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Brief Report: A Theory-of-Mind-based Social-Cognition Training Program for School-Aged Children with Pervasive Developmental Disorders: An Open Study of its Effectiveness

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INTRODUCTION

Children with pervasive developmental disorders (PDD) are impaired by early onset difficulties in reciprocal social interaction. It has been proposed that this social impairment is the result of a lack of *Theory of Mind (ToM)*: the ability to attribute mental states (e.g., beliefs, desires, intentions, and emotions) to others and to use these in predicting and explaining the behavior of others (Baron-Cohen, 1995; Serra *et al.*, 1995). Research has shown that this ability is seriously impaired in autistic children (Baron-Cohen, Leslie, & Frith, 1985), and moderately impaired in children with Pervasive Developmental Disorders, Not Otherwise Specified (PDD-NOS) (Baron-Cohen & Swettenham, 1997; Happé, 1995; Perner & Wimmer, 1985). This impairment may limit PDD-NOS children in their understanding of humor and irony, and restrict their ability to take into account the interests and knowledge of a partner in social conversation (Serra, Loth, van Geert, Hurkens, & Minderaa, 2002).

The hypothesis that an underdeveloped ToM underlies social impairment in PDD-children has led to the development of social skill interventions targeted at improving ToM-abilities. Ozonoff and Miller (1995) were the first to develop a group-based social-skills training, that has been evaluated in a controlled study with five adolescents (mean age: 13.8 [SD: 0.24]; Full Scale IQ scores above 70) participating in treatment and four adolescents in a no-treatment control group. Within two weeks, post intervention meaningful change was found in the treatment group's performance on four false belief tasks (M&Ms False Belief Task, Perner, Frith, Leslie & Leekam, 1989; Second-Order Belief Attribution Task, Baron-Cohen, 1989; Overcoat Story, Bowler, 1992; Prisoner Story, Happé, 1994), and no improvement in the control sample. No changes, however, were demonstrated on parent and teacher ratings of social competence for either group.

Steerneman, Jackson, Pelzer, and Muris (1996) developed a program for children with social handicaps, including children with PDD (Steerneman *et al.*, 1996). The program is developed for children with a range of social problems, but its effectiveness has only been examined in a study with eight children (age 6–8 years) with relatively mild social anxiety and social aggression (Steerneman *et al.*, 1996). No children with PDD were involved in this study. Full scale IQ's varied between 88 and 112. Before the training, directly after completion and four months after completion, emotion recognition (Test of perception of emotion from facial expression & Test of perception of emotion from posture cues, Spence, 1980) and ToM (Sally and Anne-test, Wimmer & Perner, 1983; pencil and Smarties box-task, Perner & Wimmer, 1985) were assessed in the children. At the same times social skills as reported by teachers and parents were evaluated. Compared to controls

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(children with educational difficulties or behavior problems) the children in the training group performed better post-test and after four months on emotion recognition and ToM tasks. Both parents and teachers perceived an improvement in social skills for the training group relative to the pre-test measure.

The two studies suggest that it is possible to improve ToM–abilities through training, but show inconsistent results regarding the extent to which the improvement of ToM enhances social skills. The generalization of improved perspective-taking skills to settings outside the clinic may be especially difficult for PDD-children. Therefore it is noteworthy that the study that demonstrated an improvement did not include PDD-children (Steerneman *et al*., 1996).

The present study extends on previous ones in two ways:

1. The effectiveness of Steerneman *et al*.'s (1996) ToM-based social cognition training is assessed when offered to children with PDD-NOS
2. Components of ToM are assessed pre- and post-treatment with the TOM Test, an instrument that provides information about the developmental progression of ToM (Muris, *et al*., 1999). Furthermore socialization (including social skills) is assessed pre- and post-treatment through parent report.

METHOD

Subjects

Eighteen children (13 boys, 5 girls), ages 8–11 years, referred to a university clinic, took part in the study. After multidisciplinary assessment by a specialized team all eighteen met DSM-IV criteria (American Psychiatric Association, 1994) for PDD-NOS. All children had a verbal IQ over 85 (mean: 97.1; SD: 14.9) as assessed with the Wechsler Intelligence Scale for Children Revised (WISC-R, Wechsler, 1974).

Procedure and Design

ToM (TOM-test, Muris *et al*., 1999) offered to the child, and socialization (VABS, Sparrow, Balla, & Cicchetti, 1984) administered to the parents, were assessed prior to training and within four weeks after completion of the treatment, with an average time between of 7 months.

The social cognition training (Steerneman *et al*., 1996) is provided group wise to 5 or 6 children simultaneously. The training is offered in 21 weekly 60 min sessions, and is targeted at the development of ToM, after initially giving attention to skills such as making acquaintance with others, and to perception and imitation. The materials and pictures used in the training differ from those used in the ToM-test.

The social-cognition training includes five monthly sessions of psychoeducation of the parents, regarding PDD, the development of ToM and the content of the training. The parents are given suggestions how to promote social cognition through playing games and story telling.

Instruments

1. The TOM Test (Muris *et al*., 1999; Steerneman, Meesters, & Muris, 2000). The TOM test comprises an interview for children between 5 and 12 years of age and consists of vignettes, stories, and drawings about which the child has to answer a number of questions. There are three subscales: (a) precursors of theory of mind (i.e., TOM 1; 22 items; subdomains: perception and imitation; recognition of emotions; pretense; distinction physical–mental), (b) first manifestations of a real theory of mind (i.e., TOM 2; 38 items; subdomains: first-order belief, understanding of false belief), and (c) more advanced aspects of theory of mind (i.e., TOM 3; 12 items; subdomains: second order belief, understanding of humor). Total TOM scores range between 0 and 72, with higher scores indicating a more mature theory of mind. TOM 1, TOM 2, and TOM 3 subscale scores vary between 0 and 22, 0 and 38, and 0 and 12, respectively.

Validity and reliability of the TOM test have been established (Muris *et al*., 1999).

2. Vineland Adaptive Behavior Scales (VABS) (Sparrow *et al*., 1984). The VABS measures adaptive behavior in four domains: Communication, Daily Living Skills, Socialization, and Motor Skills. In this study only Socialization (subdomains: Interpersonal relationships, Play/leisure and Social skills) was assessed by administering the VABS to the parents. A developmental quotient was computed by dividing developmental age according to the VABS by chronological age. This allowed the comparison of functioning in the Socialization domain pre- and

post-treatment, while accounting for maturation during time of treatment.

RESULTS

The post-treatment ToM scores are higher on all subtests, except Emotion recognition (see Table I). A Sign-test of the differences pre- and post-treatment shows significant progress for Perception/imitation ($p = 0.000$), Pretense ($p = 0.039$), First order belief ($p = 0.001$), and Irony/humor ($p = 0.002$), on the three subscales, TOM 1 ($p = 0.000$), TOM 2 ($p = 0.001$), TOM 3 ($p = 0.001$), and for TOM total ($p = 0.000$).

The VABS developmental quotients show that all children function below age-level pre- and post-treatment (see Table II), but an analysis of the differences between pre- and post-treatment scores of adaptive functioning with the Sign test shows significant progress in all Socialization subdomains: Interpersonal relationships ($p = 0.021$), Play/leisure ($p = 0.013$) and Social Skills ($p = 0.000$).

DISCUSSION

This study investigated the effectiveness of a ToM-based social cognition training program (Steerneman *et al*., 1996), when offered to 8–11 year old PDD-NOS children of (at least) average verbal intelligence. The children showed significant progress on the subdomains perception/imitation, first order belief, pretense, and understanding of humor. Parents reported significant progress in adaptive behavior (VABS, Sparrow *et al*., 1984) on the Socialization subdomains interpersonal relationships, play/leisure and social skills.

No progress was found in the ToM-subdomains recognition of emotions, distinction physical–mental, understanding of false belief, and second order belief. This lack of progress has to be considered relative to the high scores on these domains before treatment—these left little room for improvement. The high scores on these subdomains pre-treatment contradict the growth pattern of ToM skills that has been found with normally developing children. A low pre-treatment score on perception/imitation (a skill that is seen early in development) apparently does not always preclude a relatively high pre-treatment score on understanding of false belief (a later developing skill). A deviant pathway of ToM development has been found in other studies of children with PDD as well (Serra *et al*., 2002).

It is remarkable that the PDD-NOS children in our study did not show a diminished ability to recognize emotions pre-treatment on the TOM test. Findings regarding emotion recognition in children with PDD-NOS are limited and conflicting (Buitelaar, van der Wees, Swaab-Barneveld, & van der Gaag, 1999). Serra *et al*. (1995) reported lower emotional role taking abilities in PDD-NOS children, when compared to typical children, in a study in which IQ was not included in the analyses. Buitelaar *et al*. (1999) did not find significant differences in emotion recognition between PDD-children, PDD-NOS children and psychiatric controls, when matched for age and verbal IQ. Muris *et al*. (1999) assessed lower emotion recognition skills in PDD-NOS children than normal controls with the TOM test. Note however that the average verbal IQ in the study of Muris *et al*. was lower than in our study (84.3; SD: 16.1 and 96.4; SD: 17.2 respectively).

Table I. Mean Scores (Standard Deviations) for TOM-Domains and Subdomains

Subdomain	Domain	Normgroup*	Pre-treatment	Post-treatment
Perception/imitiation		8.2 (1.2)	6.6 (1.5)	8.2 (1.2)
Emotion recognition		4.7 (0.5)	5.0 (0.0)	4.9 (0.2)
Pretense		4.8 (0.5)	4.1 (1.3)	4.8 (0.5)
Distinction physical–mental		2.7 (0.5)	2.8 (0.6)	2.9 (0.2)
	TOM 1	20.3 (1.7)	18.4 (2.4)	20.9 (1.2)
First order belief		29.3 (3.8)	24.3 (4.9)	29.6 (2.6)
False belief		2.7 (0.6)	2.6 (0.6)	2.7 (0.6)
	TOM 2	32.0 (3.9)	27.0 (4.8)	32.3 (3.0)
Second order belief		0.5 (0.5)	0.6 (0.5)	0.8 (0.4)
Irony/humor		7.7 (1.9)	6.9 (2.2)	8.7 (1.6)
	TOM 3	8.1 (1.9)	7.7 (2.4)	9.5 (1.9)
	TOM total	60.4 (5.8)	52.8 (7.8)	62.7 (5.2)

*Non-clinical population of Dutch children attending regular schools; Steerneman, Meesters, & Muris, 2000.

Table II. Mean Scores (Standard Deviations) for VABS-Socialization Subdomains

Socialization-subdomain	Pre-treatment developmental quotient	Post-treatment developmental quotient
Interpersonal relationships	0.36 (0.09)	0.42 (0.14)
Play/leisure	0.39 (0.10)	0.47 (0.10)
Social skills	0.51 (0.13)	0.61 (0.15)

The relatively good performance on false belief tasks of our children prior to treatment is not surprising. Other studies of PDD-NOS children have shown fairly good performance on these tasks (Happé, 1995; Serra *et al*., 2002). The relatively good pre-treatment performance in our group on second order belief tasks and in the recognition of the distinction between physical and mental is remarkable. Considering the small number of items these tasks are assessed with, and the measurement error this may create, it seems premature to speculate about the implications.

The parents report significant progress in socialization. This finding might point towards a generalization effect, with improved social cognitive abilities leading to an improvement of social skills in daily life. This is remarkable, considering the absence of an explicit training of social skills in the treatment that was provided. However, we have to consider the possibility that the improvement in social skills is not (only) the result of the social cognition training of the child, but is (also) brought forward by the psychoeducation and advice given to the parents in five monthly sessions. Furthermore, we cannot exclude the possibility that this result reflects a halo effect on the parents, who were not blind to the intervention and who presumably had positive expectations of the outcome of the treatment.

Limitations

Some limitations of this study have to be considered. First, it is an open study, without a control condition. This precluded differentiating progress in ToM abilities due to training or to developmental change (with regard to the latter, see Steele, Joseph, and Tager-Flusberg, 2003). Second, the sample size is rather small. Third, social cognition has been assessed only with a test of the domains that were targeted in the training. A broader assessment of social cognition skills would be able to show to what extent the development of social cognition in general is facilitated by this training. Fourth, the measurement of generalization to functioning in 'the real world,' is restricted to parent report. In further research, it will be helpful to include teacher report as well, in order to minimize positive bias from those who have actively participated in the treatment. Fifth, the simultaneous provision of a child directed social cognition training and a parent directed instruction, makes it difficult to distinguish the contribution of each intervention to the outcome. Research in which only one of these interventions is compared with a control condition, could provide more insight in the relative contribution of each. Sixth, long-term effects of the interventions have not been investigated in this study. Future studies should include the measurement of long-term effects, in order to be able to differentiate a short term catch up effect, from a more enduring improvement.

CONCLUSION

Despite the limitations, this first study of the Steerneman *et al*. program with a sample of PDD-children has produced promising, although preliminary results. School-aged PDD-children are able to profit from a Theory-of-Mind-based training aimed at the improvement of social cognitive skills, provided together with psychoeducation and instruction for the parents. Their parents report that the improvement generalizes to social functioning in their daily environment.

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