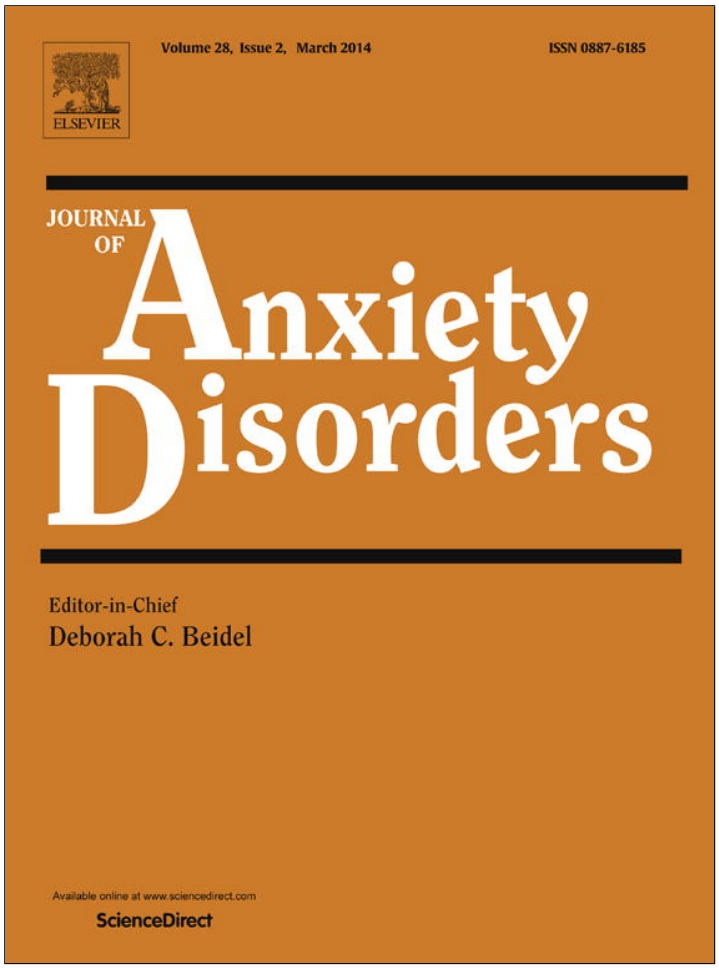

Journal of Anxiety Disorders 28 (2014) 154–159

Contents lists available at ScienceDirect

Journal of Anxiety Disorders

Attention Bias Modification Treatment for children with anxiety disorders who do not respond to cognitive behavioral therapy: a case series

Michele Bechor[a], Jeremy W. Pettit[a,*], Wendy K. Silverman[a], Yair Bar-Haim[b], Rany Abend[b], Daniel S. Pine[c], Michael W. Vasey[d], James Jaccard[e]

[a] Department of Psychology, Florida International University, Miami, FL 33199, USA
[b] Adler Center for Research in Child Development and Psychopathology, Department of Psychology, Tel Aviv University, Tel Aviv, Israel
[c] Intramural Research Program, National Institute of Mental Health, Bethesda, MD, USA
[d] Department of Psychology, Ohio State University, Columbus, OH, USA
[e] Silver School of Social Work, New York University, New York, NY

ARTICLE INFO

Article history:
Received 12 February 2013
Received in revised form 18 June 2013
Accepted 5 September 2013

Keywords:
Anxiety
Children
Attention
Treatment
Attention bias

ABSTRACT

Evidence is emerging to support the promise of Attention Bias Modification Treatment (ABMT), a computer-based attention training program, in reducing anxiety in children. ABMT has not been tested as an adjuvant for children with anxiety disorders who do not respond to Cognitive-Behavioral Therapy (CBT). This case series presents findings from an open trial of ABMT among six children (four girls; *M* age = 11.2 years) who completed a CBT protocol and continued to meet diagnostic criteria for an anxiety disorder. All children completed the ABMT protocol with no canceled or missed sessions. Child self-ratings on anxiety symptoms and depressive symptoms significantly decreased from pretreatment to posttreatment, as did parent ratings on child anxiety-related impairment. Parent ratings on child anxiety and internalizing symptoms displayed non-significant decreases from pretreatment to posttreatment. These findings support the potential promise of ABMT as a feasible adjuvant treatment that reduces anxiety and impairment among child anxiety CBT nonresponders.

1. Introduction

Anxiety disorders occur in 10–20% of children and adolescents, pose a huge financial burden on the healthcare system, and are associated with substantial impairment (Rapee, Schniering, & Hudson, 2009; Silverman, Pina, & Viswesvaran, 2008). Evidence-based treatments for anxiety in children and adolescents are largely exposure-based cognitive behavioral therapies (CBTs) (Rapee et al., 2009; Silverman et al., 2008). Despite the strong efficacy evidence for CBT, up to 50% of children and adolescents continue to meet diagnostic criteria for an anxiety disorder after a full course of treatment (Compton et al., 2004; Rapee et al., 2009; Silverman et al., 2008). To our knowledge, no empirical study has examined an adjuvant treatment for children and adolescents who did not benefit from CBT. In this article, we report promising preliminary data on Attention Bias Modification Treatment (ABMT) as an adjuvant for children and adolescents who completed a full course of CBT and continued to meet diagnostic criteria for an anxiety disorder.

Threat-related attention bias has been implicated in the development, etiology and maintenance of anxiety disorders (Bar-Haim, Lamy, Pergamin, Bakermans-Kranenburg, & van IJzendoorn, 2007; Cisler & Koster, 2010; Eldar, Ricon, & Bar-Haim, 2008; Mathews & MacLeod, 2002). The most commonly used paradigm for assessing threat-related attention bias is the visual probe-detection task. In the task, a pair of threatening and neutral stimuli is presented simultaneously and then followed immediately by a visual probe. The probe replaces the threatening stimulus on some trials and the neutral stimulus on others. An individual's difference in average response times when identifying the location of the probe following threatening stimuli versus neutral stimuli provides an index of attention bias.

Anxious individuals typically display faster response times on trials in which the probe replaces the threatening stimuli, which reflects an attention bias toward threat (Bar-Haim et al., 2007). This pattern has been replicated among children (e.g., Vasey, el-Hag, & Daleiden, 1996), adolescents (e.g., Telzer et al., 2008), and adults (e.g., Mogg, Philippot, & Bradley, 2004), including youth and adult

* Corresponding author. Tel.: +1 305 348 1671; fax: +1 305 348 3879.
E-mail address: jpettit@fiu.edu (J.W. Pettit).

0887-6185/$ – see front matter © 2013 Elsevier Ltd. All rights reserved.
http://dx.doi.org/10.1016/j.janxdis.2013.09.001

patients with Social Phobia (SOP) (e.g., Roy et al., 2008) and Generalized Anxiety Disorder (GAD) (e.g., Waters, Mogg, Bradley, & Pine, 2008), youth patients with Separation Anxiety Disorder (SAD) (e.g., Waters, Henry, Mogg, Bradley, & Pine, 2010), and youth and adults with subclinical anxiety symptoms (e.g., Mogg & Bradley, 2002).

In response to the well documented role of attention bias to threat in anxiety and its disorders, researchers have developed computer-based attention training programs to reduce anxiety (Amir, Beard, Burns, & Bomyea, 2009; Eldar et al., 2012; Schmidt, Richey, Buckner, & Timpano, 2009). ABMT is based on the idea that attention bias can be shaped via repetitive computer based training methods, although the mediators of ABMT's anxiety reduction effects require further empirical testing (Bar-Haim, 2010). In ABMT, patients complete the visual-probe detection task described above, with the critical exception that the probe always or almost always replaces the neutral stimulus and not the threatening stimulus.

ABMT has shown promising anxiety reduction effects in clinic referred adults and children (Eldar et al., 2012; Hakamata et al., 2010). Three attention training studies have been conducted with clinic referred samples of children and adolescents with anxiety disorders (Cowart & Ollendick, 2011; Eldar et al., 2012; Rozenman, Weersing, & Amir, 2011). Findings from these studies support the feasibility and promise of ABMT as a frontline treatment for children and adolescents with anxiety disorders. Whether ABMT would demonstrate similar feasibility and promise as an adjuvant among children and adolescents with anxiety disorders who do not respond to CBT is an unaddressed empirical issue. This is an important issue, however, given, as noted above, that up to 50% of anxious children and adolescents who receive CBT fail to benefit.

The purpose of the current case series was to examine preliminarily the feasibility and potential promise of ABMT as an adjuvant treatment for children and adolescents who still met criteria for anxiety disorder diagnosis following a full course of CBT. Six children (four girls) identified as nonresponders following a 12–14-week CBT protocol completed an open trial of ABMT. Nonresponse was operationally defined as continuing to meet criteria for a primary diagnosis of GAD, SAD, or SOP at the posttreatment and 12-month follow-up evaluations in the parent CBT trial. Consistent with most past ABMT research (Amir, Beard, Burns, et al., 2009; Schmidt et al., 2009), participants completed a pretreatment assessment followed by eight sessions of ABMT over 4 weeks, and then completed a posttreatment assessment. Outcomes included child self ratings and parent ratings on anxiety and related impairment. To determine whether ABMT had a general effect on negative emotions or a specific effect on anxiety, child self ratings on depressive symptoms also were collected.

2. Methods

2.1. Participants

Participants were recruited from a large, ongoing clinical trial of CBT for children and adolescents with GAD, SOP, or SAD. All potential participants had completed a 12–14-week CBT protocol similar to that used in previous trials (see Silverman, Kurtines, Jaccard, & Pina, 2009). At the time of this study, approximately 190 participants had enrolled in the CBT trial and approximately 120 participants had completed the full CBT protocol, a posttreatment assessment, and a 12-month follow-up assessment (M age at follow up = 11 years; 47% girls; 81% Hispanic). Youth were eligible for ABMT if they were between ages 8 and 14 years and met criteria for a primary DSM-IV diagnosis of GAD, SOP, or SAD at post and 12-month follow-up assessments of the CBT protocol. Exclusion criteria were (a) meeting diagnostic criteria for Organic Mental Disorders, Psychotic Disorders, Pervasive DevelopmentalDisorders, or Mental Retardation, (b) showing high likelihood and/or serious intent of self-harm, (c) not living with a primary caregiver who was legally able to give consent for participation, (d) having a serious, uncorrected vision problem and (e) having a physical disability which interfered with the child's ability to click a mouse button rapidly and repeatedly. Children with comorbid ADHD, minimally impairing tics or impulse control problems or depressive disorders were eligible, as long as the comorbid disorder was treated with medication and stable.

Of the children who had completed 12-month follow-up assessment and met inclusion criteria for the present study, ten were identified, and attempts were made to contact their families to inform them about this new treatment opportunity. Eight families were contacted, and six families agreed to participate. Two families declined and cited distance and travel time as the reason; the remaining two families could not be reached. The six participants (four girls, two boys) ranged in age from 10 to 13 years (M = 11.2 years, SD = 1.17). Age, sex, and diagnostic status of each of the six participants are provided in Table 1. Five participants were Hispanic and one participant was African-American. The mean age, ethnic distribution, and gender distribution of participants in this study were comparable to those in the larger CBT trial. Three met criteria for a primary diagnosis of SOP, and three met criteria for a primary diagnosis of SAD. One child met criteria for a secondary diagnosis of ADHD, was on a stable dose of medication prior to study entry, and remained on a stable dose of medication through the end of the study.

2.2. Measures

2.2.1. Diagnosis and severity/impairment rating

2.2.1.1. Anxiety Disorders Interview Schedule for DSM-IV: Child and Parent versions (ADIS-C/P; Silverman & Albano, 1996). Carefully trained evaluators administered the ADIS-C/P to each child and mother to assess current anxiety and related disorders in the child. Before conducting interviews, evaluators met a 100% reliability criterion on five video-taped child–parent assessments. The ADIS-C/P contains 0- to 8-point clinician severity rating (CSR) scales to assess the severity and interference of diagnosis. Interviewers assigned diagnoses that child and mother agreed were most interfering. In cases of disagreement, the interviewer considered both informants' views to derive a final diagnosis. In cases of multiple diagnoses, the relative interference of each disorder was determined by obtaining interference ratings from each source and prioritizing each disorder from most to least interfering or disturbing. The disorder deemed most interfering or disturbing was viewed as primary. In the present study, CSR ratings based on interviews with mothers and children were used separately to examine severity and interference at pre and post. Research supports the CSR's reliability (Silverman & Eisen, 1992; Silverman & Nelles, 1988) and its sensitivity to change following treatment (Mendlowitz et al., 1999; Silverman et al., 1999).

2.2.2. Measures completed by youth

2.2.2.1. Multidimensional Anxiety Scale for Children (MASC; March, Parker, Sullivan, Stallings, & Conners, 1997). The MASC is a youth self rating scale of child anxiety symptoms. It contains 39 items distributed across four factors aligned with DSM-IV diagnostic categories for anxiety disorders: Physical Symptoms, Social Anxiety, Harm Avoidance, and Separation Anxiety. Ratings are made on a four-point Likert Scale (1 = never, 2 = rarely, 3 = sometimes, and 4 = often). Test–retest reliability is satisfactory to excellent (ICCs > 0.87). The factor structure has been supported (March et al., 1997) and convergent validity has been established via significant associations with other anxiety measures (Baldwin & Dadds, 2007).

Table 1
Demographics and measure scores for 6 CBT non-responders undergoing ABMT.

Subject #	Gender	Age	DSM-IV-TR diagnosis		ADIS-C/P severity/impairment ratings		MASC	RCMAS-C	RCMAS-P	CBCL anxious/depressed *t*-score	CDI
					Parent	Child					
1	F	10	SAD	Pre	4	6	41	6	3	56	6
				Post	2	0	28	0	1	58	0
2	M	11	SAD	Pre	5	5	54	12	14	64	8
				Post	3	6	53	6	12	59	3
3	F	13	SAD	Pre	4	3	27	9	11	77	5
				Post	5	2	13	5	10	65	1
4	M	10	SOP	Pre	6	5	42	3	16	65	3
				Post	2	0	33	0	5	62	0
5	F	11	SOP	Pre	7	3	54	5	9	75	6
				Post	4	3	52	4	7	70	1
6	F	12	SOP	Pre	8	4	35	0	8	39	0
				Post	5	3	20	0	8	39	0

Note: SAD: Separation Anxiety Disorder; SOP: Social Phobia; ADIS-C/P: Anxiety Disorders Interview Schedule (child/parent versions); MASC: Multidimensional Anxiety Scale for Children; RCMAS: Revised Children's Manifest Anxiety Scale (child/parent versions); CBCL: Child Behavior Checklist; CDI: Children's Depression Inventory.

2.2.2.2. Revised Children's Manifest Anxiety Scale Child version (RCMAS-C; Reynolds & Richmond, 1978). The RCMAS is a 37-item self-rating scale designed to assess child anxiety symptoms. Twenty-eight items are summed to yield a Total Anxiety Score. Each item is rated *yes* or *no* and scored 1 or 0. Pela and Reynolds (1982) reported a 3-week test–retest reliability of 0.98 for the Total Anxiety Scale.

2.2.2.3. Children's Depression Inventory (CDI; Kovacs, 1985). The CDI is a widely used 27-item measure of depressive symptoms. Each item contains three choices, and children select the one that best describes them during the previous 2 weeks. The CDI possesses good internal consistency, and convergent validity has been demonstrated via significant correlations with clinician rated measures of depressive symptoms and other self-rated depression scales (Brooks & Kutcher, 2001; Klein, Dougherty, & Olino, 2005; Shain, Naylor, & Alessi, 1990).

2.2.2.4. Attention bias to threatening stimuli. The attention dot-probe task developed by MacLeod, Matthews, and Tata (1986), modified for use in child anxiety studies (TAU-NIMH ABMT initiative; http://tau.ac.il/∼yair1/ABMT.html), was used to obtain a performance-based measure of attentional bias toward threatening stimuli. Facial stimuli selected for this task had been used in previous studies (Bar-Haim, Morag, & Glickman, 2011; Eldar et al., 2012). During the task, children were presented with 120 trials. In each trial, a white fixation cross appeared for 500 milliseconds (ms) in the center of the screen, followed by a pair of faces (chromatic) appearing for 500 ms. The pair of faces (of the same actor showing a neutral or threatening expression) appeared on the top and bottom of the screen. In each trial, the pair of faces displayed was one of three combinations (neutral–anger, anger–neutral, or neutral–neutral). Immediately following the faces, a probe ("<" or ">") appeared in the location of either the top or bottom face. Participants were instructed to indicate the orientation of the probe by clicking the left or right mouse button (left for "<", right for ">") using their dominant hand. The probe remained on-screen until the participant responded, and then the next trial began immediately. Angry-face location, probe location, probe type, and actor were fully counterbalanced in presentation. Reaction time differences of incongruent minus congruent trials provided a measure of attention bias, such that positive values indicated bias toward angry faces and negative values indicated bias away from angry faces. Inaccurate responses, trials with response latencies <150 ms and >1200 ms, and trials with response latencies ± 2.5 SDs from the subject's mean were excluded.

2.2.3. Measures completed by parents

2.2.3.1. Revised Children's Manifest Anxiety Scale parent version (RCMAS-P; Reynolds & Richmond, 1978). In the RCMAS-P, the wording of RCMAS items was changed from *I* to *my child*, as done in past research (e.g., Kendall, 1994; Silverman et al., 1999, 2009). Each item is rated either *yes* or *no* and scored 1 or 0. Twenty-eight items are summed to yield a Total Anxiety Score.

2.2.3.2. Child Behavior Checklist Anxious/Depressed Subscale (CBCL; Achenbach & Rescorla, 2001). The CBCL contains 118 parent rated items to assess specific child behavioral and emotional problems. These items are rated by parents on a 3-point scale (*0 = not true; 1 = somewhat or sometimes true; 2 = very true or often true*). The CBCL includes two broadband scales (i.e., Externalizing, Internalizing) and eight narrowband subscales. In the present study, we examined dimensional *t*-scores on the Anxious/Depressed narrowband subscale because, relative to other scales on the CBCL, it has shown a high correlation with the severity of anxiety disorders (Aschenbrand, Angelosante, & Kendall, 2005).

2.3. Procedures

This study was conducted as approved by the Institutional Review Board. Parents provided informed consent and children provided assent. Assessments and training sessions were conducted by graduate students who had been thoroughly trained in the study's procedures.

2.3.1. Attention bias modification training

The ABMT task was identical to the attention bias assessment task but with three exceptions. First, a unique set of faces was used in this task (i.e., different from those used in the attention bias assessment task). Second, the task consisted of 160 trials: 120 angry–neutral presentations and 40 neutral–neutral presentations. Third, the probe replaced the neutral face on 100% of the trials. Threat face location (top or bottom) and actor were fully counterbalanced. Probe type (< or >) was not factorially counterbalanced but appeared with equal probability for each of the following: angry-face location, probe location, or actor. On 75% of these trials, the location of the threat face predicted the location of the probe

(behind neutral); on the other 25%, subjects saw neutral–neutral face pairs.

3. Results

Pretreatment and posttreatment scores on all measures for each of the six participants are provided in Table 1. All six patients completed the study protocol, including a pre-treatment assessment, eight ABMT training sessions, and a posttreatment assessment within 1 week of the final training session. None of the families missed or canceled a session. This perfect attendance record was corroborated by patients' and parents' anecdotal reports of very high satisfaction with the short duration of each treatment session (15 min) and the short course of treatment (4 weeks).

3.1. Severity ratings for DSM-IV anxiety disorder diagnoses

As shown in Table 1, four of the six child participants rated their primary anxiety disorder diagnoses as clinically interfering (≧4) at pre assessment, whereas only one participant rated her diagnosis in the clinical range (<4) at post. Mean child self ratings on severity/interference (0–8) decreased from pre ($M = 4.33$) to post ($M = 2.33$). In a paired samples t-test, this change was not statistically significant, $t(5) = 1.73$, $p = 0.14$.

All parent severity/interference ratings were in the clinical range at pre (≧4), whereas half of parents' severity/interference ratings were in the clinical range (<4) at post. Mean parent ratings on severity/interference significantly decreased from pre (5.67) to post (3.50), $t(5) = 3.08$, $p = 0.03$.

3.2. Child rated symptoms

As shown in Table 1, child self ratings on the MASC decreased from pre to post for all participants, and child self ratings on the RCMAS-C decreased from pre to post for all participants except Participant 6. A pre-post paired samples t-test on mean MASC scores revealed a significant decrease from pre ($M = 42.17$) to post ($M = 33.17$), $t(5) = 3.58$, $p = 0.02$. Similarly, mean scores on the RCMAS-C significantly decreased from pre ($M = 5.83$) to post ($M = 2.50$), $t(5) = 3.26$, $p = 0.02$.

Child self ratings on the CDI decreased from pre to post for all participants except Participant 6. Statistically significant pre ($M = 4.67$) to post ($M = 0.83$) decreases on mean CDI scores were observed, $t(5) = 4.39$, $p = 0.01$.

3.3. Parent rated child symptoms

Parent ratings on the RCMAS-P decreased from pre to post for all participants except Participant 6 (Table 1). Mean scores on the RCMAS-P decreased from pre ($M = 11.60$) to post ($M = 8.40$); this difference was not statistically significant, $t(5) = 1.612$, $p = 0.18$. Similarly, CBCL-Anxious Depressed scores decreased from pre to post for all participants except Participant 1 and Participant 6 (Table 1). The decrease in mean t-scores of the CBCL Anxious-Depressed subscale from pre ($M = 62.67$) to post ($M = 58.83$) was not statistically significant, $t(5) = 1.93$, $p = 0.11$.

3.4. Attention bias to threatening stimuli

Mean attention bias scores decreased from pre ($M = 27.00$) to post ($M = 8.40$), but this change was not statistically significant ($t(4) = 0.246$, $p = 0.82$). Although the mean attention bias score at pre was positive, indicating a bias toward threat on average, three of the six participants displayed a negative attention bias score at pre, indicating a bias away from threat. Attention bias scores decreased substantially from pre to post for Participant 1 (pre = 195, post = −117), increased modestly for Participants 2, 3, and 4 (M increase = 33.00), and increased substantially for Participant 6 (pre = 10, post = 129). The pre attention bias score for Participant 5 was missing due to a data collection error.

4. Discussion

The purpose of this case series was to examine preliminarily the feasibility and promise of ABMT as an adjuvant treatment for children who continued to meet diagnostic criteria for a primary anxiety disorder following a full course of CBT. Ten eligible children were identified; we were able to establish contact with the families of eight of these children. Of these eight families, six agreed to attend the clinic twice weekly for ABMT sessions. All six families completed the eight sessions of ABMT over 4 weeks with no cancelations. These findings support the feasibility of ABMT as an adjunct for children with anxiety disorders who do not respond to a full course of CBT.

With regard to anxiety reduction effects, ABMT led to significant mean reductions of anxiety symptoms on child self-report anxiety measures (MASC, RCMAS-C). Further, mean parent report of disorder interference decreased significantly from pretreatment to posttreatment. Reductions in parent report of children's anxiety symptoms also were observed from pretreatment to posttreatment, but were not statistically significant. A statistically significant reduction in mean levels of child self report depressive symptoms also was found, suggesting the effects of ABMT may not be specific to anxiety but rather impact emotional distress in general. Similar conclusions have been drawn in prior studies of ABMT among children (Rozenman et al., 2011) and adults (Hazen, Vasey, & Schmidt, 2009).

Findings regarding the statistical significance of effects, including discrepancies between the statistical significance of child self-ratings and parent ratings, should be interpreted with caution given the small sample size. Although discrepancies between child self-ratings and parent ratings are common in the child anxiety literature (Silverman & Ollendick, 2005), all anxiety reduction effects, even those that were not statistically significant, were in the expected direction regardless of informant source. Findings regarding the clinical significance of effects were generally supportive of ABMT's promise as an adjuvant treatment. Parent ratings of interference remained in the clinical range at posttreatment for half the sample, which suggests eight sessions of ABMT may be sufficient for some but not all children who do not respond to CBT. If this finding is replicated in larger trials, it will be important to investigate whether additional sessions of ABMT or CBT, or a switch to a different treatment modality (e.g., pharmacotherapy), may lead to higher response rates.

Mean attention bias scores showed a nonsignificant decrease from pretreatment to posttreatment, suggesting participants' attention was trained away from threat on average. Three participants displayed a bias toward threat at the pre assessment, and the other three participants displayed a bias away from threat. As in the multiple baseline study by Cowart and Ollendick (2011), some children displaying attention biases away from threat at pretreatment exhibited pre to post decreases in anxiety. Future studies with larger samples are needed to address whether treatment response differs as a function of pretreatment attention bias scores.

On the level of individual cases, pre to post decreases in most child report and parent report measures were observed for five of the six participants. The sixth participant evidenced pre to post decreases in anxiety severity/interference ratings, but generally did not show pre to post changes on symptom measures. This was due in part to scores of zero on two child report measures at pre, although a similar pattern of no pre to post change was observed

for parent ratings on child anxiety symptoms. It is interesting to note the sixth participant was the only participant to evidence a large increase in attention bias scores from pre to post. The other four participants with available data evidenced either a substantial decrease in attention bias (Participant 1) or modest increase in attention bias from pre to post (Participants 2–4).

The findings of this case series are generally consistent with those of previous studies on ABMT in clinic referred children and adolescents with anxiety disorders (Eldar et al., 2012; Rozenman et al., 2011) and extend the use of ABMT to anxiety disordered children who do not respond well to CBT. Nevertheless, the findings should be interpreted in light of the study's limitations. As with most case series, the absence of a control group and the small sample size prevent conclusions about the efficacy of ABMT for CBT nonresponders. Similarly, the absence of follow-up data prevents conclusions regarding the maintenance of ABMT's effects over time. Future trials of ABMT as an adjuvant treatment should include follow-up assessments.

In summary, the current case series provides initial data to support the feasibility of ABMT as an adjuvant treatment option for children with anxiety disorders who do not respond well to CBT. The findings of this case series also suggest ABMT has promise in reducing anxiety symptoms and related impairment among children with anxiety who do not respond to CBT. Future research is encouraged to examine the efficacy of ABMT as a CBT augmentation strategy in larger samples using a randomized controlled design.

Acknowledgments

This project was supported by National Institute of Mental Health Grant MH079943 to Wendy K. Silverman, National Institute of Mental Health Grant MH097931 to Wendy K. Silverman & Jeremy W. Pettit, and a Florida International University Presidential Fellowship to Michele Bechor.

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