



Low intensity behavioral treatment supplementing preschool services for young children with autism spectrum disorders and severe to mild intellectual disability

Nienke Peters-Scheffer^{a,*}, Robert Didden^{a,b}, Monique Mulders^c, Hubert Korzilius^d

^a Behavioural Science Institute, Radboud University Nijmegen, PO Box 9104, 6500 HE Nijmegen, The Netherlands

^b Trajectum Zutphen, PO Box 300, 7200 AH Zutphen, The Netherlands

^c Stichting De Driestroom, PO Box 139, 6660 AC Elst, The Netherlands

^d Institute for Management Research, Radboud University Nijmegen, PO Box 9104, 6500 HE Nijmegen, The Netherlands

ARTICLE INFO

Article history:

Received 15 December 2009

Accepted 19 April 2010

Keywords:

Low intensity behavioral treatment

Autism spectrum disorders

Intellectual disability

Young children

Preschool services

ABSTRACT

This study evaluated the effectiveness of low intensity behavioral treatment (on average 6.5 h per week) supplementing preschool services in 3–6-year-old children with autism spectrum disorder and severe to mild intellectual disability. Treatment was implemented in preschools (i.e., daycare centers) and a discrete trial teaching approach was used. Twelve children in the treatment group were compared to 22 children receiving regular intervention. At pre-treatment, both groups did not differ on chronological age, developmental age, diagnosis and level of adaptive skills. Eight months into treatment, children receiving behavioral treatment displayed significantly higher developmental ages and made more gains in adaptive skills than children from the control group. No significant differences between groups were found on autistic symptom severity and emotional and behavioral problems.

© 2010 Elsevier Ltd. All rights reserved.

1. Introduction

Young children with autism spectrum disorders (ASD) and intellectual disabilities (ID) show restricted, repetitive behaviors and deficits in social reciprocity and communication (O'Brien & Pearson, 2004). They show internalizing and externalizing behavior problems (Harley, Sikora, & McCoy, 2008) and display more impairment in adaptive behavior than children with ID only, mostly caused by lower functioning on communication and socialization (Carpentieri & Morgan, 1996). Results of relatively many studies have shown that with intensive behavioral treatment, based on applied behavior analysis (ABA), substantial gains can be made in cognitive, language, academic and adaptive skills (see e.g., Eldevik et al., 2009; Eikeseth, 2009; Green, 1996; Howlin, Magiati, & Charman, 2009; Matson & Smith, 2008; Reichow & Wolery, 2009; Rogers & Vismara, 2008; Schreibman, 2000). For example, in a study by Lovaas (1987) behavioral treatment was given to 19 children with ASD during 40 h per week using a discrete trial format. This group was compared to two control groups: one receiving 10 h or less behavioral treatment and one group not receiving behavioral treatment. Although these groups were comparable on several variables at pre-treatment, after 2 years the experimental group outperformed both control groups on educational placement and IQ. Results were maintained at follow-up (McEachin, Smith, & Lovaas, 1993).

* Corresponding author.

E-mail address: N.Peters@pwo.ru.nl (N. Peters-Scheffer).

Lovaas' approach (1987) has been replicated in older children (Eikeseth, Smith, Jahr & Eldevik, 2002; Eikeseth, Smith, Jahr, & Eldevik, 2007), children with ID (Smith, Eikeseth, Klevstrand, & Lovaas, 1997), and in other settings, such as home (Cohen, Amerine-Dickens & Smith, 2006; Sheinkopf & Siegel, 1998) and school (Eikeseth et al., 2002). Results of these studies show that while fewer children achieved average levels of functioning than in the Lovaas study (1987), a subset of children obtained an improvement in IQ. In general, better outcomes are reported for children who start treatment early and in children with a higher IQ (e.g., Harris & Handleman, 2000). Since the study published by Lovaas (1987) several empirical studies were conducted with a variety of treatment hours per week. More intensive treatment (up to approximately 40 h per week) is associated with the best results (e.g., Eikeseth et al., 2002; Eldevik, Eikeseth, Jahr, & Smith, 2006; Sallows & Graupner, 2005; Smith et al., 1997).

Despite its effectiveness, intensive behavioral treatment is difficult to implement in clinical practice and parents reported several barriers implementing such intensive treatment (Johnson & Hastings, 2001). Primary concerns are the availability of professionals (e.g., recruiting and maintaining a suitable team) and obtaining funding of the treatment from the education departments. Also, concerns about the school, child and impact on the family were reported. Therefore, children with ASD may not have the opportunity to start intensive treatment and less intensive treatment could be an accessible option.

Studies on the effects of lower intensity treatment (in terms of hours of one-to-one treatment) are therefore warranted. Until present, only one study has evaluated the effects of low intensity behavioral treatment by comparing 13 children (mean IQ of 41) receiving behavioral treatment to 15 children (mean IQ of 47) receiving the same amount of eclectic treatment (Eldevik et al., 2006). The behavioral treatment consisted of one-to-one-training and implementation of behavioral intervention in the classroom for an average of 12.5 h per week. Parents generalized the learned skills in their children to other settings, like home. The eclectic group received the same amount of treatment, which was based on a combination of alternative communication and/or total communication, sensory motor treatment, TEACCH, and other approaches. After 2 years, the behavioral treatment group had made a significantly larger progress on intellectual functioning, language comprehension, expressive language and the Communication scale of the VABS than the eclectic treatment group. Also, the behavioral treatment group had significantly lower scores on several pathology items assessed with Lovaas' measure of pathology (see Lovaas, 1987), including peer play, toy play, toilet training, affectionate behavior and general pathological symptoms. No significant effects of treatment on non-verbal intelligence, the adaptive behavior composite, daily living skills and socialization were found. Although gains were smaller than in other studies, this study suggested that even low intensity behavioral treatment can be effective in young children with ASD and ID.

Presently, our knowledge base of the effects of low intensity treatment is scarce (see e.g., Eldevik et al., 2006). Other studies, therefore, should be conducted in this area. This study evaluated the effects of low intensity one-to-one behavioral treatment in young children with ASD and ID by providing less than ten hours of one-to-one behavioral treatment per week for a period of 8 months. Although behavioral treatment mutates and evolves over time and between program differences exist (Love, Carr, Almason, & Petursdottir, 2009), treatment procedures are based on operant conditioning (e.g. stimulus control, task analysis, reinforcement, prompting, generalization, discrete-trial instruction, incidental teaching). A comprehensive skill based hierarchically organized and developmentally sequenced curriculum is used, which is individualized to each child's strengths and deficits. First, treatment is provided in a one-to-one setting at home, but over time gradual and systematic transitions to small-group and large-group formats and to other environments (as preschool, kindergarten, school) are made when children developed the skills required to learn in those settings. Generally, the training is directed by individuals with advanced training in ABA and experience with young children with autism and parents are active as co therapists of their children. Most programs provided 20–30 h of structured treatment per week and additional informal instruction and practice during the children's other waking hours for 2 or more years. Treatment is generally started at 3 or 4 years of age (Green, Brennan, & Fein, 2002).

In this study the children received 5–10 h structured one-to-one training at the preschool. Next to the one-to-one training, the children attended a preschool for children with ID. In this preschool, teachers were instructed and stimulated to use the principles of behavioral treatment to teach new skills and generalize skills learned in the training in a daily context. As usual in behavioral treatment, parents were instructed and stimulated to generalize the skills their child had learned to as many settings in the community as possible and some parents acted as co therapist for their children. The intervention period in this study is relatively short in comparison to other studies. To prevent children changing (pre)schools during the intervention period, a intervention period of 8 months was chosen to avoid a co founding influences of different schools during the intervention period. Aim of this study was to assess the effects of low intensity one-to-one behavioral treatment with an environment that informally uses behavioral principles, on developmental age and adaptive skills in 12 children with ASD and ID. Additionally, symptom severity and emotional and behavioral problems were assessed, as they could interfere with treatment and change as a result of the treatment.

2. Method

2.1. Participants and setting

All participants attended a preschool setting for children with ID and met the following criteria: (1) a diagnosis of Autistic Disorder (AD) or Pervasive Developmental Disorder Not Otherwise Specified (PDD-NOS) and ID based on DSM-IV criteria established by a licensed and independent psychologist or psychiatrist; level of IQ was assessed by standard intelligence

Table 1
Demographic characteristics of the participants at pre-treatment.

Variable	Treatment group			Control group		
	M	SD	Range	M	SD	Range
Chronological age in months	53.50	5.52	42–62	52.95	11.14	38–75
Developmental age in months	25.92	7.57	17–40	23.32	6.33	15–36
Mental Developmental Index/IQ	47.00	10.33	31–64	45.73	15.99	21–77
VABS–composite in months	20.83	6.69	13–35	19.18	4.14	11–30
Raw score PDD-MRS	11.58	4.42	1–18	12.91	3.79	3–18

Note: PDD-MRS, Pervasive Developmental Disorder in Mentally Retarded Persons; VABS, Vineland Adaptive Behavior Scales.

tests (e.g., Wechsler Preschool and Primary Scale of Intelligence–Revised, SON-2.5–7, Bayley Scales of Infant Development), (2) a chronological age below 7 years and (3) absence of medical conditions (e.g., visual impairment; uncontrolled epilepsy) that could interfere with treatment.

The treatment group consisted of 12 children who started behavioral treatment in a preschool. Parents gave their written consent in all cases. Twenty-two children comprised the control group and these children visited preschools in which no one-to-one behavioral treatment was given.

Table 1 shows chronological age, developmental age, estimated ratio of the mental developmental index, adaptive behavior composite and the total score of the Scale of Pervasive Developmental Disorder in Mentally Retarded Persons (PDD-MRS; Kraijer, 1999) Results from *t*-tests showed no statistically significant differences between groups on chronological age, $t(32) = 0.16$, $p = .88$, developmental age, $t(32) = 1.01$, $p = .32$, symptom severity of ASD, $t(32) = 0.88$, $p = .39$, and level of adaptive skills, $t(32) = 0.89$, $p = .38$.

2.2. Design

A non-randomized pretest posttest control group design was used to assess the effects of low intensity behavioral treatment. Before intake measures were collected, the third author assigned children based on therapist' availability to the treatment group or the control group. Parents and teachers were not informed about the exact aim and design of the study and were told the study was about the development of young children with ASD and ID. They were unaware of whether their child was in the experimental or in the control condition.

2.3. Treatment

All participants attended 13 preschools for children with ID for an average of 28.38 h per week (SD 3.83; range 16–36 h). A class consisted of 6–10 children with comparable disabilities and levels of functioning, and two or three teachers. Classes typically started at 9 a.m. and ended at 3 p.m. on weekdays. The treatment consisted of elements of TEACCH to structure and visualize the environment (such as visual timetables, routines, and workstations), incidental teaching, structured play and activities in a group setting. Individual physiotherapy, speech therapy, music therapy or play therapy with a maximum of 1 h per week was provided to each child. Treatment was supervised by an experienced psychologist or special educator.

In addition to the group program, the treatment group received 5–10 ($M = 6.29$; $SD = 1.31$) h one-to-one treatment per week, based on the work of Lovaas (2003) using a one-to-one discrete trial format in which no aversive stimuli were used. The treatment was provided at the preschool and began with five basic treatment targets: attention skills, responding to simple requests, non-verbal imitation, matching and communication (e.g., pointing, PECS). Depending on the child's developmental level and parental requests other targets were added. Additional programs addressed self-help skills, labeling objects and abstract concepts, identifying actions, play skills, social interaction and emotions. Teachers of the children in the treatment group also informally used ABA principles in the group context (e.g., prompting, discrete trials, extinction and reinforcement) to teach new skills and generalize mastered skills to the daily context. As in the group setting staff primarily focused on managing daily activities (e.g. eating, toileting, free play, leisure activities) and only limited worked on weekly treatment targets, these hours spend in the group setting were not counted as ABA treatment hours.

Treatment was provided by trainers and teachers of the preschool, who were supervised by a special educator with 5 years of extensive experience in applying ABA in young children with autism. Before the start of the behavioral treatment all parents, trainers and teachers received a workshop on how to apply techniques of applied behavior analysis (e.g., discrete trials, reinforcement and prompting). In the workshop, programs were demonstrated and role played. Furthermore, supervision was given through monthly staff meetings, in which all teachers received feedback on video fragments of their training sessions. Monthly, treatment sessions were observed and the trainer was provided with feedback during and after treatment using verbal instruction and modelling. A subset of parents (25%) and class room teachers (66%) trained the children for 1 h per week. In additional monthly meetings individually organized for each child parents and all teachers were informed of the skills the child had learned in training. Parents and class room teachers were instructed to generalize the skills by implementing these skills in every day routines.

As was the case in the Lovaas (1987) study, no formal measures were taken to assess procedural integrity, but through treatment protocols, the use of manuals (Leaf & McEachin, 1999; Lovaas, 2003), meetings, video-recordings during

treatment, data-sheets with trial-by-trial data and an individual learning plan with detailed descriptions of each program, and supervision by a special educator, fidelity was facilitated in the treatment group (Eikeseth, 2001). Through reports of parents, teachers and psychologists, the absence of one-to-one behavioral treatment in the control group was confirmed.

2.4. Instruments and data-collection

At pre-treatment and after 8 months of treatment all children were assessed with the Dutch version of the Bayley Scales of Infant Development (Second Edition) to determine developmental age and an estimated ratio of the mental developmental index (van der Meulen, Ruiters, Lutje Spelberg, & Smrkovský, 2002). The children with a developmental age of 30 months or more were additionally assessed with the SON-2.5–7 (Snijders, Tellegen, Winkel, & Laros, 1996). Eight children (four of the treatment group) completed this non-verbal intelligence test. After 8 months the children were assessed either with the SON-2.5–7 or the BSID-II-nl depending on the test used in pre-treatment.

The BSID-II-nl measures mental development up to 42 months. An estimated ratio score (mental age/chronological age) was used for all children who scored below the norms or were older than 42 months. The SON-2.5–7 determines non-verbal intelligence in children between 2.5 and 7.0 years old. Both tests have been validated and are commonly used for children with ID and autism (Snijders et al., 1996; van der Meulen et al., 2002).

At pre- and post-treatment and at two (i.e., period 2), four (i.e., period 3) and six (i.e., period 4) months of treatment the Dutch survey version of the Vineland Adaptive Behavioral Scales (de Bildt & Kraijer, 2003), the Dutch translation of the Child Behavior Checklist (CBCL; Achenbach & Rescorla, 2000) and the Dutch version of the PDD-MRS (Kraijer, 1999) were completed by interviewing the parents of all children. To simplify interpretation of the results only the pre- and post-treatment scores are reported. The Vineland Adaptive Behavior Scales (Sparrow, Balla, & Cicchetti, 1984) were used to measure adaptive behavior and provide an adaptive behavior composite score and scores in three domains: Communication, daily living skills and socialization. Reliability and validity of the Dutch survey version are high in individuals with ID (de Bildt, Kraijer, Sytma, & Minderaa, 2005). Since standard scores were not available for all children and only range from 1 to 10, age equivalents are reported and analyzed. The behavioral problem scale of the CBCL is a parent-completed questionnaire consisting of 100 items assessing emotional and behavioral problems and reliability and validity are adequate. American norms were used to calculate standard scores (Achenbach & Rescorla, 2000). The PDD-MRS is a 12-item questionnaire that can be used in the screening for ASD in children and adults with ID (Kraijer, 1999). It is based on the three aspects of ASD: Communication, Social behavior and Stereotyped behavior. The PDD-MRS is commonly used to screen for ASD. Reliability and validation of the PDD-MRS are good (Kraijer and de Bildt, 2005).

2.5. Statistical analysis

The statistical analysis focused on the differences between the treatment group and the control group over time. First, *t*-tests were conducted to confirm resemblance on several variables between both groups at pre-treatment. Second, Multivariate and Univariate GLM repeated measures were used to assess group differences over time.

3. Results

3.1. Developmental age and mental developmental index (MDI)

At pre-treatment, *t*-tests did not reveal any significant differences between the treatment group and the control group, on developmental age, $t(19.49) = 1.01$, $p = .32$, and the estimated ratio score of the MDI, $t(31) = 0.28$, $p = .78$. However, after 8 months of treatment, the treatment group outperformed the control group (see Table 2). Univariate GLM repeated measures

Table 2

Developmental age in months, estimated mental developmental index/IQ and F values for the treatment group versus the control group on pre- and post-treatment measures.

Variable	Treatment group				Control group				Statistics	
	Pre-treatment		Post-treatment		Pre-treatment		Post-treatment		F	p
	M	SD	M	SD	M	SD	M	SD		
Developmental age in months	25.92	7.57	34.83	10.89	23.32	6.33	25.73	8.26	$F(1,32) = 23.37$	<.01
Mental developmental index/IQ	47.00	10.33	55.83	14.94	45.73	15.99	43.73	16.74	$F(1,32) = 26.96$	<.01
VABS-composite in months	20.83	6.69	31.75	10.96	19.18	4.14	22.05	7.47	$F(1,32) = 15.68$	<.01
VABS-communication in months	26.92	12.12	39.42	15.39	25.00	10.00	29.95	13.39	$F(1,32) = 6.48$.02
VABS-daily living in months	23.83	7.28	33.25	9.04	20.14	4.68	23.23	7.70	$F(1,32) = 13.17$	<.01
VABS-socialization	20.75	4.54	34.08	8.14	24.64	8.18	25.14	7.21	$F(1,32) = 44.86$	<.01
CBCL-total	60.00	8.37	58.25	8.02	66.91	7.70	63.23	7.98	$F(1,32) = 0.40$.53
CBCL-internalizing	60.58	5.58	59.08	7.74	67.55	6.27	64.41	8.45	$F(1,32) = 0.33$.57
CBCL-externalizing	58.92	10.82	54.33	8.52	63.59	7.89	58.86	6.26	$F(1,32) < 0.01$.96
PDD-MRS raw score	11.58	4.42	10.25	3.14	12.91	3.79	11.27	3.84	$F(1,32) = 0.06$.82

(Greenhouse-Geisser) revealed significant interaction effects on developmental age, $F(1,32) = 23.37$, $p < .01$, and the estimated ratio score of the MDI, $F(1,32) = 26.96$, $p < .01$.

3.2. Adaptive skills

At pre-treatment no significant differences were found on the Vineland-composite, $t(16) = 0.78$, $p = .45$, and the domains communication, $t(19) = 0.47$, $p = .65$, daily living skills, $t(16) = 1.59$, $p = .13$, and socialization, $t(32) = 1.78$, $p = .08$. Since the subscales of the VABS were correlated, $r = .42$ to $r = .86$, a multivariate GLM repeated measures was used to analyze the differences on the subscales. A significant interaction effect, $\lambda = 0.71$, $F(12,21) = 4.33$, $p < .01$, indicated an improvement in both groups on all scales, but the progress in the treatment group was significantly larger. Univariate GLM repeated measures (Greenhouse-Geisser) also revealed significant interaction effects on the domains communication, $F(1,32) = 6.48$, $p = .02$, daily living skills, $F(1,32) = 13.17$, $p < .01$, and socialization, $F(1,32) = 44.86$, $p < .01$, representing a significantly larger progress in the treatment group (see Table 2).

An univariate GLM repeated measures analysis revealed a significant interaction effect on the VABS composite score at treatment over time, $F(1,32) = 15.68$, $p < .01$. As expected, both the treatment group and the control group made gains in adaptive skills. However, in the treatment group these gains were significantly larger (see Table 2).

3.3. Symptom severity of autism

No significant differences on symptom severity of autism appeared between both groups at pre-treatment, $t(20) = 0.88$, $p = .39$, and post-treatment, $t(27) = 0.84$, $p = .41$. GLM repeated measures shows a significant effect of time, $F(1,32) = 6.22$, $p = .02$, indicating a decrease of symptom severity over time in both groups.

3.4. Emotional and behavioral problems

Using t -tests, significant differences between both groups appeared on the total T -score, $t(21) = 2.37$, $p < .05$, and on the internalizing scale, $t(25) = 3.33$, $p < .01$, of the CBCL at pre-treatment. Differences on external scales were not significant, $t(18) = 1.32$, $p = .20$. GLM repeated measures indicated no significant effect over time and treatment for the total T -score, $F(1,32) = 0.40$, $p = .53$, the internalizing scale, $F(1,32) = 0.33$, $p = .57$, and the external scale, $F(1,32) < 0.01$, $p = .96$.

4. Discussion

In this study, 12 children with ASD and ID receiving on average 6.5 h additional behavioral treatment per week were compared to 22 children receiving treatment as usual. During 8 months all children made significant progress on developmental age and adaptive skills. However, the improvement on developmental age and adaptive skills was significantly larger in the children who received behavioral treatment supplementing preschool services. No significant changes were found on severity of ASD and on emotional and behavioral problems. The present study is the first study in this area that was conducted in The Netherlands.

A higher IQ and more intensive treatment are associated with better treatment outcome (e.g., Harris & Handleman, 2000; Lovaas, 1987). Nevertheless, this study and the study of Eldevik et al. (2006) found good results on intellectual functioning and the Communication domain of adaptive behavior. Only this study found significant differences on all adaptive domains. By contrast, Eldevik et al. (2006) found a positive effect of behavioral treatment on several measures of pathology.

Differences in outcome between this study and Eldevik et al. (2006) can be explained in terms of treatment and methodology. While the children of Eldevik et al. (2006) received 12.5 h behavioral treatment, children in the present study received only 6.5 h of one-to-one treatment. However, additionally to the one-to-one treatment the children in the present study received a behavioral approach in the group setting. Combining the one-to-one training and the informal behavioral approach in the group setting children in the present study received on average 28 h of behavioral treatment, considerably more than in Eldevik et al. (2006).

The supervision in this study is limited to 1 staff meeting of 2 h per month per location (1–5 children), supervision during treatment (on average 1 h per month per child) and 1 meeting with parents and staff of 1–2 h per month for each child. While the children in this study received on average 1.5 h of supervision per week, normally supervision during an EIBI program contains up to 10 h per week (Eikeseth, Hayward, Gale, Gitlesen, & Eldevik, 2009; Hayward, Gale, & Eikeseth, 2009). Since intensity of supervision is related to treatment outcome, this could explain differences in outcome between the studies, as in the Eldevik et al. (2006) 1–4 h consultation per week and 2 h supervision per child per week were provided.

The results of this study indicate that the largest group differences on adaptive skills are found from 2 to 6 months into treatment. Possibly, the effect of low intensity behavioral treatment diminishes over time. It remains to be investigated if this could explain the more modest results on adaptive behavior reported by Eldevik et al. (2006) after 2 years of treatment. In the present study the control group received treatment as usual, while the treatment group received an additional treatment. By contrast, the control group in Eldevik et al. (2006) received an eclectic treatment. Skills learned in the eclectic treatment as well as the expectations of the parents of the eclectic treatment could account for smaller group differences. This study found no treatment effect on symptom severity of ASD. However, it is unclear whether this can be attributed to the treatment or to

the sensitivity of the PDD-MRS, used to assess symptom severity of ASD. As this measure is a screening tool, the PDD-MRS may not be sensitive enough to measure treatment effects (Kraijer and de Bildt, 2005). In further research other instruments (e.g., CARS; Schopler, Reichler, & Rothen Renner, 2007) should be used to assess the treatment effect on symptom severity of ASD.

By contrast to this study and Eldevik et al. (2006) the Lovaas's study (1987) in which one of the control groups received less than 10 h behavioral treatment per week for 2–3 years no significant differences were found on IQ and school placement at all in comparison to another control group that did not receive behavioral treatment at all. As Eldevik et al. (2006) have stated, comparing the low intensity group of Lovaas' study to more recent research is complicated due to missing data on the exact training hours, advances in the treatment methodology and other methodological issues.

Anecdotally, parents and teachers of children in the experimental group reported as soon as after a few months into treatment that their child was more attentive to other people and events, more calm and concentrated. Some parents reported the most important improvement in the area of communication. Because the child understood the parents better and was better able to express his or her needs, challenging behavior was prevented, so parents could engage in every day situations (e.g., go to a store or visit family) with their child. Parents and teachers evaluated the learned ABA techniques as useful in coping with challenging behavior and teaching new skills to their child and used them in every day life.

This study has several limitations and strengths. Although typical for this kind of studies, the sample size is relatively small, the children are not randomly assigned to the treatment and control groups and the authors conducted part of the assessments (which is also mentioned by Eldevik et al., 2006). Although studies with random assignment to groups are superior, they are difficult to realize in clinical practice in terms of cost and ethics (Kasari, 2002; Matson & Smith, 2008). Selection on therapist availability is a common and a generally accepted alternative (see e.g., Smith et al., 1997).

Although more research is necessary in this area, preliminary results of this study suggest that children with ASD and ID may make significant gains with low intensity behavioral treatment. While treatment results are promising, the questions remains in which degree differences are clinically significant. Clinical significance is usually defined as returning to normal functioning (Jacobson, Roberts, Berns, & McGlinchey, 1999) and in this study treatment did not enable any of the participants to perform in the average range of functioning. Although the differences between the treatment group and the control group of this study are substantially smaller than in other EIBI studies (e.g. Lovaas, 1987; Sallows & Graupner, 2005), the participants were intellectually more impaired and the intervention period was relatively short. Further research over a longer period of time including measures of social validation is necessary to conclude if low intensity behavioral treatment supplementing preschool based services is an effective option if intensive behavioral treatment is not possible.

Acknowledgements

This study was funded by Stichting De Driestroom, Elst (The Netherlands). We thank parents and teachers for their participation.

References

- Achenbach, T. M., & Rescorla, L. A. (2000). *Manual for the ASEBA preschool forms & profiles*. Burlington: University of Vermont.
- Carpentieri, S., & Morgan, S. B. (1996). Adaptive and intellectual functioning in autistic and nonautistic retarded children. *Journal of Autism and Developmental Disorders*, 26, 611–620.
- Cohen, H., Amerine-Dickens, M., & Smith, T. (2006). Early intensive behavioral treatment: Replication of the UCLA model in a community setting. *Developmental and Behavioral Pediatrics*, 27, 145–155.
- de Bildt, A. A., & Kraijer, D. W. (2003). *Sociale redzaamheidschaal voor kinderen en jeugdigen met een verstandelijke beperking*. Leiden: Pits.
- de Bildt, A., Kraijer, D., Sytema, S., & Minderaa, R. (2005). The psychometric properties of the Vineland Adaptive Behavior Scales in children and adolescents with mental retardation. *Journal of Autism and Developmental Disorders*, 35, 53–62.
- Eikeseth, S. (2001). Recent critiques of the UCLA young autism project. *Behavioral Interventions*, 16, 249–264.
- Eikeseth, S. (2009). Outcome of comprehensive psycho-educational interventions for young children with autism. *Research in Developmental Disabilities*, 30, 158–178.
- Eikeseth, S., Smith, T., Jahr, E., & Eldevik, S. (2002). Intensive behavioral treatment at school for 4- to 7-year-old children with autism: A 1-year comparison controlled study. *Behavior Modification*, 26, 49–68.
- Eikeseth, S., Smith, T., Jahr, E., & Eldevik, S. (2007). Outcome for children with autism who began intensive behavioral treatment between age four and seven: A comparison controlled study. *Behavior Modification*, 31, 264–278.
- Eikeseth, S., Hayward, D. W., Gale, C., Gitlezen, J. P., & Eldevik, S. (2009). Intensity of supervision and outcome for preschool aged children receiving early and intensive behavioral interventions: A preliminary study. *Research in Autism Spectrum Disorders*, 3, 67–73.
- Eldevik, S., Eikeseth, S., Jahr, E., & Smith, T. (2006). Effects of low-intensity behavioral treatment for children with autism and mental retardation. *Journal of Autism and Developmental Disorders*, 36, 211–224.
- Eldevik, S., Hastings, R. P., Hughes, J. C., Jahr, E., Eikeseth, S., & Cross, S. (2009). Meta-analysis of early intensive behavioral intervention for children with autism. *Journal of Clinical Child and Adolescent Psychology*, 38, 439–450.
- Green, G. (1996). Early behavioral intervention for autism: What does research tell us? In C. Maurice (Ed.), *Behavioral intervention for young children with autism* (pp. 29–44). Austin, TX: Pro-Ed.
- Green, G., Brennan, L. C., & Fein, D. (2002). Intensive behavioral treatment for a toddler at high risk for autism. *Behavior Modification*, 26, 69–102.
- Harris, S. L., & Handleman, J. S. (2000). Age and IQ at intake as predictors of placement for young children with autism: A four- to six-year follow-up study. *Journal of Autism and Developmental Disorders*, 30, 137–142.
- Hartley, S. L., Sikora, D. M., & McCoy, R. (2008). Prevalence and risk factors of maladaptive behaviour in young children with Autistic Disorder. *Journal of Intellectual Disability Research*, 52, 819–829.
- Hayward, D. J., Gale, C. M., & Eikeseth, S. (2009). Intensive behavioural intervention for young children with autism: A research-based service model. *Research in Autism Spectrum Disorders*, 3, 571–580.

- Howlin, P., Magiati, I., & Charman, T. (2009). A systematic review of early intensive behavioural interventions (EIBI) for children with autism. *American Journal on Intellectual and Developmental Disabilities, 114*, 23–41.
- Jacobson, N. S., Roberts, L. J., Berns, S. B., & McGlinchey, J. B. (1999). Methods for defining and determining the clinical significance of treatment effect: Description, application and alternatives. *Journal of Consulting and Clinical Psychology, 67*, 300–307.
- Johnson, E., & Hastings, R. P. (2001). Facilitating factors and barriers to the implementation of intensive home-based behavioral intervention for young children with autism. *Child: Care, Health & Development, 28*, 123–129.
- Kasari, C. (2002). Assessing change in early intervention programs for children with autism. *Journal of Autism and Developmental Disorders, 33*, 447–461.
- Kraijer, D. W. (1999). *Handleiding AVZ-R. Autisme- en Verwante stoornissenschaal-Z-Revisie (3e herziene en uitgebreide uitgave)*. Lisse: Swets & Zeitlinger.
- Kraijer, D., & de Bildt, A. (2005). The PDD-MRS: An instrument for identification of autism spectrum disorders in persons with mental retardation. *Journal of Autism and Developmental Disorders, 35*, 499–513.
- Leaf, R., & McEachin, J. (1999). *A work in progress*. New York: DLR Books.
- Lovaas, I. O. (1987). Behavioural treatment and abnormal educational and intellectual functioning in young autistic children. *Journal of Consulting and Clinical Psychology, 5*, 3–9.
- Lovaas, O. I. (2003). *Teaching individuals with developmental delays: Basic intervention techniques*. Austin, TX: Pro-Ed.
- Love, J. R., Carr, J. E., Almason, S. M., & Petursdottir, A. I. (2009). Early and intensive behavioral intervention for autism: A survey of clinical practices. *Research in Autism Spectrum Disorders, 3*, 421–428.
- Matson, J. L., & Smith, K. R. M. (2008). Current status of intensive behavioral interventions for young children with autism and PDD-NOS. *Research in Autism Spectrum Disorders, 2*, 60–74.
- McEachin, J. J., Smith, T., & Lovaas, O. I. (1993). Long-term outcome for children with autism who received early intensive behavioral treatment. *American Journal on Mental Retardation, 97*, 359–372.
- van der Meulen, B. F., Ruiters, S. A. J., Lutje Spelberg, H. C., & Smrkovský, M. (2002). *Bayley scales of infant development-II. Nederlandse versie*. Handleiding, Amsterdam: Harcourt.
- O'Brien, G., & Pearson, J. (2004). Autism and learning disability. *Autism, 8*, 125–140.
- Reichow, B., & Wolery, M. (2009). Comprehensive synthesis of early intensive behavioral interventions for young children with autism based on the UCLA young autism project model. *Journal of Autism and Developmental Disorders, 39*, 23–41.
- Rogers, S. J., & Vismara, L. A. (2008). Evidence-based comprehensive treatments for early autism. *Journal of Clinical Child and Adolescent Psychology, 37*, 8–38.
- Sallows, G. O., & Graupner, T. D. (2005). Intensive behavioral treatment for children with autism: Four-year outcome and predictors. *American Journal on Mental Retardation, 110*, 417–438.
- Schopler, E., Reichler, R. J., & Rochen Renner, B. (2007). *The childhood autism rating scale (CARS)*. Los Angeles, CA: Western Psychological Services.
- Schreibman, L. (2000). Intensive behavioral/psychoeducational treatments for autism: Research needs and future directions. *Journal of Autism and Developmental Disorders, 30*, 373–378.
- Sheinkopf, S. J., & Siegel, B. (1998). Home based behavioral treatment of young children with autism. *Journal of Autism and Developmental Disorders, 28*, 15–23.
- Smith, T., Eikeseth, S., Klevstrand, M., & Lovaas, O. I. (1997). Intensive behavioral treatment for preschoolers with severe mental retardation and pervasive developmental disorder. *American Journal on Mental Retardation, 102*, 238–249.
- Snijders, J. Th, Tellegen, P. J., Winkel, M., & Laros, J. A. (1996). *SON-R 2,5–7 Snijders-Oomen Niet-verbale Intelligentietest – Revisie [SON-R 2,5–7 Snijders-Oomen Nonverbal Intelligence Test – Revised]*. Lisse: Swets & Zeitlinger.
- Sparrow, S. S., Balla, D. A., & Cicchetti, D. V. (1984). *Vineland Adaptive Behavior Scales* (survey edition). Circle Pines, MN: American Guidance Service.