavior. Further, the PRT intervention used a "package" of variables known to improve motivation. The individual contribution of each variable was not assessed and therefore the relative importance of individual variables in regard to improved learning and decreased disruptive behavior is unknown. Additional research in this area may also be fruitful. Finally we did not collect data for the intermediate sessions or during follow-up. More comprehensive measures of disruptive behavior may be informative. Although we did not specifically measure generalization of disruptive behavior, the children in the PRT did show significant improvements in pragmatic areas as measured by the Children's Communication Checklist (CCC) and as anecdotally reported by their teachers and parents. As well, many parents and teachers noted their observations of improvements in maladaptive behaviors in the PRT group. It is likely that these generalized improvements in these areas were related to the improvements in communication as well as decreases in disruptive behavior. Decreasing maladaptive behaviors is critical for individuals with ASD in regard to long-term outcomes as well as maintaining inclusion in educational settings, natural home and community environments, and improving social relationships (Sprague & Ryan, 1993). More research on generalized effects of school interventions would be interesting.

Overall, the results of this study have implications for teachers and specialists who work on the remediation of language disabilities and who have difficulties with disruptive behavior in their students. Specific antecedent strategies for accomplishing this goal are becoming more available for intervention for communication (Kaiser, Hancock, & Nietfeld, 2000; Vernon, 2014), academics (Koegel, Singh, & Koegel, 2010; Cowan, & Allen, 2007), and in social areas (Koegel, Kim, Koegel, & Schwartzman, 2013) with widespread positive effects.

Author Manuscript Author Manuscript Author Manuscript Author Manuscript

Incorporating motivational procedures into the intervention is likely to result in reduced levels of disruptive behavior and improved outcomes for students with ASD.

Acknowledgments

This research and preparation of the manuscript were funded in part by NIH grant #DC010924 and generous donations from the Kelly Family Foundation, the Eli and Edythe L. Broad Center for Asperger's Research, and the Kind World Foundation. The authors would like to express our sincere appreciation to the families that participated in this research and Dr. John Yun for his assistance with the statistical analyses.

References

Camarata SM, Nelson KE. Treatment efficiency as a function of target selection in the remediation of child language disorders. Clinical Linguistics and Phonetics. in press.

Carr, EG. Sign Language. In: Koegel, RL.; Rincover, A.; Egel, AL., editors. Educating and understanding autistic children. San Diego, CA: College Hill; 1982.

Carr EG, Dunlap G, Horner RH, Koegel RL, Turnbull AP, Sailor W, Anderson JL, Albin RW, Koegel LK, Fox L. Positive behavior support: evolution of an applied science. Journal of positive behavior interventions. 2002; 4(1):4–16.

Carr EG, Durand VM. Reducing behavior problems through functional communication training. Journal of Applied Behavior Analysis. 1985; 18:111–126. [PubMed: 2410400]

Carr EG, Newsom CD, Binkoff JA. Stimulus control of self-destructive behavior in a psychotic child. Journal of Abnormal Child Psychology. 1976; 4:139–153. [PubMed: 945811]

Charlop MH, Milstein JP. Teaching autistic children conversational speech using video modeling. Journal of Applied Behavior Analysis. 1989; 22:275–285. [PubMed: 2793634]

Cowan RJ, Allen KD. Using naturalistic procedures to enhance learning in individuals with autism: A focus on generalized teaching within the school setting. Psychology in the Schools. 2007; 44(7): 701–715.

Ousley O, Cermak T. Autism Spectrum Disorder: Defining Dimensions and Subgroups. Current Developmental Disorders Reports. 2014; 1(1):20–28. [PubMed: 25072016]

Dunlap G. The influence of task variation and maintenance tasks on the learning and understanding of autistic children. Journal of Experiment child Psychology. 1984; 37:41–64.

Dunlap G, Koegel RL, Kern L. Continuity of treatment: Toilet training in multiple community settings. Journal of the Association for the Severely Handicapped. 1984; 9:134–141.

Dyer K, Dunlap G, Winterling V. Effects of choice making on the serious problem behaviors of students with severe handicaps. Journal of Applied Behavior Analysis. 1990; 23:515–524. [PubMed: 2074240]

Garfin, DG.; Lord, C. Communication as a social problem in autism. In: Schopler, E.; Mesibov, GB., editors. Social behavior in autism. New York: Plenum Press; 1986.

Hart BM, Risley TR. Establishing use of descriptive adjectives in the spontaneous speech of disadvantaged preschool children. Journal of Applied Behavior Analysis. 1968; 1:109–120. [PubMed: 16795166]

Israel M, Carnahan CR, Snyder KK, Williamson P. Supporting new teachers of students with significant disabilities through virtual coaching: A proposed model. Remedial and Special Education. 2012; 34(4):195–204.

Kaiser AP, Hancock TB, Nietfeld JP. The effects of parent-implemented enhanced milieu teaching on the social communication of children who have autism. Early Education and Development. 2000; 11(4):423–446.

Kaiser, AP.; Yoder, PJ.; Keetz, A. Evaluating milieu teaching. In: Warren; Reichle, editors. Causes and effects in communication and language intervention. Vol. 1. Baltimore, MD, England: Paul H. Brookes Publishing; 1992. p. 9-47.Communication and language intervention seriesxxiii, 405 pp

Koegel LK, Koegel RL. The effects of interspersed maintenance tasks on academic performance in a severe childhood stroke victim. Journal of Applied Behavior Analysis. 1986; 19:425–430. [PubMed: 3804876]

Author Manuscript Author Manuscript Author Manuscript Author Manuscript

Koegel R, Kim S, Koegel L, Schwartzman B. Improving socialization for high school students with ASD by using their preferred interests. Journal of autism and developmental disorders. 2013; 43(9):2121–2134. [PubMed: 23361918]

Koegel, RL.; Traphagen, J. Selection of initial words for speech training with nonverbal children. In: Koegel, R.; Rincover, A.; Egel, AL., editors. Educating and understanding autistic children. San Diego, CA: College Hill; 1982.

Koegel RL, Dyer K, Bell L. The influence of child-preferred activities on autistic children's social behavior. Journal of Applied Behavior Analysis. 1987; 20:243–252. [PubMed: 3667475]

Koegel RL, Koegel LK, Surratt AV. Language intervention and disruptive behavior in preschool children with autism. Journal of Autism and Developmental Disorders. 1992; 22(2):141–153. [PubMed: 1378049]

Koegel RL, O'Dell MC, Dunlap G. Producing speech use in nonverbal autistic children by reinforcing attempts. Journal of Autism and Developmental Disorders. 1988; 18:525–538. [PubMed: 3215880]

Koegel RL, O'Dell MC, Koegel LK. A natural language teaching paradigm for nonverbal autistic children. Journal of Autism and Developmental Disorders. 1987; 17(2):187–200. [PubMed: 3610995]

Koegel, RL.; Schreibman, L.; Good, A.; Cerniglia, L.; Murphy, C.; Koegel, LK. How to teach pivotal behaviors to children with autism: A training manual. Santa Barbara, California: University of California; 1989.

Koegel LK, Singh AK, Koegel RL. Improving motivation for academics in children with autism. Journal of Autism and Developmental Disorders. 2010; 40(9):1057–1066. [PubMed: 20221791]

Laski KE, Charlop MH, Schreibman L. Training parents to use the natural language paradigm to increase their autistic children's speech. Journal of Applied Behavior Analysis. 1988; 21:391–400. [PubMed: 3225256]

Lord C, Wagner A, Rogers S, Szatmari P, Aman M, Charman T, Dawson G, Durand MV, Grossman L, Guthrie D, Harris S, Kasari C, Marcus L, Murphy S, Odom S, Pickles AL, Shaw E, Seigel B, Sigman M, Stone W, Smith T, Yoder P. Challenges in evaluating psychosocial interventions for autistic spectrum disorders. Journal of autism and developmental disorders. 2005; 35(6):695–708. [PubMed: 16496206]

Lovaas OI. Behavioral treatment and normal educational and intellectual functioning in young autistic children. Journal of Consulting and Clinical Psychology. 1987; 55(1):3–9. [PubMed: 3571656]

Matson JL, Benavidez DA, Compton L, Paclawskyj T, Baglio C. Behavioral treatment of autistic persons: A review of research from 1980 to the present. Research in Developmental Disabilities. 1996; 17(6):433–465. [PubMed: 8946569]

McGee GG, Krantz PJ, McClannahan LE. The facilitative effects of incidental teaching on preposition use by autistic children. Journal of applied behavior analysis. 1985; 18(1):17–31. [PubMed: 3997695]

Miller, JF. Assessing Language Production in Children: Experimental Procedures. Allyn & Bacon; Boston, NY: 1981.

Mohammadzaheri FM, Koegel LK, Rezaee M, Rafiee SM. A Randomized Clinical Trial Comparison Between Pivotal Response Treatment (PRT) and Structured Applied Behavior Analysis (ABA) Intervention for Children with Autism. Journal of Autism and Developmental Disorders. 2014:1–9.

Nelson KE, Camarata SM, Welsh J, Butkovsky L, Camarata M. Effects of imitative and conversational recasting treatment on the acquisition of grammar in children with specific language impairment and younger language-normal children. Journal of Speech and Hearing Research. 1996; 39(4): 850–859. [PubMed: 8844564]

Neef NA, Iwata BA, Page TJ. The effects of interspersal training versus high density reinforcement on spelling acquisition and retention. Journal of Applied Behavior Analysis. 1980; 13:153–158. [PubMed: 7364694]

Reese RM, Richman DM, Belmont JM, Morse P. Functional characteristics of disruptive behavior in developmentally disabled children with and without autism. Journal of Autism and Developmental Disorders. 2005; 35(4):419–428. [PubMed: 16134028]

Author Manuscript Author Manuscript Author Manuscript Author Manuscript

Reichow B, Volkmar FR, Cicchetti DV. Development of the evaluative method for evaluating and determining evidence-based practices in autism. Journal of autism and developmental disorders. 2008; 38(7):1311–1319. [PubMed: 18095149]

Shah, A.; Wing, L. Cognitive Impairments affecting social behavior in autism. In: Schopler, E.; Mesibov, GB., editors. Social behavior in autism. New York: Plenum Press; 1986.

Seltzer MM, Shattuck P, Abbeduto L, Greenberg JS. Trajectory of development in adolescents and adults with autism. Mental retardation and developmental disabilities research reviews. 2004; 10(4):234–247. [PubMed: 15666341]

Skiba RJ, Peterson RL. School discipline at a crossroads: From zero tolerance to early response. Exceptional Children. 2000; 66(3):335–396.

Sprague, JR.; Rian, V. Support systems for students with severe problem behaviors in Indiana: A descriptive analysis of school structure and student demographics. Indiana University; Bloomington: 1993. Unpublished manuscript

Volkmar FR, Lord C, Bailey A, Schultz RT, Klin A. Autism and pervasive developmental disorders. Journal of child psychology and psychiatry. 2004; 45(1):135–170. [PubMed: 14959806]

Voos AC, Pelphrey KA, Tirrell J, Bolling DZ, Vander Wyk B, Kaiser MD, McPartland JC, Volkmar FR, Ventola P. Neural mechanisms of improvements in social motivation after pivotal response treatment: two case studies. Journal of autism and developmental disorders. 2013; 43(1):1–10. [PubMed: 23104615]

Williams JA, Koegel RL, Egel AL. Response-reinforcer relationships and improved learning in autistic children. Journal of Applied Behavior Analysis. 1981; 14:53–60. [PubMed: 7216932]

Yoder PJ, Kaiser AP, Alpert C, Fischer R. Following the Child's Lead When Teaching Nouns to Preschoolers With Mental Retardation. Journal of Speech and Hearing Research. 1993; 36:158–167. [PubMed: 7680732]

Author Manuscript Author Manuscript Author Manuscript Author Manuscript

Table 1

Participant Characteristics and Disruptive Behavior

Characteristics	**ABA group**		**PRT group**		
	N	**%**	**N**	**%**	
Gender					
Male	9	60	9	60	
Female	6	40	6	40	
Ethnicity					
Iranian	15	100	15	100	
	ABA group		PRT group		
	M	SD	M	SD	*p*-value
Age (in months)	110.47	18.62	110.67	18.71	ns
MLU	2.77	.49	2.76	.50	ns
Disruptive Behavior					
1st Session	9.6	.8	11.5	1.2	.001
Last Session	8.5	.56	1.6	.2	.0001

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript

Table 2

Definitions for Fidelity of Implementation. An asterisk (*) indicates differences between the two conditions.

Child Attending
The interventionist must have the child's attention prior to presenting an opportunity.
Clear Opportunity
The question/instruction/opportunity (SD) to respond must be clear and appropriate to the task.
Child Choice *
For PRT groups the interventionist should follow the child's **choice** with tasks and activities.
However, the interventionist must always assume control should the child engage in hazardous (i.e. self-injury) or inappropriate (i.e. self-stimulation) activities. If child is not showing interest in the current task, interventionist should attempt to change the activity.
For the ABA group the interventionist should choose the materials or activity that is relevant to the target behavior.
Maintenance Tasks *
For the PRT intervention, the interventionist should be **interspersing** tasks the child can already perform with acquisition (new) tasks. For the adult-directed ABA groups the target behavior should be worked on exclusively.
Contingent
Reinforcement must be contingent upon child's behavior. The interventionist's response (i.e. giving the child a reinforcer) must be dependent upon the child's response (i.e. saying "little toy").
Natural *
For the PRT intervention reinforcement should be **natural** or directly related to the desired behavior. For the adult-directed ABA intervention reinforcement should included food items, activities, or items (stickers) that the child enjoys but are unrelated to the intervention.
Contingent on Attempts *
For PRT any goal-directed **attempt** to respond to questions, instructions, or opportunities should be reinforced. Although an attempt does not necessarily need to be correct, it has to be reasonable. For the adult-directed ABA intervention a strict shaping paradigm must be used wherein each rewards are provided upon correct responses or responses that are at least as good or better than the previous response.