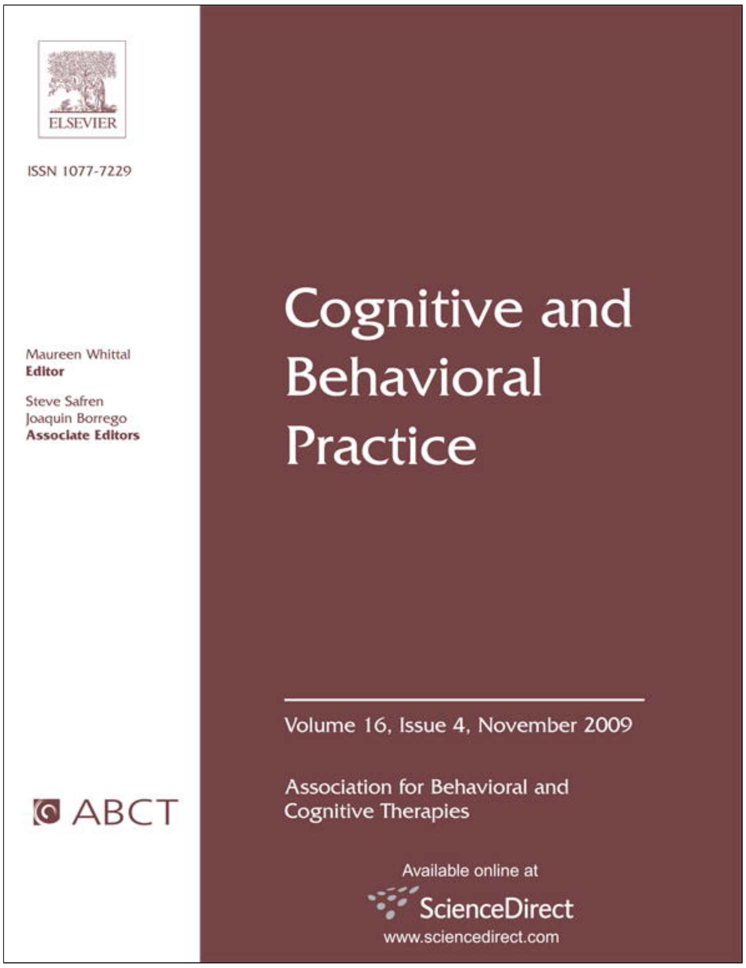
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Parent-Child Interaction Therapy for Children Born Premature: A Case Study and Illustration of Vagal Tone as a Physiological Measure of Treatment Outcome

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Evidence-based psychosocial interventions for externalizing behavior problems in children born premature have not been reported in the literature. This single-case study describes Parent-Child Interaction Therapy (PCIT) with a 23-month-old child born at 29 weeks gestation weighing 1,020 grams, who presented with significant externalizing behavior problems. Treatment outcome was assessed using standard measures of maternal and child functioning and observational measures of the parent-child interaction, as well as a physiological measure of heart rate variability (i.e., vagal tone) used to assess parasympathetic control in the child. Maternal reports of child behavior problems and their own stress and depressive symptoms decreased after treatment. Behavioral observations demonstrated improved parenting practices and child compliance, and vagal tone showed comparable increases as well. Results suggest that PCIT is a promising psychosocial intervention for children born premature with externalizing behavior problems, and that vagal tone may be a useful measure of treatment outcome.

PREMATURE birth, defined by the American Academy of Pediatrics as less than 37 weeks gestational age, has increased in prevalence greatly over the past decade and is currently considered a significant public health concern (2006). Compared to full-term infants, infants born preterm are at increased risk for a variety of medical and behavioral health problems during infancy and also later in life. A meta-analysis suggested school-age children who were born preterm had significantly higher rates of externalizing behavior problems in 81% of the 16 studies examined, and they were 2.64 times more likely to meet diagnostic criteria for ADHD among the 7 studies that assessed the presence of this behavior disorder (Bhutta, Cleves, Casey, Cradock, & Anand, 2002). Although research comparing behavior problems between preterm and full-term children is limited, it has been proposed that preterm children are more likely to experience a "pure" form of ADHD, suggesting a central nervous system origin (Salt & Redshaw, 2006). Negative behavioral outcomes, including externalizing behavior problems, have been shown to worsen over time among children born premature (Aylward, 2002), highlighting the need for early identification and intervention.

Several child factors, such as neuromotor and intellectual functioning, (Nadeau, Boivin, Tessier, Lefebvre, & Robaey, 2001), and family factors, such as resources and parental education level (Salt & Redshaw, 2006), have been hypothesized to account for behavior problems in the child born prematurely. Parenting styles have also been shown to affect rates of behavior problems among children born preterm. Mothers who encourage more autonomy and age-appropriate behaviors report fewer behavior problems in their preterm children (Eiser, Eiser, Mayhew, & Gibson, 2005). Thus, interventions targeting parenting and parent-child interactions may help improve behavioral outcomes in children born preterm.

It is recommended that treatment of premature infants include medical, psychological, developmental, and educational approaches (Maccow, Howard, & Swerlik, 2006). A few early intervention programs combining developmental and support services for preterm infants and their parents have been used and found successful at

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reducing developmental problems, at least in the short term, and programs involving both parents and children have been the most efficacious (McCarton, Wallace, & Bennett, 1996). For example, mothers randomized to a family-based intervention in the neonatal intensive care unit showed more contingent and sensitive parent-infant interactions and less maternal stress compared to control mothers who did not receive an intervention (Browne & Talmi, 2005). Research examining psychosocial interventions for children born preterm is limited (Xu & Filler, 2005), and no study has specifically targeted externalizing behavior problems.

Parent-Child Interaction Therapy (PCIT) is an empirically supported treatment for preschool-age children designed to change parent-child interaction patterns and thereby reduce children's externalizing behavior problems (Eyberg, Nelson, & Boggs, 2008; Zisser & Eyberg, in press). During PCIT, parents are taught skills to establish a nurturing and secure relationship with their child while increasing their child's prosocial behavior and decreasing negative behavior. Treatment progresses through two distinct phases. The first phase, called Child-Directed Interaction (CDI), focuses on strengthening the parent-child attachment, increasing positive parenting, and improving child social skills. The second phase, called Parent-Directed Interaction (PDI), focuses on improving parents' expectations, ability to set limits, consistency and fairness in discipline, and reducing child noncompliance and negative behavior.

PCIT may be particularly promising as a psychosocial treatment for children born premature because it focuses on establishing an authoritative parenting style, combining warmth, clear communication, and firm limit setting (Baumrind, 1967, 1991). Mothers of preterm children have a heightened awareness of their child's vulnerability (Eiser et al., 2005), which may lead to greater permissiveness and thus inadvertently have a negative effect on parenting. Although research has demonstrated the effectiveness of PCIT for treating other at-risk child populations, such as children with abuse histories (Chaffin et al., 2004) and mental retardation (Bagner & Eyberg, 2007), the effectiveness of this treatment has not been reported for children born premature.

In addition to measuring the effectiveness of PCIT in this population using traditional outcome measures, such as parent-report questionnaires and observations of parent-child interactions, physiological measures may provide further information about changes that occur within the child. Kagen (2007) asserted that a combination of verbal reports, behavioral observations, and biological data would provide the most valid assessment of psychological constructs. In addition, physiological data may help to illustrate the biological underpinnings of psychosocial interventions (e.g., changes in a child's ability to self-regulate) and guide future intervention development. To our knowledge, only one study has examined physiological response following child psychosocial treatment. Stadler and colleages (2008) found higher baseline heart rate to be a significant predictor of behavior therapy success for school-age children with disruptive behavior disorder participating in a 2-week summer treatment program.

In this case study, we measured changes in cardiac vagal tone (VT), a physiological index of emotion regulation that reflects autonomic influence of the central nervous system on heart rate variability (Beauchaine, 2001; Porges, 2001), before and after treatment as well as changes within each assessment between a baseline period and stressor condition. VT is a measure of respiratory sinus arrhythmia (RSA), or the variability in heart rate associated with breathing, and is thought to be an indicator of parasympathetic functioning (Berntson et al., 1997). In the developmental literature, VT has been measured during both resting (nonstress) conditions and in response to challenging conditions.

During resting conditions, high levels of VT are thought to represent an inhibitory influence of the brainstem on the heart (via the vagus or 10th cranial nerve) allowing the child to appropriately respond and regulate to the environment (Porges, 2001). During tasks or conditions that demand sustained attention and other non-fight-or-flight responses, higher cognitive and perceptual systems are thought to exert top-down influences on the brainstem nuclei that contribute to cardiac VT, resulting in a decrease in the components of heart rate variability associated with respiratory rhythm (i.e., VT). In this way, active attention to and engagement with environmental demands results in a decrease in VT during challenging tasks and conditions (Porges, 2001). A decrease in VT from rest to a challenging condition is seen as an adaptive response of self-regulation, indicating a child's readiness to engage in the environment (Porges, 2001; Sheinkopf et al., 2007). Attenuations in this aspect of VT regulation have been found to predict behavior problems in preschoolers (Porges, Doussard-Roosevelt, Portales, & Greenspan, 1996) and adaptive VT regulation has been found to predict resilient outcomes in at-risk preschoolers (Sheinkopf et al., 2007).

Preschool-age children with behavior problems have been shown to have dysregulated emotion regulation associated with heart rate variability (Calkins & Dedmon, 2000). Additionally, higher heart rate variability of very low-birth-weight preterm neonates was associated with fewer behavior problems at 3 years (Doussard-Roosevelt, Porges, & McClenny, 1996). However, changes in physiological indices of emotion regulation following PCIT have not previously been examined in any population. It was expected that overall VT would increase after treatment completion, reflecting overall improvements in emotional regulation, and that there would be decreases in VT between the baseline period and stressor condition, consistent with previous findings demonstrating decreases in vagal reactivity following challenging tasks (Beauchaine, 2001).

Method

Participants

"Tim Jones," a 23-month-old (20 months corrected for prematurity) White male, was a twin born at 29 weeks and weighed 1,020 grams at birth. He was cared for in the Neonatal Intensive Care Unit for 2.5 months and required a blood transfusion during his hospitalization. Since birth, Tim has been seen regularly at a follow-up clinic for children born premature to assess medical, developmental, and behavioral progress. At his 18-month corrected age follow-up visit, Tim displayed several difficult behaviors, including hitting his twin brother, disobeying requests by the examiner, and throwing frequent temper tantrums. As a result of observing these behaviors, Tim's pediatrician referred his mother, Ms. Jones, to receive a behavioral intervention as part of a larger study examining PCIT for children born premature. Results on the neurological exam were normal. Tim was administered the Bayley Scales of Infant and Toddler Development–Third Edition (Bayley, 2006) during his follow-up visit to assess cognitive and language functioning. Tim received composite scores of 90 on the Cognitive subtest (age equivalent of 18 months) and 71 on the Language subtest (age equivalent of 11 months on receptive communication and 16 months on expressive communication) based on his adjusted age of 20 months. Although Tim did not receive any formal diagnoses, the Bayley examiner indicated Tim displayed moderate delays in both receptive and expressive language.

At the intake, Ms. Jones, a 25-year-old Caucasian single mother, was a college student with Social Security as her primary source of income. Tim's biological father, who was never married to Ms. Jones, provided monthly child support and had custody of Tim and his brother two nights a week. Primary presenting problems at home included physical aggression (e.g., hitting his brother and other children), temper tantrums, noncompliance (e.g., refusing to clean up), and difficulty transitioning from one activity to another. Tim reportedly would not sit still and frequently climbed on furniture. Ms. Jones reported that these behavior problems began at around 12 months and worsened since that time.

Measures

Child Behavior Checklist for 1½- to 5-Year-Olds (CBCL; Achenbach & Rescorla, 2001)

The CBCL is a 99-item parent-rating scale designed to measure the frequency of children's behavior and emotional problems. Only two items from the CBCL differ from the earlier CBCL 2- to 3-year-old version (Achenbach, 1992), which had interrater agreement reported to range from .56 to .76 and concurrent validity with the Richman Behavior Checklist in a sample of preterm preschoolers (Spiker, Kraemer, Constantine, & Bryant, 1992). The CBCL has demonstrated very good 8-day test-retest reliability (r=.68 to .92, mean r=.84), interrater reliability (mean mother-father r=.61, mean parent–child care provider r=.65), and success in discriminating between referred and nonreferred children (Achenbach & Rescorla, 2001). On the broadband Externalizing, Internalizing, and Total Scales, a T-score greater than 63 is in the clinically significant range, whereas T-scores between 60 and 63 are in the borderline clinically significant range.

Eyberg Child Behavior Inventory (ECBI; Eyberg & Pincus, 1999)

The ECBI is a 36-item parent-rating scale designed to measure disruptive behavior in children between 2 and 16 years. The Intensity Scale measures the frequency with which disruptive behavior occurs and the Problem Scale measures how problematic the child's behavior is for the parent. The Intensity and Problem Scales of the ECBI yield internal consistency coefficients with preschoolers of .95 and .93 (Eyberg & Pincus, 1999); interrater (mother-father) reliability coefficients of .69 and .61 (Eisenstadt, McElreath, Eyberg, & McNeil, 1994); and test-retest reliability coefficients of .80 and .85 across 12 weeks and .75 and .75 across 10 months, respectively (Funderburk, Eyberg, Rich, & Behar, 2003). On the EBCI Intensity and Problem Scales, T-scores of 60 and higher are clinically significant.

Parenting Stress Index–Short Form (PSI-SF; Abidin, 1995)

The short form of the PSI is a 36-item self-report instrument for parents of children ages 1 month to 12 years and contains three factor-analytically-derived subscales (Parent Distress, Parent-Child Dysfunctional Interaction, Difficult Child). The short form subscales have shown Cronbach's alphas of .87, .80, and .85, respectively, and 6-month test-retest reliabilities of .85, .68, and .78, respectively (Abidin, 1983). The PSI and the PSI-SF total scores are highly correlated with one another (.94), and on the long form of the PSI, higher scores have been associated with increased severity of conduct-disordered behavior (Eyberg, Boggs, & Rodriguez, 1992; Ross, McNeil, Eyberg, & Hembree-Kigin, 1998). Scores between the 81st and 84th percentile are in the borderline range, whereas scores at the 85th percentile and higher are clinically significant.

Beck Depression Inventory-II (BDI-II; Beck, Steer, & Brown, 1996)

The BDI-II is a widely used 21-item self-report assessment of depressive symptoms. The BDI-II has demonstrated good internal consistency (α = .89 to .93) and concurrent validity with other measures of depression (Whisman, Perez, & Ramel, 2000). Each of the 21 items corresponding to a symptom of depression is summed to give a single score for the BDI-II. There is a 4-point scale for each item ranging from 0 to 3. Cut score guidelines for the total score of the BDI-II include the following: 0–13 is considered minimal range, 14–19 is mild, 20–28 is moderate, and 29–63 is severe.

Dyadic Parent-Child Interaction Coding System–Third Edition (DPICS-III; Eyberg, Nelson, Duke, & Boggs, 2004)

The DPICS-III is a revised version of a behavioral coding system that measures the quality of parent-child social interactions (Eyberg, Bessmer, Newcomb, Edwards, & Robinson, 1994). The convergent and discriminative validity of the DPICS categories have been extensively documented, and the psychometric data are summarized in the DPICS-III manual (Eyberg et al., 2004). Parent categories recorded for this study were behavior descriptions (statements describing the child's current actions); reflections (statements with the same meaning as a preceding child verbalization); praises (statements expressing positive evaluation of the child); criticisms (statements expressing disapproval to the child); questions; and commands (directions). Child compliance to parent commands giving opportunity to comply was also recorded.

To examine changes in parent-child interactions during the child-led play, we created two composite categories of “Do Skills” (behavior descriptions, reflections, and praises) and “Don't Skills” (questions, commands, and criticisms) reflecting behaviors parents are taught to use and not to use during child-led play. Child responses to parent commands (percentage of compliance and noncompliance) were measured during the clean-up situation.

Cardiac Vagal Tone (VT)

VT is a measure of RSA, the influence of breathing on heart rate. VT is an index of parasympathetic influence on heart rate and is reflective of emotion regulation and engagement of the environment. VT was computed from ECG signals that were recorded by telemetry and digitized at a 1 millisecond sampling rate using the BIOPAC MP100 Data Acquisition System (BIOPAC Systems Inc., Goleta, CA). Electrocardiogram (ECG) was acquired with three electrodes placed on the child's chest and abdomen. The electrodes were connected to a wireless transmitter, stored in a small backpack, and sent to a PC in an adjacent observation room. The ECG signal was digitized and recorded, with heart beats represented by the presence and timing of the R-waves in the ECG signal and heart period calculated from the interval between R-waves. VT was derived from time-series analysis of R–R intervals from digitized ECG recordings. HR was derived from interbeat intervals defined by detection of R-waves to the nearest millisecond. The system coordinated behavioral events and physiological signals by marking the videotape and physiological data with the same time stamp.

In accordance with recent recommendations (Task Force of the European Society of Cardiology and the North American Society of Pacing and Electrophysiology, 1996), VT values were calculated based on a combination of an automated approach and a manual approach (Berntson et al., 1997). First, postprocessing of the ECG took place offline by use of a series of automated algorithms. To control for artifact, including activity level of the child, artifact detection for the ECG time series used a moving confidence interval that detected R–R intervals outside of expected values. Missed or spurious R-waves were detected, flagged, and corrected by linear interpolation. Subsequent processing employed a time-series analysis and a moving polynomial filter to remove low frequency trends in the ECG signal. This process removes periodicities in the ECG signal that are outside the frequency range of the respiratory cycle. Second, following the automated approach of interpolating abnormal R–R intervals, VT values were calculated based on a set of stringent criteria. During the 10-min baseline period, the VT value represents the first continuous 2 min with no more than 15% artifact rates on average. During the 5-min child-led play and cleanup situations (described below), the VT value represents an average of a 2-min period in which each VT value has less than 15% artifact. The computations for the VT index utilized the time-series analysis and calculations developed by Porges (1986), which is the natural log of the variance of the R–R interval measurements in milliseconds squared (i.e., Lnmsec2). This measurement of VT is defined as the rhythmic variation of heart rate during the frequency range of respiration. In other words, VT reflects the ability of the parasympathetic nervous system to modulate heart rate effectively and is viewed as an indicator of parasympathetic functioning (Porges, 2001).

Assessment Procedure

Following the initial intake, Ms. Jones was asked to complete several parent rating scales at a pretreatment evaluation. The rating scales included measures of Tim's behavior problems as well as Ms. Jones' parenting stress, parenting practices, and mood. Ms. Jones and Tim were observed during a 10-min baseline period watching a pleasant video (*Baby Einstein*) to measure resting VT and two standard 5-min parent-child interaction situations (i.e., child-led play and cleanup) to measure the quality of the interaction. Observations were coded by an undergraduate research assistant who was masked to intervention status and did not know whether Tim received PCIT between the pre- and posttreatment assessments. The undergraduate student coder was trained to 80% agreement with a criterion tape before coding the mother-child interactions and met weekly with a second undergraduate student coder to maintain reliability and avoid observer drift as part of the larger randomized trial.

This procedure was repeated during a posttreatment evaluation 20 weeks after the pretreatment evaluation. During the entire 20-min observation, Tim's heart rate was measured to assess changes in overall VT between the pre- and posttreatment assessments as well as between the baseline period and stressor condition (i.e., cleanup) within each assessment. Instructions to Ms. Jones during the two assessments were identical. During the baseline period, she was asked to make sure Tim stays in the room and keeps the ECG leads on his chest and stomach. Ms. Jones was told to let Tim choose the game during the child-led play and have him clean up all the toys by himself during the clean up. All toys and furniture used during the two assessments were also identical. As described above, the artifact detection procedure to calculate VT controlled for any potential differences in activity level across assessments.

At the pretreatment evaluation, Ms. Jones' report on the CBCL suggested that Tim's Internalizing (T=64), Externalizing (T=79), and Total (T=70) Problems were all in the clinically significant range. Her report on the ECBI Intensity Scale indicated the frequency of Tim's overall disruptive behavior along with how problematic his behavior was for Ms. Jones were both in the clinically significant range (T=82 and 77, respectively). On the PSI-SF, Ms. Jones' total stress score was at the 80th percentile, documenting borderline clinically significant levels of overall stress. More specifically, Ms. Jones' responses on the Difficult Child subscale was in the clinically significant range (85th percentile), suggesting that Tim's behavior made him difficult to manage. However, Ms. Jones did not report clinically significant levels of stress on the parental distress and parent-child interaction subscales (55th and 70th percentiles). On the BDI-II, Ms. Jones' acknowledged minimal levels of depressive symptoms (Total Score=13).

During the child-led play observation, Ms. Jones demonstrated difficulty following Tim's lead. Although she reflected (repeated or paraphrased) Tim's speech twice, she did not use any unlabeled (nonspecific praises, such as "Nice job") or labeled (praise specifying the positive behavior, such as "Nice job putting the blocks away") praises and did not provide any descriptions of his behavior (e.g., "You're putting one block on top of another"). Ms. Jones gave 11 commands and asked Tim 11 questions during this 5-min observation period, both of which take the lead away from the child in play. Therefore, Ms. Jones had a total number of 2 "Do" skills and 22 "Don't" skills. During the 5-min cleanup situation, Tim was compliant to only 4% of his mother's commands. Tim's vagal tone increased from the baseline to cleanup situations, suggesting an attenuated physiological response to stress, which has been linked to aggressive behaviors in children (van Goozen, Fairchild, Snoek, & Harold, 2007).

The assessment indicated that Tim's disruptive behaviors were outside normal limits, and that Ms. Jones experienced significant stress as a result of her child's behavior. Based on the observed parent-child interactions, it was determined that treatment would focus on increasing the specificity of Ms. Jones' positive verbalizations to increase behaviors incompatible with Tim's problem behaviors and on helping her to stop her high rate of negative verbalizations to extinguish attention-seeking behaviors (e.g., whining). In addition, treatment targeted Ms. Jones' ability to set limits in order to decrease Tim's noncompliance and aggressive behaviors. It was expected that this intervention in the parent-child interaction would also help Tim's mother cope more effectively with her own stress and depressive symptoms and, in turn, improve in her interactions with her son. Ms. Jones was amenable to the recommendation of PCIT, and she appeared highly motivated to begin treatment.

Treatment

PCIT involves two distinct phases. The first, Child-Directed Interaction (CDI) phase, resembles traditional play therapy and focuses on strengthening the parent-child attachment, increasing positive parenting, and improving child social skills; the second phase, Parent-Directed Interaction (PDI), resembles clinical behavior therapy and focuses on improving parents' expectations, ability to set limits, and consistency and fairness in discipline as they learn specific techniques to reduce child noncompliance and other negative behaviors.

During the CDI phase, parents learn to follow the child's lead in play by using the nondirective PRIDE skills or "Do skills": *P*raising the child, *R*eflecting the child's statements, *I*mitating the child's play, *D*escribing the child's behavior, and using *E*nthusiasm in the play. They learn to change child behavior by directing the PRIDE skills to the child's appropriate play and consistently ignoring undesirable behaviors. Parents also learn to avoid using criticisms (e.g., "Don't whine"), questions (e.g., "What do you want to play with next?"), and commands (e.g., "Hand me that toy"), which all take the lead away from the child and are referred to as the "Don't skills." During CDI coaching sessions, the therapist coaches the parent in their use of the Do and Don't skills as they play with their child, until parents meet criteria for skill mastery (i.e., 10 behavioral descriptions, 10 reflections, 10 labeled praises, and less than 3 questions, Commands, and Criticisms), as assessed during a 5-min observation at the start of each session.

During the PDI phase, parents learn to direct the child's behavior when necessary with effective commands and specific consequences for compliance and noncompliance. In PDI coaching sessions, parents work toward meeting the mastery criteria of PDI skills that serve as an indicator of their consistency. Throughout the PDI phase of treatment, the therapist guides the parents in applying the principles and procedures of CDI and PDI to the child's behavior at home and in other settings.

Ms. Jones and Tim were seen in treatment for 15 weekly sessions over the course of 4 months. Tim's biological father attended 4 sessions, his maternal grandmother attended 1 session, and the early intervention provider attended 1 session. These sessions followed the standard PCIT protocol. In PCIT, all caregivers in the child's home are encouraged to participate in treatment. For the session in which both Tim's father and grandmother participated, session length was increased to 75 min. Previous research suggests that involvement of additional caregivers in PCIT may help maintain long-term treatment effects (Bagner & Eyberg, 2003). The early intervention provider watched the session from behind the one-way mirror to understand the skills taught during PCIT and encourage Ms. Jones' use of these skills during subsequent home visits. During treatment, Ms. Jones' ratings of Tim's behavior were tracked weekly using the ECBI Intensity Scale, which is sensitive to weekly changes in child behavior during PCIT. Figure 1 illustrates the changes in Tim's behavior on this scale throughout treatment. Regular tracking of the ECBI score provided information that allowed us to monitor Tim's behavior closely during treatment.

Special steps were taken to tailor the intervention to Tim's prematurity status. Eyberg (2005) defined tailoring as making changes in the focus or delivery of an intervention to address specific needs of a particular family. Parents of children born premature report lower social, emotional, and physical well-being (Eiser et al., 2005), and are more likely to show a lax parenting style due to their child's medical vulnerability (Singer et al., 2007). During Ms. Jones' interactions with Tim, the therapist provided constant reassurance and encouragement during coaching to address specific concerns about Tim's safety and physical well-being. For example, the therapist provided Ms. Jones with a play-by-play of Tim's behavior when in time-out and made supportive comments such as, "Tim is doing fine in the chair. I know it is difficult to hear him cry, especially after all you have been through since his birth. However, it is important to set firm limits with Tim, so he will listen more to you in the future." Additionally, Tim's twin brother was incorporated during two of the later PDI sessions to help provide Ms. Jones, a single mother, support and guidance in how to use the CDI and PDI skills with both children together. These sessions were helpful as they represented the majority of Ms. Jones' daily interactions.

Considering Tim's young age and developmental level, we followed recommendations outlined for young children with MR (Bagner & Eyberg, 2007), which demonstrated how PCIT can be tailored to children's developmental level while adhering strictly to the treatment manual. For example, in this study Ms. Jones was encouraged to use gestural cues along with verbal directions during PDI (e.g., pointing to a block while saying, "Please give me that block").

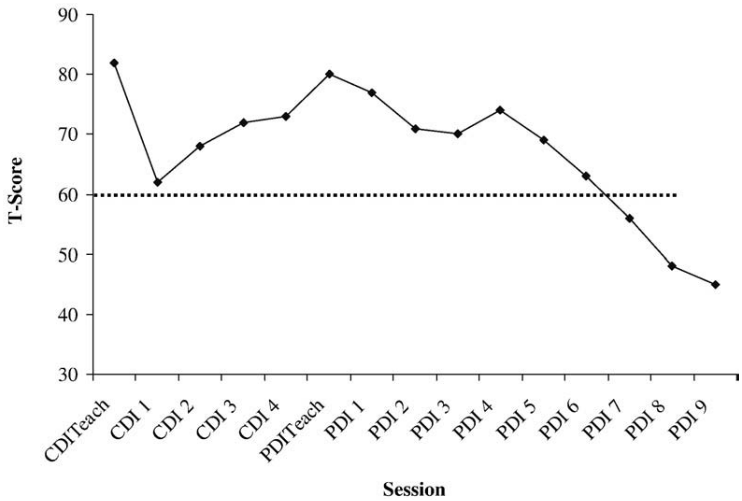

Fig. 1. ECBI intensity score change across the 15 treatment sessions.

Table 1
Changes in Parent-Report Measures

Measure	Pretreatment	Posttreatment	Follow-up
Child Behavior Checklist (T-Score)			
Internalizing Scale	64	41*	43*
Externalizing Scale	79	37*	44*
Total Scale	70	37*	44*
Eyberg Child Behavior Inventory (T-Score)			
Intensity Scale	82	38*	47*
Problem Scale	77	42*	43*
Parenting Stress Index – Short Form (Percentile)			
Parental Distress Scale	55	1	1
Dysfunctional Interaction Scale	70	40	5
Difficult Child Scale	85	5*	20*
Total Stress Scale	80	1*	1*
Beck Depression Inventory – Second Edition (Raw Score)			
Total Score	13	5*	0*

Note. Asterisks indicate clinically significant change from pretreatment.

All therapy sessions were videotaped to assess treatment integrity. An undergraduate research assistant not involved in coding the behavioral observations randomly selected 50% of the session tapes from this case and checked them for fidelity to treatment session checklists in the PCIT manual (Eyberg & Lab, 1999). Percent agreement with session checklist items yielded 94% accuracy (range = 71–100%).

Results

According to Ms. Jones' responses on the CBCL, ECBI, PSI-SF, and BDI-II at the posttreatment assessment, 20 weeks after the pretreatment session, Tim's behavior was within normal limits on all measures, as were Ms. Jones' parenting stress and depressive symptoms. At a 4-month follow-up, re-administration of these four questionnaires remained well below clinically significant levels, suggesting maintenance of treatment gains for both Tim and Ms. Jones following treatment (see Table 1).

As shown in Table 2, observations of the parent-child interaction during the child-led play showed that Ms. Jones used the Do skills (i.e., praises, behavior descriptions, and reflections) more frequently at the posttreatment assessment than at the pretreatment assessment and markedly reduced the Don't behaviors (i.e., questions, criticisms, and commands). In the cleanup situation, Ms. Jones demonstrated her use of positively stated commands to redirect Tim from negative behavior, and Tim's compliance, coded during the cleanup situation, increased from only 4% before treatment to 94% at the posttreatment assessment, a highly substantial change.

In addition to changes in parent and child behaviors, Tim's VT was measured during the 10-min baseline period, 5-min child-directed play, and 5-min cleanup situation. As shown in Table 2 and parallel to the changes in parent and child behaviors, Tim's VT was considerably higher (better regulated) at the post- than pretreatment assessment during all three situations. VT had a 3-fold increase during the baseline period and a 1.5-fold increase during the child-directed play and cleanup. In addition to changes in overall VT between the pre- and posttreatment assessments, changes in VT were meaningful between the baseline period and cleanup situation within each assessment. VT increased between the baseline period and cleanup at the pretreatment assessment, whereas it decreased at the post-treatment assessment.

Discussion

This case study illustrated the use of PCIT with a 23-month-old child born at 29 weeks gestation weighing 1,020 grams who presented with significant externalizing behavior problems. The results suggest that PCIT is a promising intervention for treating the behavior problems of children born premature. The changes in parent report measures and behavioral observations are consistent with findings from previous randomized trials of PCIT.

Parent report of child behavior problems, as well as parenting stress and maternal depression, showed positive changes from clinical to normative levels after treatment. These treatment effects were maintained during the 4-month follow-up period. Behavioral observations demonstrated an improved parent-child interaction and increased child compliance to parental commands following treatment. Ms. Jones mastered the CDI skills, including increasing her use of behavior descriptions and reflections. Although not formally assessed, these changes appeared to increase the number verbalizations and clarity of Tim's speech. Ms. Jones also learned to avoid

Table 2
Changes in Parent and Child Behaviors and Child Physiology

Measure	Pretreatment	Posttreatment	Change Scores
Parent Skill Acquisition during 5-min Child-Directed Interaction (CDI)			
Number of Do Skills	2	24	22
Number of Don't Skills	28	8	-20
Child Behavior during 5-min Clean Up			
Percent Compliance	4	94	90
Child Physiology (Vagal Tone)			
Baseline (10 min)	1.91	7.02	5.11
CDI (5 min)	3.29	4.91	1.62
Cleanup (5 min)	3.91	5.56	1.65

Note. Change scores are calculated by posttreatment minus pretreatment scores.

asking questions during her interactions with Tim. Reducing these intrusive verbalizations allowed Tim to lead the play and minimized opportunities for coercive interchanges that might occur if Tim chose not to answer. Ms. Jones also reduced her critical statements during her interactions with Tim, which helped to maintain a positive focus during the mother-child interactions. Ms. Jones' performance of the CDI skills at the posttreatment assessment had dropped little from mastery criteria attained at the last treatment session, and continued to show the warmth that results from the CDI. Ms. Jones' performance of PDI at the posttreatment assessment also showed her mastery of positively stated commands during the PDI to redirect Tim from negative behavior, and Tim showed a dramatic increase in his compliance to his mother's commands.

In addition to the traditional parent-report questionnaires and observations of the parent-child interaction, this study provides the first physiological outcome data following PCIT. Based on measurement of VT, the child displayed increased parasympathetic control and improved emotion regulation following treatment. The physiological changes were parallel with changes in the parent-report of child behavior problems and are consistent with previous research demonstrating an inverse relationship between heart rate variability and scores on the CBCL Externalizing Scale (Pine et al., 1996, 1998). Thus, PCIT may help a child improve his or her own physiological arousal.

Changes in VT within each assessment of this case study provide unique findings as well. It was expected that VT would decrease between the baseline period and stressor (i.e., cleanup) due to previous findings demonstrating decreases in vagal reactivity following challenging tasks (Beauchaine, 2001) and the theory that reductions in VT from baseline to a challenging task indicates the child's ability and readiness to engage in the environment (Porges, 1995, 2001). For example, infants at 9 months who did not decrease VT in response to a social task had more behavior problems at 3 years (Porges et al., 1996). Although unexpected, changes in Tim's VT between the baseline period and cleanup increased at the pretreatment assessment, which is consistent with recent research linking attenuated physiological and endocrine responses to stress with aggressive and antisocial behavior (van Goozen et al., 2007). As expected, Tim's VT decreased between the baseline and stressor at the posttreatment assessment, representing improved emotional and behavioral regulation (Calkins & Dedmon, 2000). Given these physiological changes, it would be interesting to develop a model in which monitoring the child's physiology could be used to inform behavior change during treatment. This information can be used to tailor PCIT to meet the specific needs of each child. Furthermore, including psychophysiological measures in future research may help to elucidate child-level mechanisms of behavior change.

The findings of this study are also unique because of the age of the treated child. PCIT was developed for children between the ages of 2 and 7 (Herschell, Calzada, Eyberg, & McNeil, 2002), but most studies examining outcomes have included children ages 3 and older. The randomized trial examining outcomes with cognitively delayed children (Bagner & Eyberg, 2007) first demonstrated the feasibility of a downward extension of the PCIT age range. This case study of a child aged 23 months (20 months after correcting for premature status) further suggests that PCIT can be effective with children chronologically and developmentally younger. The application of PCIT for children younger than 3 years can have broader implications, particularly given the increased importance placed on prevention efforts in children born premature.

There are a number of limitations inherent in the case study design, including the inability to conduct statistical analyses, no control group, and a lack of generalizability. For example, VT shows a normative increase across childhood (Bornstein & Suess, 2000), so changes in VT may have in part been due to maturation effects that could not be controlled in this case study. However, the time period for this study is considerably shorter than in studies of maturational effects on VT in children. Additionally, the treatment was delivered in a clinical research setting as part of a larger randomized clinical trial, further limiting the generalizability of the treatment effects to private practice and other settings. Finally, behavioral observations and collection of VT data were not completed at the follow-up assessment, lessening confidence in conclusions about long-term effects for this population. Nevertheless, case studies offer a unique opportunity to examine the application of therapy to a new clinical population and provide concrete and persuasive demonstrations of clinical phenomena prior to examining the treatment with a larger sample (Kazdin, 1998).

In sum, this case study suggests the feasibility of successful extension of PCIT to a new population with a high prevalence of externalizing behavior problems. Changes in parent-report measures of child behavior and parent functioning, behavioral observations of parent-child interactions, and physiological measurement of the child all improved following treatment, providing initial support for the effectiveness of PCIT for children born premature. Given the considerable increase of preterm birth to 12.5% of all births in the U.S. in the last decade (Berman & Butler, 2006), these findings yield significant public health relevance. Future research should examine the efficacy of PCIT for children born premature in a larger randomized clinical trial. In addition, this case study uniquely demonstrates child physiological changes following PCIT, which should undergo further empirical study.

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