BRIEF REPORT

Brief Report: Effect of a Focused Imitation Intervention on Social Functioning in Children with Autism

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Abstract Imitation is an early skill thought to play a role in social development, leading some to suggest that teaching imitation to children with autism should lead to improvements in social functioning. This study used a randomized controlled trial to evaluate the effect of a focused imitation intervention on initiation of joint attention and social-emotional functioning in 27 young children with autism. Results indicated the treatment group made significantly more gains in joint attention initiations at post-treatment and follow-up and social-emotional functioning at follow-up than the control group. Although gains in social functioning were associated with treatment, a mediation analysis did not support imitation as the mechanism of action. These findings suggest the intervention improves social functioning in children with ASD.

Keywords Autism · Imitation · Intervention · Social · Reciprocal imitation training

Introduction

Imitation is an early emerging skill that serves an important cognitive and a social function in typical development (Uzgiris 1981). Children with autism exhibit significant deficits in imitation (Smith and Bryson 1994) as well as later emerging social behaviors (APA 2000), leading to the proposal that an early deficit in imitation could disrupt the development of intersubjectivity and lead to broader social impairments in autism (Rogers and Pennington 1991).

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Although it has yet to be established whether imitation deficits are a cause or a consequence of social impairment in autism, a number of studies have found a significant relationship between imitation and other social behaviors in children with autism, including social reciprocity and initiation of joint attention (e.g., McDuffie et al. 2007; Rogers et al. 2003). This relationship in combination with research on the role of imitation in typical social development, has led to the suggestion that teaching imitation should lead to broader improvements in social functioning in children with autism (Ingersoll 2008; McDuffie et al. 2007; Rogers 1999). Given the pervasive deficits in social behavior in autism, the possibility that a focused imitation intervention could lead to broader gains in social functioning is important to investigate.

Reciprocal Imitation Training (RIT) was developed to teach the social function of imitation to young children with autism (Ingersoll 2008). RIT uses a blend of naturalistic behavioral and developmental strategies to teach imitation within a social-interactive context. A series of single-subject design studies (Ingersoll et al. 2007; Ingersoll and Schreibman 2006) and a small randomized controlled trial ($n = 21$) (Ingersoll 2010) have shown RIT to be efficacious for increasing spontaneous object and gesture imitation in young children with autism. Importantly, one single-subject design study found collateral improvements in coordinated joint attention during RIT intervention sessions for four of five participants (Ingersoll and Schreibman 2006). To further validate the efficacy of this approach for improving social functioning more broadly in young children with autism, it is necessary to apply the gold standard of a randomized controlled trial and standardized assessments of social functioning. Further, although improvements in coordinated joint attention occurred at the onset of treatment, it could not be

established that gains in imitation were responsible for these improvements. Thus, it is important to examine whether improvement in social behaviors are a result of the intervention's effect on imitation.

The primary goal of study was to investigate whether a focused imitation intervention results in broader gains in social functioning in young children with autism. For this study, we examined both a specific indicator of social functioning, initiation of joint attention, as well as a general indicator of social functioning, parent report of social-emotional skills. A secondary goal was to examine whether improvements in social functioning were a result of the intervention's effect on the children's imitation skills.

Methods

Participants

Participants were 29 children with autism between 27 and 47 months. Pre- and post-treatment imitation data from 22 of these children were presented in a previous paper that examined the effect of RIT on imitation (Ingersoll 2010). One child in the control group withdrew from the study after pre-treatment assessments due to his family's busy schedule. One child in the treatment group withdrew after 6 sessions due to the excessive commute to the treatment site (>1 h each way). This yielded a total of 27 children included in the final data analysis. Neither child's scores on any of the pre-treatment measures were outside of the range of the children who completed the intervention. All children received a clinical diagnosis of autistic disorder (autism) based on DSM-IV-TR criteria from a licensed psychologist and met the cut-off for autism or autism spectrum disorder on the Autism Diagnostic Observation Schedule-Generic (ADOS-G; Lord et al. 2000) (see Table 1).

Design and Procedure

Children were administered standardized assessments of cognitive, language, and social functioning at pre-treatment. Children were matched within three months on expressive language age on the *Preschool Language Scale, 4th Edition* (PLS-4; Zimmerman et al. 2002) and randomly assigned to the treatment ($n = 14$) or control group ($n = 13$) using a coin flip. Children in the treatment group received 3 h per week of RIT for 10 weeks and children in the control group received treatment as usual in the community. All children continued to receive their existing educational programming throughout the study. Programming involved a variety of interventions, including special education/early intervention services, speech-language pathology services, occupational therapy, in-home applied behavior analysis. There were no differences between groups in number of hours or type of outside therapy received.

Dependent Measures

Two social measures were administered at pre-treatment, post-treatment, and 2–3 month follow-up to determine the effect of RIT on social development. The *Early Social Communication Scales* (ESCS; Seibert et al. 1982) uses a series of activities and adult prompts to examine the child's ability to engage in social interaction with the examiner. The ESCS was administered by masters' level clinicians. With a few exceptions, the same examiner administered the ESCS for each child at all three time points. The children's total number of lower and higher level joint attention initiation bids was used as measure of initiation of joint attention (IJA). Reliability was calculated by two independent raters on 25% of the observations using percent agreement [(smaller number/larger number) × 100], yielding agreement of 80% (range 40–100%).

Table 1 Participant characteristics

	Group M (SD)		*p* value
	Treatment ($n = 14$)	Control ($n = 13$)	
Gender (% male)	93%	85%	n.s.
Ethnicity (% minority status)	36%	39%	n.s.
Chronological age[a]	39.3 (7.3)	36.5 (8.0)	n.s.
Range	22–47	26–47	
Nonverbal mental age[a] (Bayley)	20.8 (6.6)	17.9 (7.5)	n.s.
Range	8–30	7–30	
Expressive language age[a] (PLS-4)	17.3 (5.5)	16.2 (5.9)	n.s.
Range	9–23	6–23	
Outside intervention per week	11.0 (8.1)	13.2 (8.8)	n.s.
Range	1.25–25.5	.25–25	

[a] Months

The *Social-Emotional Scale* of the *Bayley Scales of Infant Development, 3rd Edition* (Bayley 2005) was administered only at pre-treatment and follow-up. The *Social-Emotional Scale* is a standardized parent-report measure of social and emotional development that was adapted from the *Greenspan Social-Emotional Growth Chart* (Greenspan 2004). It assesses acquisition of social and emotional milestones in young children, including self-regulation and interest in the world, communicating needs, engaging others and establishing relationships, using emotions in an interactive, purposeful manner, and using emotional signals or gestures to solve problems (Bayley 2005). The score for one child in the control group was missing for this assessment at follow-up.

Two imitation measures were administered at pre- and post-treatment and were used in the mediation analysis.[1] The *Motor Imitation Scale* (MIS; Stone et al. 1997) included 8 object and 8 gesture imitation tasks administered in a structured setting. The *Unstructured Imitation Assessment* (Ingersoll 2010) included 10 object and 10 gesture imitation tasks administered in a social context. Responses for both measures were scored on a 3-point scale: a "2" was recorded if the child produced an exact imitation, a "1" was recorded if the child produced an emerging response (e.g., the child attempted to manipulate the toy in the correct manner, but failed to complete the act exactly as modeled), and a "0" was recorded if the child failed to imitate. For each action, only the best trial was recorded. Scores could range from 0 to 32 for the MIS and 0–40 for the UIA. Reliability was calculated by two independent raters on 25% of the observations. Cohen's Kappa collapsed across items and participants was .93 for the MIS and .84 for the UIA.

Treatment

Children in the treatment group received RIT targeting object and gesture imitation[2] 1 h per day, 3 days per week for 10 weeks. Treatment was conducted in a small room with pairs of identical play materials. RIT uses several naturalistic techniques to teach imitation during social interaction with a responsive partner. To promote reciprocity, the therapist contingently imitated the child's verbal and nonverbal behavior, described the child's actions using simplified language, and expanded the child's utterances. To teach imitation, the therapist modeled an action, either with an object or a gesture, once a minute on average. Actions were modeled up to three times, paired

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[1] Outcome data based on the imitation measures were reported elsewhere (Ingersoll 2010).

[2] Gestures were not targeted for three children due to their low developmental age (<15 months).

with a verbal marker describing the action. If the child did not imitate the action within 10 s of the third model, the therapist physically prompted the child to complete the action. The therapist praised the child for imitation and returned to using contingent imitation and describing the child's play. Other social behavior, including initiation of joint attention, was not prompted or systematically reinforced.

Therapist Training and Fidelity of Implementation

All therapy was conducted by undergraduate and graduate-level research assistants. Each child worked with at least three different therapists throughout treatment to promote generalization. Therapists were trained to 90% correct implementation in RIT through didactic presentation, observation of the intervention techniques, and feedback from experienced masters' level clinicians during their first several sessions. Fidelity of implementation was scored on 10% of the sessions using the RIT Fidelity Form (Ingersoll and Lalonde 2010). Fidelity of implementation was high across sessions (mean = 4.7 out of 5; range = 3.3–5.0).

Results

Primary Data Analysis

The children's performance on each measure was compared for the two groups using a mixed model ANOVA with time (pre, post, follow-up) as the within group variable and group (treatment vs. control) as the between group variable. There was a main effect of group, $F(1, 25) = 4.90$, $p < .05$, $\eta_p^2 = .16$ on joint attention initiations on the ESCS, such that the treatment group had a higher frequency of joint attention initiations than the control group. This main effect was driven by a significant time by group interaction, $F(2, 50) = 3.78$, $p < .05$, $\eta_p^2 = .13$ such that treatment group made more gains in joint attention initiations than the control group over time. Post hoc comparisons of the simple effects showed that the treatment group made significantly more joint attention initiations at follow-up than pre-treatment ($p < .05$). The treatment group also made significantly more joint attention initiations than the control group at post-treatment ($p < .05$) and follow-up ($p < .05$) (see Fig. 1).

There was a significant main effect of time, $F(1, 24) = 30.28$, $p < .01$, $\eta_p^2 = .56$ for the *Social-Emotional Scale*, such that parents rated their children higher at follow-up than pre-treatment. There was also a significant time $\times$ group interaction, $F(1, 24) = 6.20$, $p = .02$, $\eta_p^2 = .21$, indicating that the treatment group made substantially more gains on this measure at follow-up than the
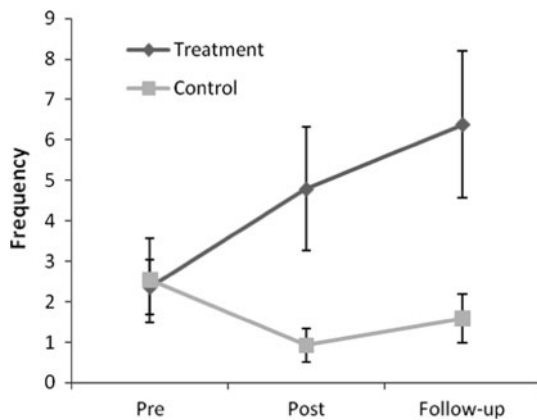
Fig. 1 Initiation of joint attention on the ESCS at pre-treatment, post-treatment, and follow-up by group. *Error bars* represent standard error
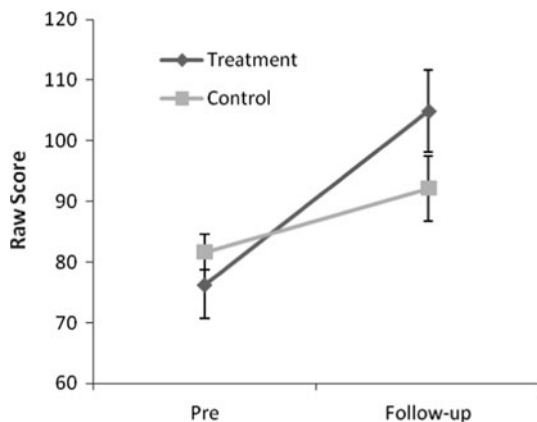

Fig. 2 Social-emotional functioning on the *social-emotional scale* at pre-treatment and follow-up by group. *Error bars* represent standard error

control group. Post hoc tests of simple effects suggested that both the treatment ($p < .001$) and the control group ($p < .05$) had higher scores on the *Social-Emotional Scale* at follow-up than pre-treatment (see Fig. 2).

Secondary Data Analysis

To examine whether changes in imitation were responsible for improvement in social functioning, a mediation analysis was conducted using the Sobel test described by Baron and Kenny (1986). We converted the two social measures to z-scores and combined them to produce a single measure of social functioning at pre-treatment and follow-up. We created a change score by subtracting the pre-treatment from the follow-up score. We conducted the same procedure with our imitation measures to produce an overall measure of change in imitation from pre- to post-treatment. Statistical mediation can be said to occur if: (1) the

treatment is related to change in the outcome (social functioning); (2) the treatment has an effect on the proposed mediator (imitation); (3) the mediator is related to therapeutic change; (4) The relation between the intervention and therapeutic change is reduced after statistically controlling for the proposed mediator (Kazdin and Nock 2003). Although the first three criteria of mediation were met, the fourth criterion was not, $z = -.81$, ns, leading us to retain the null hypothesis.[3]

Discussion

This study examined the effect of a focused imitation intervention on social functioning in young children with autism. Children in the treatment group made significantly greater gains in their initiation of joint attention at post-treatment and follow-up than the control group. Further, the children in the treatment group made greater gains in social-emotional functioning at follow-up than the control group. These findings replicate and extend our previous findings of collateral improvements in social behavior as a result of RIT (Ingersoll and Schreibman 2006) using a more controlled design and standardized measures of social functioning.

Although we found evidence for an effect of the treatment on social functioning, the hypothesized mechanism of this effect, improvement in imitation, was not supported by the mediation analysis. One possibility is that we were underpowered to detect an effect of mediation due to our relatively small sample. However, an alternative explanation is that the intervention was responsible for gains in social functioning via some other mechanism. RIT targets the two components of imitation that are involved in reciprocal imitation: Imitation production and imitation recognition. There is limited research on imitation recognition in children with autism. What has been done suggests that there is some evidence that they can recognize when their actions are being imitated as indicated by social signaling, as well as increased attention to and "testing" of the examiner (Nadel 2002). However, children with autism appear to be less responsive to being imitated than typical children or children with developmental delay (Lewy and Dawson 1992), and, unlike typical infants, do not tend to show an understanding of the imitator's intention to imitate (Nadel 2002). These findings suggest a possible impairment in imitation recognition in young children with autism. There is also evidence that prolonged imitation of their behavior can increase social responsiveness and

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[3] Given our small sample size, we also used the bootstrapping multivariate extension of the Sobel test developed by Preacher and Hayes (2004) to test for mediation. The results were unchanged.

coordinated joint attention in children with autism, suggesting that imitation recognition is responsive to intervention (Escalona et al. 2002; Tiegerman and Primavera 1984). In our previous single-case study, we found gains in coordinated joint attention in the first phase of treatment which involved only contingent imitation and linguistic mapping (Ingersoll and Schreibman 2006), suggesting that the beneficial effect of RIT on social behavior may be due, at least in part, to the intervention's effect on imitation recognition. Research that can examine this possibility is necessary.

This possibility leads us to question whether direct instruction in imitation production is necessary to achieve gains in social functioning. Several findings lead us to conclude that it is. First, previous research has shown only short-term benefits of contingent imitation; its removal resulted in a return to baseline rates of eye gaze (Dawson and Galpert 1990) and attention to therapist (Harris et al. 1987). In our study, gains in joint attention skills were found on a separate behavioral measure administered outside of the treatment context (i.e., not during contingent imitation) both at post-treatment and at a two- to three-month follow-up. Second, treatment gains were also found on a parent report measure that assesses a wider range of social skills than those identified in previous studies of contingent imitation. Both of these findings suggest that other aspects of the intervention were important for supporting continued social development (Ingersoll and Schreibman 2006). Third (Nadel and Peze 1993) found that contingent imitation alone did not teach role switching in children with autism. In typical development, it is this alternation between being the imitator and the imitatee that conveys social interest in a partner (Nadel 2002; Uzgiris 1981) and lays the foundation for more sophisticated social exchanges (Eckerman et al. 1989). Future dismantling research is needed to determine the active treatment components, both for teaching imitation, the primary target of the intervention, as well as social interaction.

There are several limitations to this study that should be acknowledged. The therapists, examiners, and parents were not blind to the children's group assignment and the control group did not receive an active treatment. These aspects may have affected the expectancies of the parents or examiners. In addition, all of the children continued to receive their existing educational programs, which involved various combinations of special education/early intervention, speech, occupational therapy, and in-home ABA. Although the groups did not differ in the type and amount of services received per parent report, it is unclear which specific skills and treatment strategies were being used. Thus, it is possible that the groups did differ in some important ways on these variables or that the services that the treatment group received interacted with the

intervention in this study, enhancing child response. Finally, this study only followed participants for two to three months post-treatment. It is hoped that the gains observed in social functioning in the treatment group would continue over time; however, additional research regarding the longer term efficacy of this approach for improving social functioning is needed.

In sum, our findings suggest that that a low-intensity, focused intervention targeting imitation can significantly improve autism-specific deficits in social functioning that sustain (or continue to improve) two to three months after program completion. It also adds to the growing body of literature which suggests that short-term focused interventions can lead to broader improvement in developmental skills in children with autism (Kasari et al. 2008). In this study, gains in social functioning could not be attributed to the intervention's effect on the children's imitation; rather, social improvements were likely result of the intervention's effect on some other behavior, possibly imitation recognition. Research on the longer term effects of the intervention on wider range of social behavior is needed.

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