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Increasing Responsive Parent–Child Interactions and Joint Engagement: Comparing the Influence of Parent-Mediated Intervention and Parent Psychoeducation

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Abstract

Enhancing immediate and contingent responding by caregivers to children’s signals is an important strategy to support social interactions between caregivers and their children with autism. Yet, there has been limited examination of parents’ responsive behaviour in association with children’s social behaviour post caregiver-mediated intervention. Eighty-five dyads were randomized to one of two 10-week caregiver-training interventions. Parent–child play interactions were coded for parental responsivity and children’s joint engagement. Significant gains in responsivity and time jointly engaged were found post JASPER parent-mediated intervention over a psychoeducation intervention. Further, combining higher levels of responsive behaviour with greater adoption of intervention strategies was associated with greater time jointly engaged. Findings encourage a focus on enhancing responsive behaviour in parent-mediated intervention models.

Keywords

Parent-mediated intervention; JASPER; Toddlers; Autism; Responsivity; Joint engagement

Introduction

A responsive parenting interaction style has been defined as when parents notice and then, contingently act on their children’s interests, body language, speech, and nonverbal communication (Mahoney and Perales 2003). This notion of contingent responding to

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children's behaviour is common to early intervention models that focus on teaching parents strategies to interact with their children. In both typical and atypical development, studies have demonstrated that a parents' interaction style can be influenced; however, the corresponding influence of this change on children's behaviour is not yet clear.

The clarity of a child's communicative bids may also influence a parent's responsiveness where infrequent, idiosyncratic and unclear bids may be less easily detected by the caregiver (Doussard-Roosevelt et al. 2003). For children who demonstrate delays in critical early social communication skills including the ability to share an interaction with another person (joint engagement: Adamson et al. 2009), supporting parents' ability to notice and contingently respond to emerging social communication bids can provide additional learning opportunities for the child (Sameroff and Fiese 2000). Thus, teaching parents to interpret these cues is an important goal across early interventions.

A focus on responsivity can be found in models that vary in teaching strategies from direct mass trialed teaching (e.g., reinforcement for a correct response) through naturalistic developmental behavioural interventions (e.g., responding to a play action or social comment) as well as delivery contexts from discussion based education programs through hands on live coaching. The goal of the current study is to examine changes in parental responsive behaviour in two different intervention contexts including a parent education talk based intervention and a parent-mediated intervention both focused on enhancing social interactions between caregivers and their children with autism spectrum disorder (ASD).

Parents' Responsive Behaviour

Parents' interaction style can be viewed as a continuum of behaviour from responsive through directive styles. To be considered highly responsive, parents must provide developmentally appropriate and timely responses to not only the child's overt communicative bids, but also subtle bids including eye gaze, physical orientation, facial expression, and gestures (Warren and Brady 2007). Responsive interactions also include limited redirection of the child's attention to the adult's interests, and few adult commands to control the interaction-rather these behaviours characterize a directive interaction style. Within the extant literature on typical development, a responsive style has been associated with advances in children's play skills (e.g., Bornstein and Tamis-LeMonda 1997), language (e.g., Tamis-LeMonda et al. 2001), and social skills (e.g., Landry et al. 2000). These associations have not been found with other parental styles, such as directiveness.

Exploration of parental responsiveness over the course of early childhood indicates that parental responsivity is dynamic, changing over time as children's initiations change with development (Bornstein et al. 2008). Therefore, characteristics of children and their communicative bids may influence parental responsivity. This may be important for special populations of children who may demonstrate poor "readability" or clarity of their social communication bids such as children with ASD. Poor clarity in children's bids has been found to impact parents' ability to notice and scaffold a child's behaviour (Adamson et al. 2012).

Longitudinal Associations: Responsivity and Child Outcomes in Atypical Development

Parental verbal responsivity has been linked to social initiations for children with ASD where increases in verbal responsivity including commenting on the child's attentional focus, expanding children's communication and prompting language can lead to gains in concurrent prompted and spontaneous language (Venker et al. 2012). Responsive interactions also predict language gain scores 3 years later for children with ASD (Haebig et al. 2013) and 6 years later for children with Fragile X (Brady et al. 2014). Further, parental responsivity has also been associated with the amount of time children spend jointly engaged, a state of engagement where children coordinate attention between a *shared* activity and their interaction partner (Patterson et al. 2014; Ruble et al. 2008). In children with ASD, joint engagement has been linked to gains in spoken language (Kasari et al. 2008).

Young typically developing (TD) children easily spend the majority of their play-based interactions with parents jointly engaged (e.g., Adamson et al. 2004). Yet, in comparison to TD children matched for language level, children with ASD are spending only a fraction of that same time jointly engaged (Adamson et al. 2009). Time jointly engaged is associated with language development (e.g., Kasari et al. 2008) and social behaviour including social initiations and joint attention (e.g., Patterson et al. 2014). Children with ASD who already experience significant challenges in social communication are further at risk to miss out on daily language learning opportunities offered through time jointly engaged. Due to the significant role of joint engagement in children's development, it is critical to target joint engagement for children with ASD in order to maximize their opportunities to learn from interactions with parents. Evidence of improvement in child-initiated joint engagement for children with ASD is found in a number of recent randomized controlled trials of parent-mediated interventions (Kasari et al. 2010, 2014a, b, 2015). While time jointly engaged is positively associated with parental responsive behaviour at baseline of intervention (Patterson et al. 2014), parental responsiveness has not been examined in relation to changes in joint engagement over the course of a parent-mediated intervention.

Parent-Mediated Interventions: Influence on Parents' Responsive Behaviour

Parent-mediated interventions often center on increasing parental responsiveness as a means to improve child outcomes. For example, quasi-experimental studies focusing on dyads including children with ASD have reported on the implementation of Responsive Teaching, an intervention explicitly designed to enhance caregiver responsivity (Mahoney and Perales 2003). Findings document increases in parents' responsive behaviour and children's social interactive behavior (Kim and Mahoney 2005; Mahoney and Perales 2003).

When responsiveness is examined in randomized controlled trials, the evidence is less clear for improvements in child outcomes as a result of improvements in parental responsive behavior. For example, examinations of parental synchrony (parental verbal behaviour

directed to the child's focus of attention and actions: Siller et al. 2013 and a construct congruent to responsivity) indicate that parental synchrony can be improved but effects on child outcomes are mixed. Pickles et al. (2015) report partial mediation of the effect of the Preschool Autism Communication Trial (PACT) treatment on autism symptoms by both parent synchrony and child initiations. However, intervention studies of the Focused Playtime Intervention targeting parental synchrony (Siller et al. 2013; Kasari et al. 2014a, b) have focused on improved outcome in children's communication skills. In the case of these two studies, both documented increases in parental responsivity post treatment, however, Kasari et al. (2014a, b) found no related gains in children's communication outcomes and Siller et al. (2013) found only small gains for children with the greatest language delays. Further, responsiveness measured as a result of the parent-mediated Early Start Denver Model reported no significant effect of treatment over community control on parents' responsivity or children's social attention or initiations (Elder 2011; Rogers et al. 2012).

The Current Study

Directly targeting responsiveness in parents increases their responsiveness to their children in some models of early intervention but current data do not clearly support changes in their children's behaviors. This paper examines the differential influence of two parent intervention packages on parents' responsive behaviour and the cascading association between their responsive behaviour and the time spent jointly engaged with their children. Therefore, the purpose of the current study was two fold. First, we examine how parents' responsive behaviour changes over the course of participation in a parent-mediated social communication intervention for toddlers with ASD (JASPER: Joint Attention, Symbolic Play, Engagement, and Regulation-Kasari et al. 2006, 2010, 2014a, b) versus participation in an individual parent education intervention. The interventions differed in delivery context (parent mediated vs. individual discussion) and content (see methods section and "Appendix" for full description of intervention conditions). We hypothesized that parents in the parent-mediated condition (JASPER) would show increases in responsive behaviour over those in the psychoeducation arm referred to as the Parent Education Intervention (PEI). Although the parent-mediated JASPER intervention focuses specifically on teaching parents strategies to increase social communication and language outcomes, parent's global responsiveness to their children's behaviour may also improve.

Second, we examine the relationship between parents' responsive behaviour and children's joint engagement over the course of the intervention and the 6-month follow up period. We hypothesized that greater responsive behaviour would be associated with more time jointly engaged with children in child-initiated activities. In addition, we hypothesized that parents who demonstrated a combination of implementation of JASPER strategies along with high responsivity would have the most success engaging their children.

Methods

Participants

Children—The current study included 85 of the 86 toddlers enrolled in a larger randomized controlled intervention trial (Kasari et al. 2015). One child was excluded because the

primary measure examined in this study (parent–child interaction video) was missing at entry. Inclusion criteria for the intervention required that children were 36 months of age or younger at study entry, had no significant physical disabilities, and had received a diagnosis of ASD confirmed by independent assessors using the Autism Diagnostic Observation Schedule (ADOS: Lord et al. 2001) and Autism Diagnostic Interview Revised (ADI-R: Lord et al. 1993). Children were recruited from an outpatient early intervention program providing 30 h per week of combined behavioural, speech, and occupational therapies. Children were primarily male ($n = 70$) with an average chronological age of 31 months ($SD = 3$ months). About 40 % of the parents identified their children as non-White: African American ($n = 2$), Asian ($n = 10$), Hispanic ($n = 7$) or mixed race ($n = 14$). The majority of toddlers were identified as Caucasian ($n = 52$). Developmental level was assessed using the Mullen Scales of Early Learning (MSEL: Mullen 1995). Children's average score on the MSEL at entry was 68.16 ($SD = 20.41$). Children's receptive and expressive language skills were measured using the Reynell Developmental Language Scales (Reynell and Gruber 1990). Children's average receptive language age equivalent score at entry was 15.65 months ($SD = 7.44$ months), and average expressive language age equivalent score was 14.02 months ($SD = 5.21$ months). See Table 1 for participant characteristics by treatment group. At the end of the 10-week intervention, 83 toddlers completed exit assessments. Finally, 72 dyads returned for the 6 month follow up visit. Consistent with intent to treat analyses, all dyads were included in the analyses.

Parents—Each family identified one primary caregiver to participate in the intervention sessions and parent–child interaction tapings. Additional caregivers were invited to observe. The 85 caregivers were primarily mothers ($n = 76$) with eight fathers and one grandmother. Caregivers were primarily college educated ($n = 38$ undergraduate, $n = 28$ graduate) with several parents completing some college ($n = 14$), specialized training ($n = 2$) or high school ($n = 3$).

Procedures

Design and Intervention—Children were randomized to one of two 10 week-long treatment arms including JASPER, a parent-mediated intervention, and a Parent Education Intervention (PEI). Randomization was conducted by an independent data-coordinating center. In the parent-mediated intervention arm participants received one-to-one live coaching for 1 h weekly in a targeted social communication intervention: Joint Attention Symbolic Play, Engagement, and Regulation (JASPER). JASPER intervention focuses on children's spontaneous initiations of social communication gestures, language, and play acts. Parents are taught the developmental sequence of these target communication and play skills, and then coached through a package of strategies to target developmentally appropriate skills within the context of play with toys and people. High quality JASPER asks caregivers to go beyond just responding. The intervention goes into depth about the way the caregiver is to respond and the quality of that response. Therefore, although the coaching support includes contingent responding, the parent is also taught to use specific strategies to provide a rich, high quality response to children's communication, and play behaviours. For example, caregivers are taught to focus on how and when to structure the environment, how and when to prompt, how to create developmentally appropriate play routines, how to

expand children's communication- in each of these examples, parents are asked to do more than just follow in on the child's lead. Parents were taught to deliver the JASPER intervention with their child with live support from a trained clinician who modeled the strategies and then provided verbal feedback as the parent practiced the strategies with his/her child. Families who were randomized to the PEI intervention also received weekly 1-h intervention, however, the child was not present for the sessions. The parent spoke one-on-one with a trained interventionist who followed a manualized protocol (Brereton and Tonge 2005) designed to focus on improving parental understanding of ASD, and strategies to improve their child's developmental outcomes. The protocol includes information about autism, child development, communication and social interaction skills, behavioural principles for managing challenging behaviour and strategies for teaching new skills. For further information about the interventions, please see Kasari et al. (2015).

Measures—Children completed two assessments including: the Mullen Scales of Early Learning (MSEL: Mullen 1995), and a 10-min caregiver-child play interaction (CCX) with a standard set of toys (including a ball, pop-up toy, blocks, figurines with bikes, dinosaurs, dishes, dolls, furniture, shape-sorter, and bus). Parents were asked to play with their child as they typically would. The CCX videotapes were coded for parental responsive behaviour, parents' adoption of JASPER strategies, as well as children's joint engagement.

Parents' Responsive Behaviour—The Maternal Behaviour Rating Scale (MBRS: Mahoney et al. 1986) characterizes parents' interactive behaviour. The validity of the MBRS subscales have been examined through factor analysis (Mahoney et al. 1986) and the MBRS has been used previously across atypical populations and interventions with high reliability (e.g., Fewell and Deutscher 2002; Kim and Mahoney 2005; Patterson et al. 2014). High reliability has been demonstrated with the scale items when applied to families of TD children as well as children with developmental delays including ASD (e.g., Kim and Mahoney 2005). The coding system includes 12 items representing responsiveness, affect, achievement orientation, and directiveness. The responsiveness item is the focus of the current study. Responsiveness was operationalized as a "parent's active and appropriate response to the child's actions on objects as well as both verbal (e.g., vocalizations, language) and nonverbal communication and behaviour (e.g., gestures, body language, facial expression)" (Mahoney and Perales 2003). While highly sensitive parents may monitor and notice the child's bids, the definition of responsivity requires that the parent take an action based on what they observe. An "appropriate" response is one that follows in on the child's attentional focus and fits the intent of the child's communicative bid rather than responding by redirecting the child's attention or by ignoring the bid. However, interruption of dangerous or highly inappropriate behaviour would not be counted against the responsive behaviour score. Responsivity was scored on a scale of 1–5 where the score represented behaviour throughout the 10-min interaction. A score of 1 on the MBRS represented chronic lack of response to the child's behaviour, while a 5 represented a parent who responded immediately and appropriately to both overt bids (e.g., spoken language) and subtle bids (e.g., eye contact, body orientation, facial expression). Two raters blind to child condition and time point including one undergraduate student and one graduate student independently coded the data after reliability had been established using training videos. Inter-rater

reliability (Cohen's Kappa) was calculated based on double coding of a random 25 % ($n = 60$) of the sample across participants, treatment arms, and time points. Kappa scores indicate high reliability for MBRS responsiveness (0.89).

Joint Engagement in Child-Initiated Activities—Children's joint engagement was coded from the CCX video using an adapted schema from Adamson et al. (2009) where time jointly engaged included time in supported joint engagement and coordinated joint engagement. A period of supported joint engagement described time where the child demonstrated awareness of the parent's participation (e.g., takes turns with the same object, follows parent suggestion in play with the object) while in coordinated joint engagement the child directly acknowledges the partner and shared activity through triadic eye gaze, language, and/or gesture. Consistent with previous studies using this coding system, we collapsed supported and coordinated joint engagement (Kasari et al. 2010, 2014a, b, 2015). In addition, the initiator of the interaction (child or parent) was noted. The analysis focused on the total time spent jointly engaged in a child-selected activity. Reliability was established between independent and blinded coders including research assistants and graduate students for total time jointly engaged on a random 25 % of videotapes across time points, conditions, and participants (Intra-Class Correlation: ICC = .95).

Parents' Adoption of JASPER Strategies—Parents' use of JASPER strategies was also coded from the CCX. The coding system included core JASPER components including parents' appropriate arrangement of the environment (e.g., minimizing distractions, selects appropriate play materials), mirrored pacing (e.g., composite of imitation, timing and positioning of play acts), communication strategies (e.g., imitation and expansion of language, models language at the child's level) and prompting strategies (e.g., appropriateness and type of prompt, whether prompt matches the child's level of need of support) (see Gulsrud et al. 2015 for detailed information and scoring procedures). The components were rated using 2-min intervals (total of five intervals for a 10 min video). Parents' "total fidelity" was obtained by calculating the mean percentage score across the four core strategy domains. Research assistants and graduate students trained to reliability coded the data. Reliability was established between two independent and blinded coders on a random 20 % of videotapes across time points, conditions, and participants. ICCs by variable ranged from .86 to .97 ($M = .92$).

Statistical Analyses

A mixed linear model was conducted to explore differences in parents' responsiveness score between intervention arms (JASPER and PEI) and over time. Linear mixed models allowed for subject level random intercepts. To address the primary aim of the study, a piecewise linear model was applied to the three major time points (entry, exit, and 6-month follow up). Time was split into two segments: (a) entry through exit, and (b) exit through 6 month follow up. In addition, time jointly engaged in child-initiated activities was included as a time-varying covariate to examine the secondary aim of the association between parents' responsiveness and the time children spent jointly engaged with their parent. Finally, to examine the influence of the combination of parents' intervention strategy use and responsive behaviour, parents group status (low responsiveness and low fidelity, mixed low/

high responsivity and fidelity, high responsivity and high fidelity) was examined as a predictor of children's time jointly engaged at study exit and follow up.

Results

Descriptives and Preliminary Analyses

At study entry there were no significant group differences in children's developmental characteristics between treatment groups including Mullen score ($F(1, 84) = 0.01, p = .97$), Reynell expressive language age equivalent scores ($F(1, 84) = 0.13, p = .72$), and Reynell receptive language age equivalent scores ($F(1, 84) = 0.06, p = .94$).

Parents' Responsivity—Parents randomized to JASPER did not differ significantly in their average responsivity at study entry from those randomized to PEI ($F(1, 84) = 1.04, p = .75$; see Table 2 for mean scores by treatment arm and over time). On average, parents in this sample entered the study with a responsivity score of 2.67 ($SD = 1.13$). A score of 2 is considered “unresponsive” indicating parents showed infrequent, slow, or inappropriate (negative or rejecting) responses to their child and a score of three indicates consistent and appropriate responses, mixed with slow or inappropriate responses (Mahoney and Perales 2003). Therefore on average, parents demonstrated limited appropriate and timely responses to their children's behaviour at study entry.

Children's Joint Engagement—Total time in joint engagement was not significantly different between groups at study entry (PEI $M = 164.23$ s; JASPER $M = 140.29$ s). However, when the total time is separated into child-initiated, and parent-initiated joint engagement the groups did differ significantly at baseline. At entry dyads in the PEI group demonstrated more than double the total seconds of child-initiated joint engagement ($M = 114.57$ s, $SD = 132.36$ and 50.29 s ($SD = 67.11$), PEI and JASPER respectively).

At study exit, dyads in the PEI group were spending an average of 90.86 s ($SD = 116.31$ s) in child-initiated joint engagement and increased to an average of 182.98 s at follow up ($SD = 128.35$ s). In contrast, dyads in the JASPER group were spending an average of 215.83 s jointly engaged in child-initiated activities ($SD = 136.69$ s) at study exit and an average of 276.29 s jointly engaged at 6-month follow up ($SD = 182.26$ s). The change in time jointly engaged in child-initiated activities for the JASPER group from entry to follow up compared to PEI group was statistically significant ($F(1,71) = 40.48, p < .01$).

Primary Analysis: Parents' Responsivity and Children's Engagement

Descriptive statistics were conducted to ensure that statistical assumptions were met for linear mixed models. A longitudinal mixed model including all 85 dyads was conducted to examine the association between parents' responsivity and children's joint engagement in child-initiated activities (JECI). A model was constructed with parents' responsivity item score as the outcome. Two additional parameters were included in the model: treatment group (PEI or JASPER) and children's entry MSEL score. Children's entry MSEL score was included to control for variability in children's developmental level at baseline across the 85 dyads.

Responsivity Over Time and by Treatment Group—Time was a significant predictor of parents' responsive behaviour ($F(1,148) = 8.12, p < .01$). In addition, a significant interaction with time was found where higher scores were associated with treatment group status at study exit ($F(1,148) = 9.46, p < .01$) and across all time points ($F(1,148) = 10.20, p < .01$). These findings indicate differential increases by treatment group were consistent with study hypotheses. Parents in the JASPER parent-mediated intervention arm showed greater increases in responsivity than those in PEI. At study exit, on average parents in the JASPER group received a score of 3.77 ($SD = 1.02$) indicating that parents were approaching an average score of 4, which describes parents who consistently and appropriately respond to their children's behaviour. Care-givers maintained some of these gains at 6-month follow up ($M = 3.05, SD = 1.06$). In contrast, parents in the PEI group remained stable at study exit receiving an average score of 2.62 ($SD = 0.85$) and a score of 2.47 at follow up ($SD = 0.75$).

Developmental Level—To examine the influence of children's developmental level on parents' responsive behaviour, children's entry MSEL score was included as a parameter in the model. Children's MSEL score was not a significant predictor of parental responsivity ($F(1, 148) = 0.36, p = .55$) indicating no systematic association between a child's developmental level and their parent's responsive behaviour.

Joint Engagement—Time jointly engaged in child-initiated activities was found to be a significant time-varying covariate ($F(1, 148) = 13.413, p < .01$). This finding indicates that children's initiation of joint engagement with their parent was significantly associated with their parents' responsive behaviour at all time points.

Secondary Analyses

A secondary analysis was conducted to explore the association between parents' responsive behaviour and their additional JASPER strategy use with children's time jointly engaged in child-initiated joint engagement. The 83 dyads still present in the study at intervention exit were split into three groups based on parents' responsivity and total JASPER strategy scores at study exit. For ease of interpretation, a median split was applied on exit scores for both responsivity and strategy use variables such that values equal to or below the median were considered "low" and values above the median were considered "high" relative to the group. Three groups were created including: (a) low responsivity and low strategy use (low group: $n = 31$), (b) low responsivity and high strategy use or high responsivity and low strategy use (mixed group: $n = 28$), and (c) high responsivity and high strategy use (high group: $n = 24$). Using a linear regression model, group membership at study exit was a significant predictor of time in child-initiated joint engagement at study exit ($F(1, 81) = 16.10, p < .01$) and at study follow up ($F(1, 70) = 12.02, p < .01$). Children in dyads with caregivers who demonstrated both high responsivity and high strategy use spent the most time jointly engaged in child-initiated activities both at study exit ($M = 242.75$ s, $SD = 134.30$) and 6-month follow up ($M = 310.95$ s, $SD = 152.35$). See Table 3 for means by group.

Discussion

Earlier studies have demonstrated JASPER's influence on children's joint engagement. This study demonstrates that JASPER parent-mediated intervention also increases parents' responsive behaviour and these increases were associated with more time jointly engaged during intervention and at the 6-month follow up visit. Parents who combined both high responsivity and high JASPER strategy fidelity spent the most time jointly engaged with their child.

Parents' responsive behaviour varied systematically by treatment condition. Although similar before intervention, parents receiving JASPER demonstrated higher average responsive behaviour scores at exit ($M = 3.76$, $SD = 1.02$) while parents in the PEI intervention maintained low and stable levels of responsiveness to their children. The JASPER intervention model focuses on supporting children's initiations of social communication and play skills. Therefore, parents are encouraged to be very sensitive to their children's bids and to shape those behaviours by responding and expanding the behaviour. As such, JASPER strategies are congruent with responsive behaviour and the intervention supported parents' appropriate and timely responses to their children's behaviour. Although the PEI intervention also included content relevant to children's social engagement and communicative development, the package content was broader than JASPER including a focus on caregiver's stress and wellbeing. Both PEI and JASPER were delivered one to one with parents however, JASPER sessions included live coaching and practice with the child while PEI focused on discussion without the child present.

Change in Responsivity

As a group, parents began with MBRS responsivity scores that represented largely inconsistent, delayed, and inappropriate responses to children's behaviour. These entry scores are consistent with previous samples noted in the literature (Kim and Mahoney 2005; Mahoney and Perales 2003). On average, parents' increased their scores approximately one point on a five-point scale. This change represents an observable shift in parents' global interaction style with their child. Parents now notice and respond contingently to more subtle forms of children's communication and social behaviour including shifts in physical orientation to the environment, facial expressions, gestures, and verbal approximations across children with a range of skills and challenges. We would consider this level of improvement clinically meaningful. This sample included children with developmental scores on par for their age and those with severe delays. However, children's developmental level at study entry was not significantly associated with parents' responsive behavior. Study findings demonstrate that parents in JASPER were highly responsive not only to the children with the greatest language and social skills but, also those experiencing significant delays. Further descriptive examination of children's characteristics may provide more detailed information about child factors that may influence responsivity including clarity and frequency of communicative bids.

Responsivity and Joint Engagement: Focusing on Children's Social Initiations

Considering the limited spontaneous social engagement of children with autism, focusing on supporting children's initiations of joint engagement is challenging, but necessary. This study demonstrates an association between parental responsivity and the time the dyad spent in *child-initiated* episodes of joint engagement. Periods of joint engagement can be separated into child-initiated and parent initiated. Who initiates the episode of joint engagement often leads to qualitatively different interactions. For example, during parent-initiated periods of joint engagement the parent selects the activity and often redirects the child's attention, prompting the child to attend, communicate that is at odds with the definition of responsivity. Although parents may be able to command a child to respond to a demand, answer a question or act on a shared object, these prompted responses do not address the core challenge associated with social initiations. In contrast, in periods of child-initiated joint engagement, the child spontaneously drives the social interaction by selecting and sharing the activity with the parent. Fostering such initiations of social engagement as well as supporting the child to maintain this social interaction requires a different set of strategies than adult led prompted engagement. For example, congruent with a responsive interaction style parents may follow in and respond to the child's choices and communication to support the child's social engagement rather than redirect the child to the parents' selections and demands. The findings of this study are consistent with previous demonstration of increases in child-initiated joint engagement post JASPER intervention (e.g., Kasari et al. 2006, 2014a, b, 2015). Yet, overall there is a paucity of literature focusing on children's initiations of social engagement with intervention studies often reporting prompted rather than spontaneous social outcomes (Kasari and Patterson 2012).

Combining Responsivity and Additional Intervention Strategies

Considering the often fleeting engagement, and limited reciprocity of children with autism when compared to typically developing children (Adamson et al. 2001), it is important to acknowledge the intensity of the demand placed upon the caregiver to continue to consistently and appropriately respond over time. In light of these factors, it is notable that parents maintained a portion of the gains in responsivity made in highly supportive one-on-one JASPER treatment when they continued without support over the course of the 6-month follow up period. Although responsivity may be a necessary foundation, responsive behaviour alone may not be sufficient to continue to support development over time for children with complex needs. Further, understanding how to balance appropriate and timely responding within the structure and complexity of the intervention context may also be necessary. The findings demonstrate that a lack of balance demonstrated through mixed profiles of responsivity and strategy use (low/high and high/low) were not associated with the greatest gains in joint engagement. For example, following to a "fault" where a caregiver follows the child's every bid losing the direction and coherence of the larger play routine (high responsivity, low strategy use) or overly directing the child and missing out on opportunities to respond to the child's play ideas or communication (high strategy use, low responsivity) were both examples of mixed profiles. Rather, responsive behaviour may need to be timely and appropriately combined with additional teaching strategies to continue to support children's development. Secondary analyses demonstrated that a combination of

high responsivity and high JASPER strategy implementation at study exit and 6-month follow up was associated with greater time jointly engaged in child-initiated activities.

Limitations and Next Steps

The study findings demonstrate an association between parental responsivity and children's joint engagement across time however, a limitation of the study is that the direction of this association cannot be determined. Detailed sequential analyses may shed some light on the bidirectional influence of both parent and child behaviour within the interaction. A strength of the current study is the examination of the influence of children's varied communication skills as a covariate in the model. Children's language skills were not a predictor of parents' responsivity, indicating that parents' responsivity may not be driven by the child's skill level.

Further examination of the specific role of live coaching within the JASPER model may also provide insights into the tools needed to support gains in responsivity. Coaching has been demonstrated to provide unique gains in parental strategy use over discussion and observation alone (Shire et al. 2015), however, the unique influence of coaching on a parent's broader interaction style has yet to be examined.

Follow up assessments were conducted 6 months post treatment in the current study. Future studies may include further longitudinal examination of the sustainability of early intervention effects on parents' interaction style and if highly responsive parental behaviors continued to be associated with better child engagement over time. In addition the association between responsivity and other core developmental targets such as language or play skills are needed.

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Appendix

See Table 4.

Table 1

Child and parent characteristics at study entry (n = 85 with entry CCX)

	JASPER (n = 43)	PEI (n = 42)
<i>Child characteristics</i>		
Chronological age	M = 31 months (SD = 4)	M = 32 months (SD = 3)
MSEL standard score	M = 67.98 (SD = 20.29)	M = 68.36 (SD = 20.78)
Reynell receptive language AE	M = 15.84 months (SD = 7.68)	M = 15.48 months (SD = 7.32)
Reynell expressive language AE equivalent	M = 14.52 months (SD = 5.4)	M = 13.8 months (SD = 5.04)
Gender (males/females)	36/7	34/8
Ethnicity		
African American	0	2
Asian	4	6
Caucasian	28	24
Hispanic	2	5
Mixed	9	5
<i>Caregiver characteristics</i>		
Primary caregiver		
Mother	37	39
Father	6	2
Grandparent	0	1
Caregiver education		
High school	0	3
Some college	6	8
Specialized training	0	2
College degree	21	17
Graduate degree	16	12

Table 2

Parental responsivity by treatment arm and over time

Treatment arm	Entry (n = 85) Mean (SD)	Exit (n = 83) Mean (SD)	Follow up (n = 72) Mean (SD)
PEI	2.71 (1.13)	2.62 (0.85)	2.47 (0.75)
JASPER	2.63 (1.07)	3.77 (1.02)	3.05 (1.06)

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Table 3

Mean time jointly engaged in child-initiated activities

Responsivity (R) and strategy adoption (SA) group	Entry (n = 85) Mean (SD)	Exit (n = 83) Mean (SD)	Follow up (n = 72) Mean (SD)
Low R + low SA	77.97 s (88.70)	73.17 s (93.27)	164.04 s (128.89)
Low R + high SA OR High R + low SA	99.97 s (146.81)	160.14 s (143.05)	231.59 s (179.85)
High R + high SA	64.83 s (76.06)	242.75 s (134.31)	310.95 s (152.35)

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Table 4

JASPER and parent education intervention (PEI) topics

Session	JASPER	PEI
1	Intervention goals and individual developmental targets; setting up the environment	Intervention goals and individual developmental targets
2	Initiating activities	Parental concerns and priorities
3	Establishing play routines	Managing challenging behaviour
4	Maintaining routines	Changing consequences for behaviour
5	Scaffolding routines and engagement	Encouraging new behaviour
6	What to do when a child is unengaged/dysregulated	Communication challenges for children who are non-verbal
7	Communication and joint attention	Communication challenges for children who are verbal
8	Recognizing and responding to joint attention skills	Recognizing and responding to social challenges
9	Imitating and expanding language	How to play together
10	Generalizing skills, review and next steps	Review and next steps