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Promoting emotion regulation in young children with autism via parent-mediated intervention: lessons learned from an initial investigation

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ABSTRACT

Emotion regulation is critical for mental health and social competence. Many children with autism spectrum disorder struggle to regulate emotions yet there are few evidence-based programs to support this skill. This study examined whether parent-mediated intervention for emotion regulation holds promise in improving this skill among young children with autism spectrum disorder. A multiple probe single-case design evaluated potential efficacy with five parent-child dyads. Results of visual analyses generally did not support effects of the intervention on parent support for emotion regulation and children's demonstration of this skill in semi-structured tasks. However, follow-up interviews indicated that parents found the intervention useful and applied strategies in daily life. Parent interview data suggested a broad range of child treatment responses.

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Autism; emotion regulation; preschool; young children; parent-mediated; intervention

Emotion regulation is the process of increasing, maintaining, or decreasing the intensity of emotion in response to situational demands (Thompson & Goodvin, 2007). It is central to child development given its relation with social success and well-being (Denham, 2006; Karreman & Vingerhoets, 2012). In infancy and early childhood, emotion regulation is largely facilitated by caregivers. As children age, emotion regulation strategies typically become more advanced and include increasingly independent, adaptive management of emotional response for personal and social success (Thompson & Goodvin, 2007).

Emotion regulation and autism spectrum disorder

Autism spectrum disorder is characterised by deficits in social interaction and communication as well as the presence of repetitive and restricted behaviours (American Psychiatric Association, 2013). Approximately 70% of children on the autism spectrum experience emotional dysregulation (Totsika et al., 2011). These difficulties occur in

young children with autism spectrum disorder with and without intellectual disability (Berkovits et al., 2017; Totsika et al., 2011), and dysregulation in young children with autism spectrum disorder predicts later social and behavioural concerns regardless of cognitive skills (Berkovits et al., 2017). Moreover, inadequate emotion regulation relates to poor interpersonal interactions, disruptive behaviour, academic problems, and mental health concerns (Ursache et al., 2012; Zablotsky et al., 2012).

Despite the central role of emotion regulation in social and behavioural functioning and high rates of dysregulation reported in children on the autism spectrum, few interventions exist. Recently, emotion regulation-focused interventions designed for older children and adolescents with autism spectrum disorder suggest the promise of cognitive-behavioural approaches in supporting emotion regulation skill development (e.g., Weiss et al., 2014, 2018). However, the need for cognitive meta-awareness central to these programs render them inappropriate for young children and potentially those with intellectual disabilities.

There is considerable research to support the use of parent-mediated intervention to address social-emotional and behavioural needs in young children with disabilities (Kaminski et al., 2008), such as increased attentional and behavioural self-regulation (Baggett et al., 2010), social engagement (Karaaslan et al., 2013), social communication (Shire et al., 2015), and decreased behavioural issues (Lyon & Budd, 2010). Throughout this literature, increased positive parenting practices have been connected to improved child outcomes (e.g., Ward et al., 2016). While research in parent-mediated intervention to support core social and communication skills in young children with autism is supported by evidence (Wong et al., 2015), research demonstrating similar gains in emotion regulation is less clear. Although not specifically targeting emotion regulation per se, there is a considerable body of research to indicate that connections exist between improved parenting skills and social-emotional gains for children (e.g., Godin et al., 2019; Meadan et al., 2009). Findings from other parent-mediated interventions have indicated that parental self-efficacy (Sanders & Woolley, 2005) and parent emotion regulation (Zachary et al., 2019) potentially moderated outcomes, supporting the importance of increasing these skills in parents. Additionally, research targeting mutual engagement between mothers and children with broad developmental disabilities produced gains in social engagement among these children (Karaaslan et al., 2013, 2015; Mahoney & Perales, 2003). This evidence supports the contention that parent-mediated intervention can promote emotion regulation in children with autism spectrum disorder. However, further work is needed to fill the gaps in the research literature to build an appropriate evidence base for this approach, including feasible brief interventions (Godin et al., 2019) and research that specifically targets emotion regulation (Mazefsky, 2015).

Regulation of emotional lability in autism through caregiver supports

Regulation of Emotional Lability in Autism through Caregiver Supports (hereafter referred to as “the Intervention”) is an 8-week, parent-mediated intervention designed to help parents of preschool-aged children on the autism spectrum to facilitate child emotion regulation through psychoeducation, modelling, coaching, and constructive

feedback. Lessons follow the developmental progression of emotion regulation skill formation. Parents are taught to support children's identification, expression, and modulation of emotion (Cole et al., 1994) using evidence-based teaching strategies for skill-building in children on the autism spectrum (e.g., modelling, visual supports; National Autism Center, 2015). Based on research indicating greater maladaptive and fewer constructive emotion regulation strategy use among preschoolers on the autism spectrum compared to typically developing peers (Hirschler-Guttenberg et al., 2015), parents are instructed to use these strategies to foster children's attentional deployment, response modulation, and when developmentally appropriate, cognitive reappraisal. These emotion regulation strategies are central to adaptive modulation of emotion (Gross, 2014). In preliminary research, mothers reported significant increases in child regulation and decreases in parent stress related to the child's behaviour (Rispoli et al., 2019).

The current study examined the preliminary efficacy of the Intervention using observational data collected throughout the program and post-intervention parent interviews. It was expected that children participating in the Intervention would evidence increased adaptive and decreased maladaptive emotion regulation strategies. Participating mothers were expected to display increased verbal and nonverbal strategies to support emotion regulation.

Method

Participants and setting

Five biological mother-child dyads were recruited via community mental health and therapy clinics in a Midwestern state in the United States. Mother participants (hereafter referred to as "parents") were 26 to 39 years old and spoke English as their primary language. Children were 3 to 6 years old, spoke English as their primary language, and were previously diagnosed with autism spectrum disorder (per Diagnostic and Statistical Manual-5th edition criteria; American Psychiatric Association, 2013) or Autism (per Individuals with Disabilities Education Act, 2004). The Autism Diagnostic Observation Schedule, 2nd Edition (Lord et al., 2012) was administered for diagnostic verification. To ensure ability to participate in the Intervention, children were required to demonstrate an expressive or receptive language standard score ≥ 80 on the Preschool Language Scales, 5th Edition (Zimmerman et al., 2011) and a General Conceptual Ability >70 coupled with a Verbal or Nonverbal Ability domain standard score ≥ 80 on the Developmental Ability Scale, 2nd Edition (Elliott, 2007). The first author, a licensed psychologist with research reliability in Autism Diagnostic Observation Schedule- 2nd Edition assessment, completed testing. Additional demographic information is included in Box 1. All assessments and sessions were conducted in family homes.

Constructs and measures

Emotion related behavioural coding system

The coding system was developed for the study to code parent strategies for supporting child emotion regulation and children's emotion regulation strategies during weekly

Box 1. Participant demographics

<i>Dyad</i>	<i>Mother</i>				<i>Child</i>				Current services			
	Age ^a (Y)	Race/ethnicity	Marital status	Education level	Family income ^b	Gender	Age ^a (Y:M)	Race/ethnicity		General conceptual ability ^c	Receptive language ^d	Expressive language ^d
A	35	White	Married	Some graduate school	200001+	Male	5:8	White	107	113	106	Speech language therapy, occupational therapy, social work
B	26	Black	Single	Some graduate school	50001-75000	Female	3:3	Black	87	91	83	Speech language therapy, applied behavioural analysis
C	39	White	Married	Graduate degree	50001-75000	Male	3:1	White	92	84	100	Speech language therapy, occupational therapy, social skills training
D	27	White	Married	Graduate degree	75001-100000	Male	3:10	White	84	62	81	Speech language therapy, occupational therapy, autism classroom
E	35	White	Married	Graduate degree	75001-100000	Male	6:7	White/Hispanic	91	99	95	Speech language therapy, occupational therapy, social skills training

^aInitial baseline assessment.

^bGross family income (per year) reported in United States dollars.

^cStandard score estimate of intelligence; measured by the Developmental Ability Scale, Second Edition (Elliott, 2007).

^dMeasured by the Preschool Language Scales, Fifth Edition (Zimmerman et al., 2011).

observations (see Procedures). Codes were adapted from research studying parent-child interactions during dysregulating tasks (Grolnick et al., 1998; Gulrud et al., 2010; Hirschler-Guttenberg et al., 2015). Ten-second intervals were used to tally occurrence or non-occurrence of each behaviour. Individual codes were combined into four composite scores for each observation: parent verbal and nonverbal support, and child positive and maladaptive emotion regulation skills.

The *verbal support for emotion regulation* score indicated parents' use of vocal prompting or questioning, verbal comforting, encouragement, acknowledging distress, acknowledging positive emotion, and modelling emotion. The *nonverbal support for emotion regulation* score included parents' use of physical prompting, physical comforting, redirecting/distracting, using visual supports, and ignoring distress strategies.

Children's *positive emotion regulation skills* included the following strategies: using action to achieve a goal, such as manipulating a key to unlock a box; distracting self; engaging in self-talk; seeking adult assistance; seeking adult comfort; and physical self-soothing behaviours. *Maladaptive emotion regulation behaviours* included the occurrence of idiosyncratic/repetitive behaviours, physical objections, and verbal objections.

Parent interviews

At follow-up, parents shared their impressions and suggestions for the Intervention via individual, semi-structured interviews lasting approximately 17 to 30 minutes. See interview questions in [Appendix 1](#).

Design and procedure

The study was approved by the Michigan State University Human Research Protection Program. Parent consent was obtained prior to participation. Child assent was not sought given age and developmental level of participating children, consistent with guidance from the Human Research Protection Program. Parents received small monetary incentives for completing each session.

Experimental design

A concurrent multiple-probe design was used to examine the effect of the Intervention (independent variable) on parent and child emotion regulation strategies (dependent variables). Dyads were randomly assigned to 5, 7, 9, 11, or 13-week baseline consistent with recommendations for introducing randomisation in single-case design (Kratochwill et al., 2013; Kratochwill & Levin, 2010). Assessments were weekly during baseline and intervention, with staggered probe assessments occurring for dyads in longer baseline phases (Holcombe et al., 1994). One 3-month follow-up evaluated maintenance effects, consistent with similar parent-mediated intervention studies (e.g., Ingersoll, 2012; Whalen & Schreibman, 2003). Dyad B declined participation in the follow-up assessment.

Data collection

Fifteen-minute parent-child observations occurred weekly during baseline and intervention and once at 3-month maintenance. Using recommendations from

Thompson (2014), highlighting the need to understand children's efforts to regulate emotion relative to emotional goals when judging the effectiveness of attempts to establish emotion regulation, videotaping procedures included situations in which child goals for regulating emotion could be assumed by trained observers. Each week, the researcher introduced a 5-minute frustrating task, such as completing a puzzle with incorrect pieces, intended to elicit mild to moderate frustration. Tasks were adapted from similar research examining children's emotion regulation strategies (e.g., Goldsmith & Rothbart, 1999). Parents were instructed to support the child throughout the task. A 10-minute free play segment followed. Weekly frustration task assignments were randomised across dyads.

Intervention

Intervention sessions were manualised and implemented with the parent and child present for 1 to 2 hours per week over 8 consecutive weeks. The first and second authors served as interventionists. Intervention session structure aligned with empirically supported parent training interventions (e.g., Vismara et al., 2009), including didactic instruction, interventionist strategy demonstration, parent strategy practice with feedback, and mutual goal-setting for strategy use during everyday routines. Each session began with a brief review and question and answer of strategies from the session prior, followed by psychoeducation about the current session's topic and skill demonstration. Then the parent attempted the strategies taught. The interventionist demonstration and parent practice were always conducted with the child, who was present throughout the session, except for the final three sessions focused on behavioural analysis and skill generalisation. That is, parents were taught to identify antecedents and consequences of behaviour, collected data on dysregulated behaviour, and were instructed on how to identify the function of dysregulated behaviour. Subsequently, they learned to match function-based strategies introduced in previous weeks. Every session concluded with the interventionist and parent collaboratively establishing goals for the parent's use of the strategies in the coming week, using a structured worksheet. Goals varied across dyads but generally focused on the parent practicing skills and applying them during transitions, car rides, meals, and bedtime.

Intervention sessions included: (i) mutual engagement in play; (ii) visual and verbal prompting to build emotion vocabulary and identification; (iii) modelling appropriate emotion regulation; (iv) verbal and physical strategies to support child emotion regulation strategies; and (v) adapted Tucker Turtle technique (Lentini, 2007; Schneider, 1974) to support emotion regulation using visual and verbal prompting. To facilitate parents' awareness of the function of dysregulation and guide strategy selection, a central component of parental socialisation of emotion regulation (Thompson, 2014), final sessions included: (vi) collecting behavioural data; (vii) using data to identify appropriate strategies; and (viii) generalisation and maintenance of supports. Additional details are reported in Rispoli et al. (2019).

Interventionist training and fidelity

The second author (doctoral school psychology student completing certification as a board-certified assistant behavioural analyst) completed an 8-hour didactic training

with the first author. Subsequently, the interventionist trainee observed the first author implement the Intervention with a volunteer family and established implementation fidelity with a second volunteer family $\geq 90\%$ across each session. As reported in Rispoli et al. (2019), treatment integrity was high (range = 96.88–100.00%; $M = 98.88\%$).

Data analysis

Two graduate research assistants blind to experimental condition rated parent and child behaviours. Raters completed 2-day training with the first author and achieved 80% inter-rater reliability with the first author across three practice videos. Coding reliability was assessed using inter-observer agreement. Inter-rater reliability checks were conducted on a random selection of 20% of videos within baseline, intervention, and maintenance conditions (Kratochwill et al., 2013). Discrepancies (agreement < 80%) were addressed through meetings with the first author and raters. Agreement was acceptable: verbal parent support = 83–100%; active parent support = 78–100%; positive child emotion regulation = 90–100%, and maladaptive child emotion regulation = 83–100%.

Intervention effects were evaluated using visual analysis and the non-parametric TauU summary index (Parker et al., 2011; Ross & Begeny, 2014). Changes in level, trend, and variability were rated across each phase (Ganz & Ayres, 2018) by two researchers, including one individual external to the research team. Consensus ratings were used for discrepancies.

Qualitative data were evaluated using systematic thematic analysis (Nowell et al., 2017). Two graduate research assistants not involved in the Intervention implementation or behavioural coding completed iterative analysis in which they became familiar with the data, generated initial codes, identified, reviewed, defined, and named themes and produced a report. The second author reviewed 30% of all themes to triangulate findings. Cohen's kappa was 0.81, indicating “almost perfect” agreement (Landis & Koch, 1977).

Results

Treatment efficacy

Parent behaviours are displayed in Figures 1–4. Child behaviour graphs are not displayed due to lack of effects (available upon request). Tables 1 and 2 display level changes.

Parent verbal support for children's emotion regulation

Free play. Results from visual analysis indicated that all parents except Parent E demonstrated variable rates of verbal emotion regulation support across phases, making it difficult to discern trends following introduction of the intervention. Four of five parents (A, C, D, and E) were rated as demonstrating more verbal support for emotion regulation skills, on average, from baseline to intervention. A positive, moderate effect (Tau-U = .31, $p < .05$) was found for verbal support.

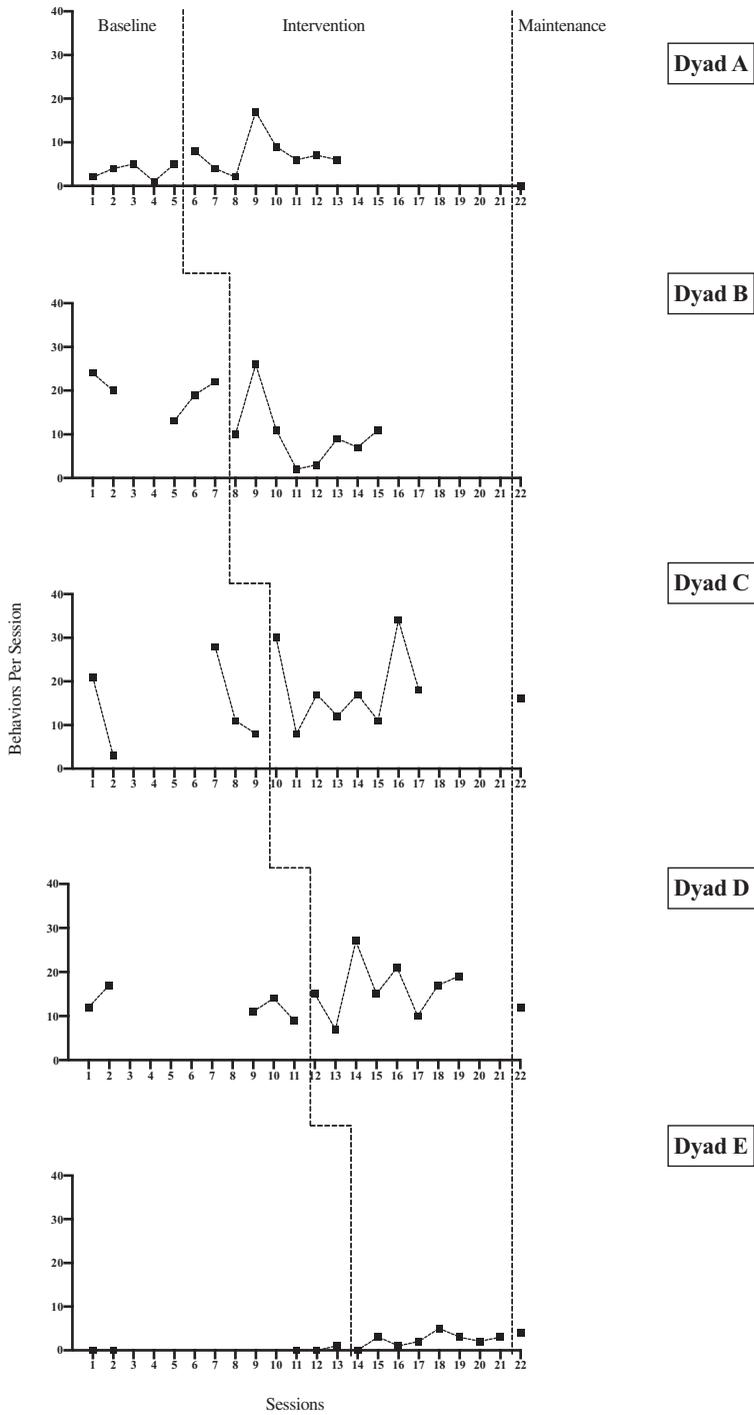


Figure 1. Parents' verbal emotion regulation support during free play.

Frustration tasks. Variability was observed across most phases for parents, again rendering it difficult to determine trends following intervention introduction. No parents were rated as demonstrating more verbal support for emotion regulation skills

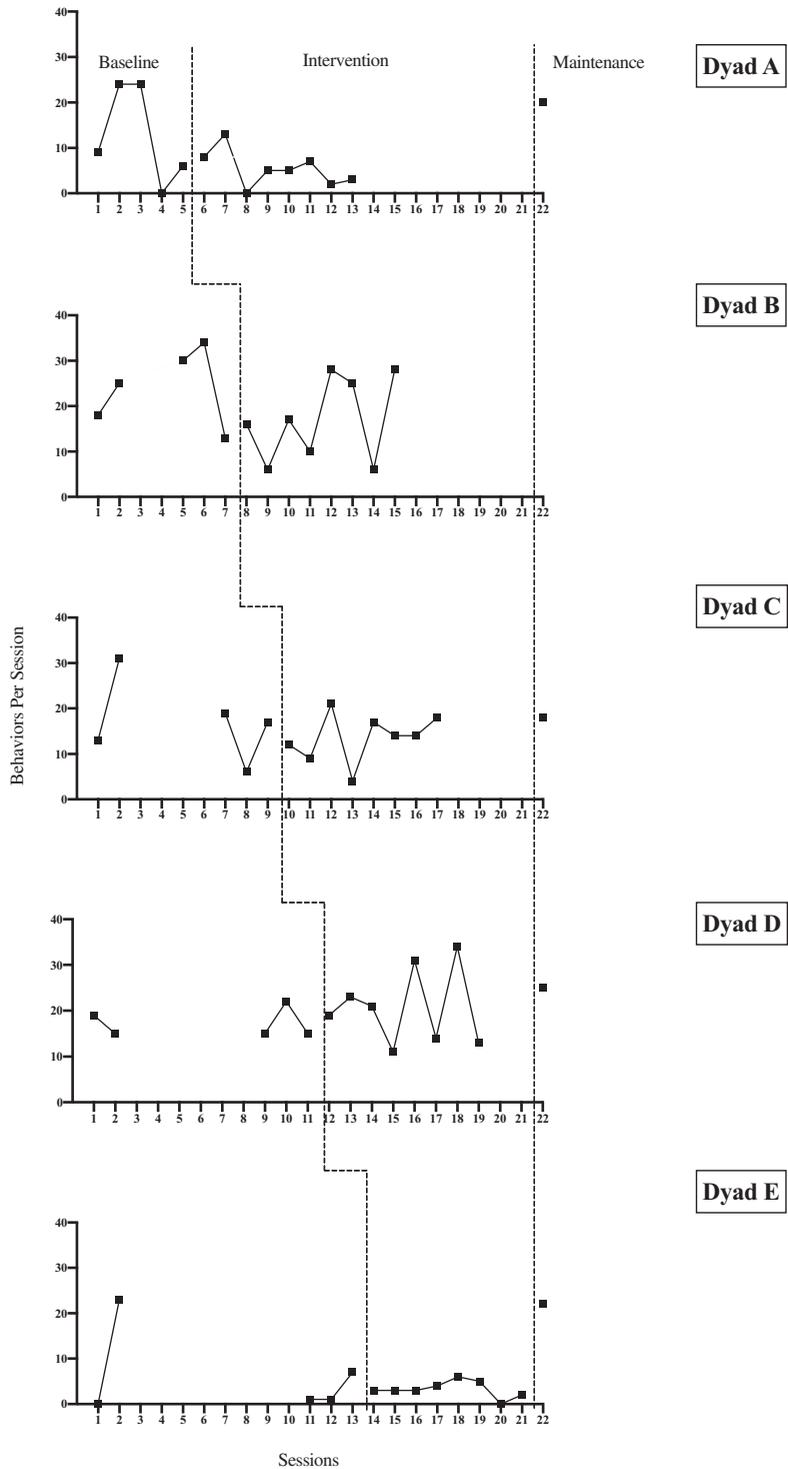


Figure 2. Parents' verbal emotion regulation support during frustration tasks.

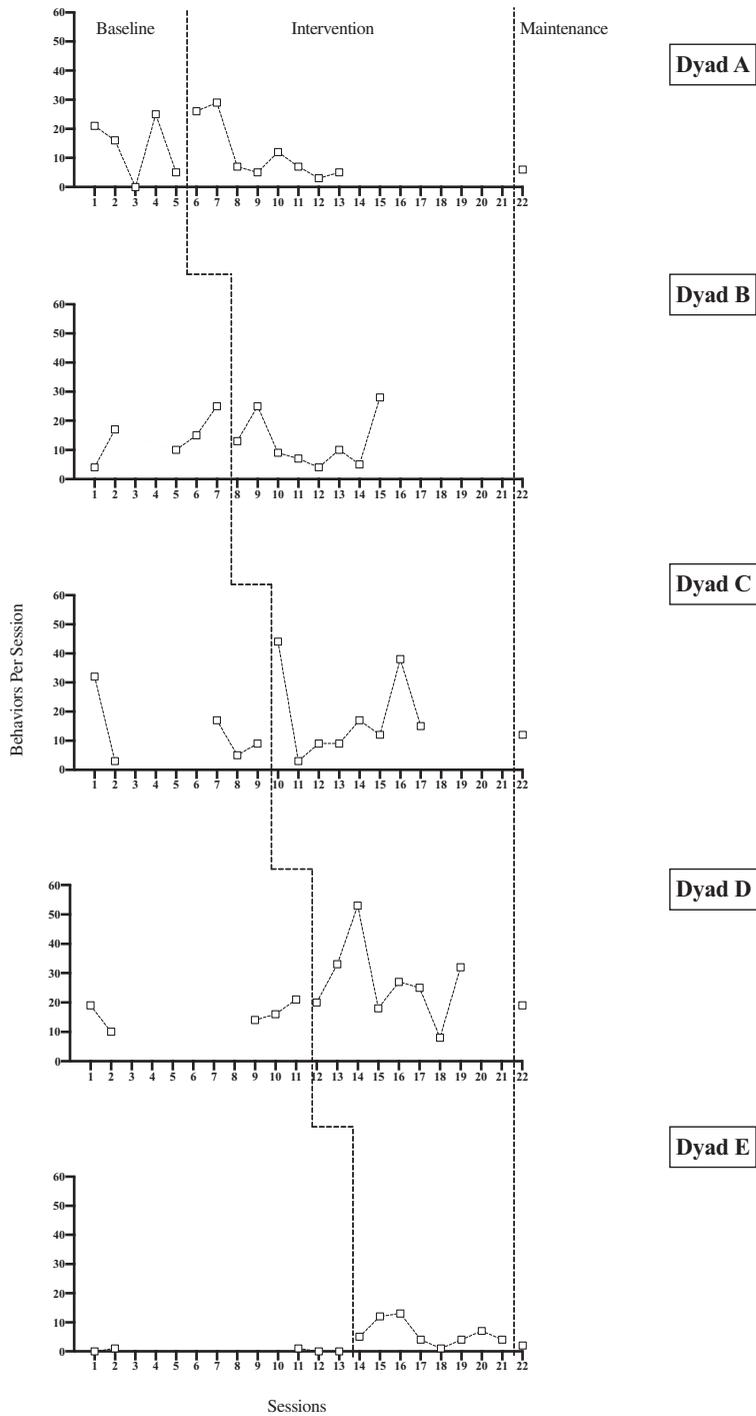


Figure 3. Parents' active emotion regulation support during free play.

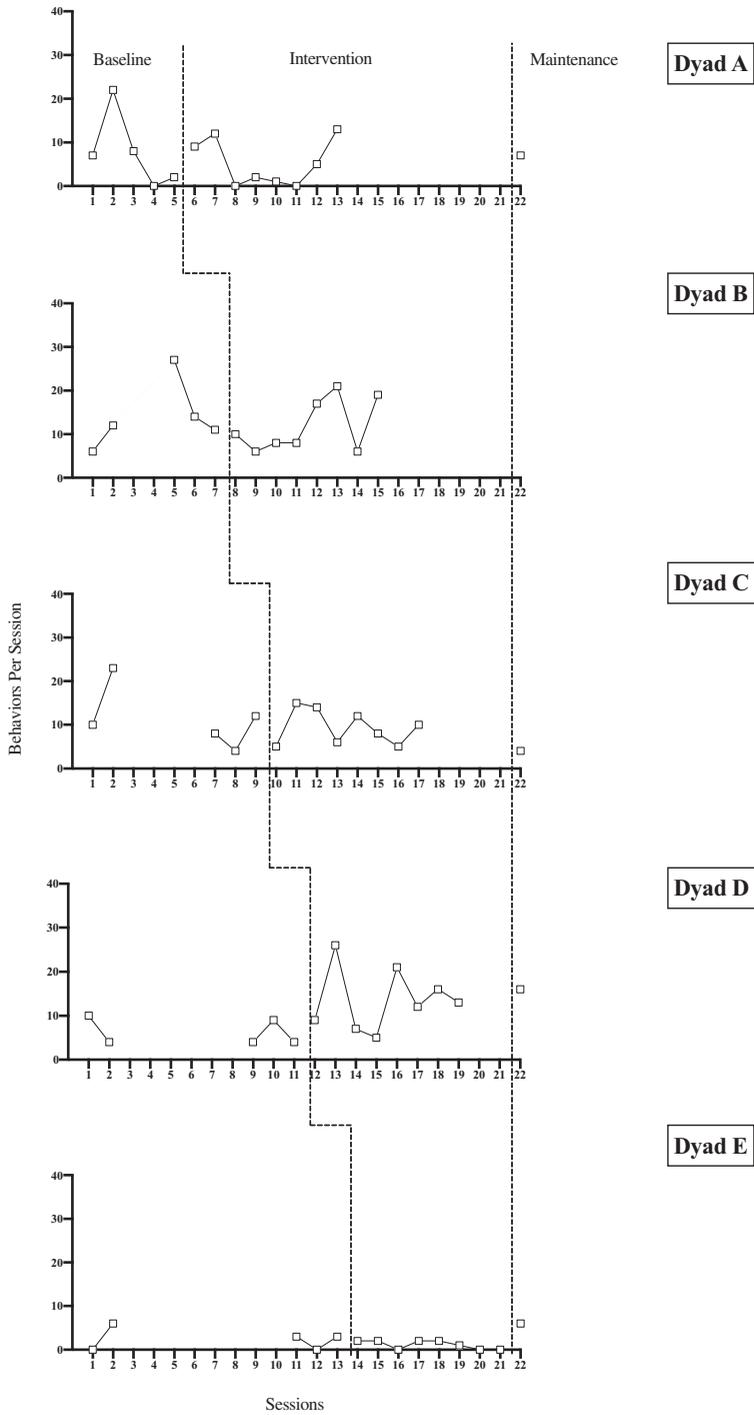


Figure 4. Parents' active emotion regulation support during frustration tasks.

Table 1. Parent strategy level change across tasks.

Parent	Verbal				Active			
	Frustration tasks		Free play		Frustration tasks		Free play	
	Baseline	Intervention	Baseline	Intervention	Baseline	Intervention	Baseline	Intervention
A	12.6	5.38	3.80	7.38	7.80	5.25	13.60	12.00
B	25.00	17.75	19.60	9.88	14.00	11.88	14.20	12.50
C	17.20	13.63	12.80	18.63	11.40	9.38	11.00	17.88
D	49.80	20.75	12.60	16.38	6.20	13.63	16.00	27.00
E	6.40	3.25	0.20	2.38	2.40	1.13	0.40	6.25

Bolded values indicate increases in number of strategies observed per interval.

following introduction of the intervention. A negative, moderate effect ($\text{Tau-U} = -.33$, $p < .05$) was found for verbal support.

Parent active support for children's emotion regulation

Free play. Variability was evident for all but one parent (E) across baseline and intervention. However, trend did not increase following the introduction of the intervention for this parent. Three parents (C, D, E) demonstrated an increase in average use of active strategies following introduction of the intervention. A moderate, positive effect was observed for parent active strategies in ($\text{Tau-U} = .32$, $p < .05$).

Frustration tasks. All but Parent E displayed variable rates of active support for emotion regulation across baseline and intervention. There was no increasing trend observed for Parent E following introduction of the intervention. Just one parent (D) was rated as having increased average active strategy use from baseline to intervention. A small, nonsignificant negative effect ($\text{Tau-U} = -.01$, $p = .9$) was found.

Parent growth and barriers

Thematic analysis of parent interviews revealed themes of parents' personal growth, including recognising the need for emotion regulation support (see Table 1). Parent D described this as a "major realization" and Parent C noted increased awareness of the need to intentionally support regulation. Parent E commented on increased awareness of the need to model adaptive regulation to support these skills in her child. Other responses suggest that the Intervention empowered parents: Parent A noted, "it made me feel like... I wasn't alone in dealing with all of these things." The Intervention encouraged parents to engage children in challenging situations they may have previously avoided for fear of dysregulated responses. For instance, Parent A commented on the need to, "push him out of his comfort zone and play with him like he's a normal kid." Parents also extended their knowledge to incorporate techniques using other materials. For instance, drawing upon the introduction of breathing apps during one session, Parent D made use of her Breathe app on her Apple watch to assist her child in using deep breathing. Conversely, Parent D commented that she was sometimes too busy to remember to support her child's emotion regulation skills throughout the day, and Parent C indicated that she had not used the materials in some time at follow-up. See Appendix for additional quotes.

Table 2. Child emotion regulation skill level change across tasks.

Child	Adaptive				Maladaptive			
	Frustration tasks		Free play		Frustration tasks		Free play	
	Baseline	Intervention	Baseline	Intervention	Baseline	Intervention	Baseline	Intervention
A	17.80	9.13	2.80	7.25	1.60	1.38	17.40	8.38
B	9.80	13.63	12.00	6.88	4.80	2.88	8.60	4.00
C	6.80	10.88	15.20	9.50	3.40	2.13	2.80	7.63
D	15.40	9.75	7.80	5.50	3.20	6.38	21.60	17.13
E	10.80	13.25	7.20	5.38	2.40	3.13	14.20	12.00

Bolded intervention values indicate improvements in children's emotion regulation strategies observed per interval.

Child adaptive emotion regulation

Free play. Children displayed variable rates of adaptive emotion regulation skills during baseline and intervention, making it difficult to determine trends following intervention introduction. Though data for Child D were stable, there was no clear trend following intervention introduction. Increased average adaptive skill use was only observed for Child A in free play. Effects were negative and insignificant ($\text{Tau-U} = -.29, p = .06$).

Frustration tasks. Variability was observed for adaptive emotion regulation skills displayed by children during frustration tasks. Trend changes could not be discerned. Three children (B, C, E) were rated as demonstrating more adaptive emotion regulation skills, on average, from baseline to intervention during frustration tasks. The effect size was negative and insignificant ($\text{Tau-U} = -.07, p = .65$).

Child maladaptive emotion regulation

Free play. All children displayed variable maladaptive behaviours across phases, again making it difficult to determine trends following intervention introduction. Rates of maladaptive behaviours were low overall across both phases. Nevertheless, decreases in average use of maladaptive emotion regulation behaviours were observed for four children (A, B, D, E) during free play. Small negative, insignificant, effects were found ($\text{Tau-U} = -.19, p = .21$).

Frustration tasks. Except for Child A, variability was observed for maladaptive ER behaviours across baseline and intervention. There was no discernible trend observed following intervention introduction for Child A. Three children (A, B, C) were rated as displaying less frequent maladaptive emotion regulation behaviours, on average, during frustration tasks. The effect size was small and insignificant ($\text{Tau-U} = -.03, p = .82$).

Parent report of child emotion skill growth

During follow-up interviews, parents noted positive changes in their children including identifying and verbalising emotions and responding to tools that support emotion regulation (see Table 2). For instance, Parent C described presenting pictures of a house the family was visiting for vacation to prepare her child for the new environment and commented on his ability to adapt quickly upon arrival. There were limitations to these improvements, however. As an example, Parent D noted that while her child's

emotion identification techniques improved, he continued to struggle to identify his own emotions and struggled to understand certain techniques from the Intervention. Parent E described child improvements at school but not at home.

Treatment acceptability

Quantitative data reported in Rispoli et al. (2019) suggested that parents found the Intervention to be highly acceptable. Qualitative data from parent interviews extended these findings by highlighting potential avenues for improvement in future studies. Several parents presented ideas related to increased access to interventionists and intervention materials to solidify their learning of the Intervention techniques, such as more frequent meetings and practice opportunities (Parents A, C), and providing video and web-based materials to reinforce concepts (Parents D, E). Parents C and D expressed a desire for integration of emotion regulation-focused content into other therapeutic services.

Discussion

Many children with autism spectrum disorder have trouble regulating their emotions (Totsika et al., 2011) and adaptive emotion regulation promotes school readiness and prevents mental health challenges (Ursache et al., 2012). Programming is needed to support adaptive emotion regulation skills in young children on the autism spectrum. The Intervention aimed to address this gap by supporting early emotion regulation skill acquisition in preschool-age children on the autism spectrum through parent-implemented techniques.

This study examined the influence of the Intervention on parents' support of children's emotion regulation skills and adaptive and maladaptive regulatory strategies. Visual analyses provided little support for intervention effects. Effect size calculations suggested moderate, positive effects for parent emotion regulation support during open-ended play but negative effects during frustrating tasks. Average rates of parents' verbal and active emotion regulation-supportive strategies increased for most participants. Effect sizes for child regulation skills were small and nonsignificant but most children's adaptive regulation skills increased on average.

Qualitative data obtained from parent interviews contextualise results regarding treatment efficacy. Specifically, some parents noted that their children improved in skills that serve as precursors to emotion regulation, such as emotion identification, but continued to struggle with regulation. Another parent commented that her child's emotion regulation skills improved in school but not at home. Moreover, during interviews, parents described generalisation of strategies taught during the intervention, such as creating visual tools to help prepare one child to visit a novel vacation home. These examples suggest parents were able to transfer use of at least some intervention strategies to family life, despite inconsistent support for treatment effects.

Extant literature on parent training and parent-mediated intervention provides some possible explanations for the results. In Kaminski and colleagues' (2008) meta-analysis of 77 behavioural parent training programs, larger effect sizes emerged for programs that targeted positive parent-child interactions and emotion communication skills, consistent use of parenting practices, and homework or skill practice between

sessions. In their review of home-based parent-mediated interventions for young children, Meadan and colleagues (2009) found support for using the naturalistic home environment to foster parent skill development yet highlighted a need for increased use of parent-friendly materials demonstrating use of intervention strategies. The Intervention addresses many but not all of these components. Most notably, though parent handouts and weekly goal setting supported parent skill transfer, parent practice and strategy use were not evaluated systematically. It is possible that parents varied in use of resources and attempts to apply skills outside of sessions, likely due to factors including difficulty understanding strategies and how to use them in everyday routines, and limited time and/or motivation for between-session practice.

Other findings suggested parent-specific variables may influence effects of parent-mediated interventions. Parental self-efficacy (Sanders & Woolley, 2005) and parent emotion regulation (Zachary et al., 2019) were identified as potential moderators in other parent-mediated interventions. Additionally, Karaaslan and Mahoney (2015) found that increased maternal responsiveness related to increased child attention and initiation during social interaction following parent-mediated Responsive Teaching intervention, but the same was not true for children's social development. Instead, these skills were mediated by changes in children's social attention and initiation. Parents' perceptions of their ability to support emotion regulation as well as their own regulation skills and children's executive functioning capacities may affect treatment response during the Intervention.

Future research should also incorporate measurement of parents' progress with weekly individualised goals (i.e., parent fidelity), their own emotion regulation, and broader evaluation of children's emotion skills to better understand mechanisms of change in the Intervention. The measurement protocol used in this study may have precluded detection of observable improvements since data collection focused on more sophisticated indicators of regulation and occurred in home settings only. It is possible that some children were relatively less developed in their emotion skills, and by gaining skills in emotion identification, were on a pathway toward regulating emotion. The current study reflects known limitations in emotion regulation measurement among children with autism spectrum disorder (Weiss et al., 2014) and the need to ensure reliability and social validity of outcomes following parent-mediated interventions (Meadan et al., 2009).

Several avenues for improving the Intervention emerged from findings and other relevant literature. Parent strategy use may be improved by assigning parents "homework" to practice intervention strategies consistent with other evidence-based parenting interventions (Ward et al., 2016). Coaching sessions to ensure parent mastery of intervention strategies should also be explored, given other findings suggesting parent coaching results in better outcomes than interventionist observation (Shire et al., 2015). Future research should also consider parent-interventionist alliance, as several studies highlight the role of alliance in moderating outcomes (e.g., Metcalfe et al., 2021). Technology such as video recordings that allow for review of child emotion regulation skills during family routines and a website containing information to aid parents' understanding and use of intervention strategies may also increase intervention potency (Wong et al., 2015).

Practical implications inform efforts to engage parents in emotion regulation intervention for young children with autism spectrum disorder. Quantitative and qualitative

findings suggest benefit in bringing attention to the need for emotional awareness and regulation skills in these children. Efforts to support parent uptake of emotion regulation intervention strategies, such as offering additional opportunities to learn content through online repositories that contain intervention information or providing parent coaching, as well as discussing ways to adapt materials for everyday activities, are also indicated. Moreover, when collaboratively establishing goals for parent strategy use, auxiliary skills (e.g., behavioural management) should be considered to bolster the effectiveness of emotion regulation-specific strategies. Finally, practitioners should assist parents with integrating emotion regulation strategies into the array of techniques they are using to support other skills such as language and social communication.

Limitations

Study outcomes were measured through semi-structured frustration tasks designed to elicit frustration in young children. Efforts were made to avoid influence of confounding variables, such as repeated exposure to a given task. However, the degree to which frustration tasks garnered child frustration and therefore opportunities for children and parents to demonstrate skills varied widely across tasks and dyads. Thus, variation in outcomes was likely due in part to the varied response to tasks among children. Information about parents' use of intervention techniques outside of sessions was not collected. Future evaluation of the Intervention should establish a criterion for parent strategy use within sessions and measure strategy use outside of sessions to determine parents' fidelity to intervention implementation. Additionally, generalisability was limited by sample homogeneity including high levels of education obtained by mothers, and lack of children with co-occurring intellectual disabilities. Future research should increase sample diversity.

Conclusion

While results of visual analyses generally did not support statistically significant effects of the Intervention on parent support for emotion regulation and on children's demonstration of this skill in semi-structured tasks, follow-up interviews pointed to clinical significance in that parents found the intervention useful and they applied the strategies in daily life. Moreover, interview data suggested a broad range of anecdotal child treatment responses. Future research in parent-mediated intervention to support young children's emotion regulation should consider additional practice opportunities via strategies such as parent coaching.

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Appendix

Questions and themes from post-intervention parent interviews

Interview questions

1. What did you experience from participating in the Intervention?
 Probe 1: What did you learn from participating in the Intervention?
 Probe 2: What strategies were most effective in helping you support your child's emotion regulation skills?
 Probe 3: How did your experience compare to what you expected when you agreed to participate in the study?
 2. What did your child experience from participating in the Intervention?
 Probe: Were there any changes in your child's behavior?
 3. In what ways could the Intervention be improved to make it more effective?
 Probe 1: How could the Intervention be improved to help you learn skills to support your child's emotion regulation skills?
 Probe 2: How could the Intervention be improved to help your child learn skills to manage their emotions?
 4. How does the Intervention compare to other interventions and services your child has or is currently receiving? That is, how is it alike or different?
 Probe 1: How does the Intervention compare to other interventions that you've used with your child, such as PECS, prompting language, supporting behavior?
 Probe 2: How does the Intervention compare to other services that your child has or currently receives, such as early intervention, speech therapy, or Applied Behavioral Analysis (ABA)?
 5. If the Intervention was available to all families with young children who have been diagnosed with ASD, when and how would you have liked to hear about it?
 Probe 1: When in relation to receiving the diagnosis of ASD for your child?
 Probe 2: In what ways would you have liked to hear about the Intervention, such as a website, your child's doctor, your child's teacher, etc.?
- Questions adapted from Hodgson et al. (2016); Pickard et al. (2016); Stadnick et al. (2013).

Interview themes

Theme/subtheme	Exemplar quotes
Parent personal growth	
Recognizing need for emotion regulation support	<p>Parent D: <i>It was a major realization and eye opener on how much I was working on everything else on language, on social skills. But not necessarily emotion identification.</i></p> <p>Parent C: <i>We just are kind of aware of where he's at at that moment and what's helping, and just kind of something for us to tuck in the back of our head of where we're at and be a little more conscious about it rather than random</i></p>
Awareness of self and child's emotions	<p>Parent E: <i>really being very intentional about how I talk through my own emotions, because this is the same thing I get, I have to be controlled so often that I think there's time when I relax at home, I can get pretty dysregulated myself</i></p>
Comfort and empowerment	<p>Parent A: <i>I really like ... the Intervention because it made me feel like, number one, I wasn't alone in dealing all of these things. And it kind of brought me some comfort that I wasn't the only parent out there experiencing these things. It was a great help that you came into my home and you worked through these things with me and This made me feel a little more empowered in helping him... There was a level of comfort there, like, OK, we're doing the right things and I'm learning these things and it was just very helpful, very gratifying to be able to give him this opportunity.</i></p>
Parenting skills gained	
support for emotion regulation	<p>Parent E: <i>One thing, when we went out using that breathe one with the monster app has been great. I've used that multiple times. Especially when we are somewhere, like we're at summer school and we're starting to fall apart. That kind of helps us come back together.</i></p> <p>Parent C: <i>I think one of the things that was really helpful for us and it's still up on the fridge over there is just being more conscious of the scale of different ways of helping him, like being from least involved to most involved</i></p>
Encourage child skill application	<p>Parent A: <i>And then another thing that you taught me, which I thought was super crucial and I don't even know why, but um, you know ... it was (child's name). He showed me like I need to push them, I need to push him out of his comfort zone, um, and play with him like he's a normal kid. Like I would my nieces and nephews and um, I think that's been really helpful and kind of an eye opening experience for me. Like, Oh yeah, I guess I have been kind of letting him run the show.</i></p> <p>Parent C: <i>I mean, we used to not be able to go ... I remember a trip to McDonald's, and we couldn't stay there. He just panicked. So now I'm trying, those other things that are stressful for him, trying to think of how we can use that, too. So it's somehow I find time to go and take pictures of, but it is helpful. It's something that definitely works for him.</i></p>
Extend the Intervention to meet child's needs	<p>Parent D: <i>But we try and work on the breathing. Which is cool, because I know my Apple watch has the Breathe app in it. It does a countdown, and inhale, and it has vibration, and it gives a visual, and it pulses in, and shows you when to breathe in, and then breathe out. So it's very visual based. And so I use that with him sometimes, or as a, "Let's breathe in." And it shows a picture of a circle, and it gets bigger, and then it gets smaller when you exhale.</i></p> <p>Parent C: <i>We've learned like where [intervention materials] work, like the pictures work best in the car, you know what I mean? We did have the feelings things, but now that I think about it, those have been in the bag for a while, and we haven't pulled them out because he's kind of expanded a little bit on his own, and we have bought books of different</i></p>

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Theme/subtheme	Exemplar quotes
Child ER skill attainment Identifying/verbalizing emotions	<p><i>feelings and things like that, that we read at night. So we've kind of adjusted it, I guess, here and there.</i></p> <p>Parent A: <i>I think it was helpful for him that we were learning these new techniques. You know, I think maybe, um, it kind of reassured him a little more, I think I'm not quite sure because it's always hard to get stuff out of him and I feel like, you know, going, circling back around to the emotion stuff because we were working with that emotion stuff. I think it's easier on him now that he can talk about these things. And feel safe that we're talking about these things.</i></p> <p>Parent D: <i>We have some books where there's characters in there where they'll be happy, the happy farmer, and, "Farmer happy." But sometimes I don't know if he, sometimes I state it and say, "The farmer is happy." And then, "Yay, the farmer is happy." So, I'd have to pay a little bit more attention to, is he mimicking what I say? But he'll see stuff, I think. I'm trying to recall, like I think we've watched movies and, somebody happy and he said, "Happy." "Yeah, you're right." Or somebody is laughing or, be like, "Happy." I'm like, "Yeah, you're right.</i></p>
Tools to manage emotions	<p>Parent C: <i>So we keep that in the car for him, and we also did picture stories for ... going to Florida, and we had her take pictures of every room in her house. So when we got there, he was anxious, but this year he actually got out of the car; the year before, he didn't want to get out of the car, after 24 hours in the car, could you imagine? Like, what's happening? Then he ran through every room, and we still had the pictures for him. We brought them with us, and that was it. He was fine. The same thing with restaurants. I actually took all four of my kids by myself to a restaurant last week, which is unheard of. He's maybe been to 10 restaurants in his life, like because he just couldn't do it.</i></p> <p>Parent E: <i>There has been some improvements and it's been more of like us doing proactive measures to make sure things don't get out of hand. Like, there's times when we, this summer, you only get so much to be on the game system, otherwise we get really elevated, we get mad about losing. Then times when you have to just be quiet. We have a forced quiet time and so that helps too. It's just kind of like you're forced to regulate it, so quiet hour where you just need to be mindful. Proactive measures.</i></p>
Intervention acceptability alignment with other programs/services	<p>Parent C: <i>I think they kind of really mirror each other, because like once ... I think it gave us some language to talk with speech to ... Like when we were planning for a trip to California and I was very stressed about how we were going to feed four kids on the road when we can't go into a restaurant. So I was kind of brainstorming with that, talking with her about, "Oh, this is what I'm anxious about, and we're going to try these pictures we did with ... "She's like, "Oh, well I have all these pictures about going out to a restaurant." She had them, so she said, "Here." Photocopied them for us. So just gave us like, "Oh, wait. These people have these resources.</i></p> <p>Parent C: <i>Kinda made us more aware of it also, and then we're willing to ask people for, 'Oh, do you have something like this? Do you have something like this?' Some of it just gave us more of we're matching their language now, so they were ... 'Oh, yeah, here, we have this.' ... probably for him, it made everything a little more consistent, too. For the</i></p>

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Theme/subtheme	Exemplar quotes
Timing of the Intervention implementation	<p>teachers, when we tell them he's visual, she's like, 'Oh, I have those things. Okay.'</p> <p>Parent D: <i>Because early intervention is the absolute key. Some of the things that do happen I know overlap with play therapy and some things that are like ABA, where you continuously make him ask for things or what they have you do for speech development, and so it all overlaps.</i></p> <p>Parent A: <i>I would say each child is different. Now if you have an ASD child who has much more like meltdown behaviors and completely out of control behaviors, I would think sooner. Because that's why it's different for every kid.</i></p> <p>Parent C: <i>Knowing that there's going to be something like this down the road would've been helpful. Knowing like, okay, there's things we can teach you on how we can get him out of a building without a fit; how you can go to a restaurant without a fit. All these things, like we're going to be able to help with that. ... Like, you're kind of like, "Oh, here's this diagnosis. Now what?" But to have somebody say, "Okay, here's all your different options, and this would be one of them," as far as they can teach you how to help them work through some of these things, it would've been helpful.</i></p> <p>Parent D: <i>I know for (my child), I think it came about, as his language was starting to develop, and he was starting to have an understanding of other concepts, it was good timing for him at that point, for him to understand, and for him. ... So I definitely think as anything earlier intervention, it's important, but it just depends, I think, each kid at exactly when can they identify these emotions, or do they seem to have an understanding of it. And then, if not, what would benefit them?</i></p>
Improvements for future	<p>Parent A: <i>Um, I don't know if in further studies, like if you could talk with people like twice a week, that would probably be awesome.</i></p> <p>Parent D: <i>It's hard when you're trying to incorporate everything on top of ... unfortunately most autistic kids don't just have, just emotion, and difficulties with emotion regulation. It's a lot of other things going on. I think it would be a great program integrated into one of, like, ABA therapies, or school programs, a special part, even 10 minutes a day on recognition of, and parents doing it as well as part of the normal household. I think it would be a great intervention that's used very routinely within classrooms or ABA therapy occupation, you know what I mean, [occupational therapy]. But more like the ABA therapy or setting, I think would be great, because I think they do a little bit, but not routinely.</i></p> <p>Parent E: <i>Or you could even encourage parents to record situations where their children are kind of over the ... because you get lost sometimes in that moment when you're the parent and then sometimes you can ... kind of like watching tapes of football games.</i></p>