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The effectiveness of an attention bias modification program as an adjunctive treatment for Post-Traumatic Stress Disorder

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ABSTRACT

Attention bias modification (ABM) may be an effective treatment for anxiety disorders (Beard, Sawyer, & Hofmann, 2012). As individuals with PTSD possess an attentional bias towards threat-relevant information ABM may prove effective in reducing PTSD symptoms. We examined the efficacy of ABM as an adjunct treatment for PTSD in a real-world setting. We administered ABM in conjunction with prolonged exposure or cognitive-processing therapy and medication in a community inpatient treatment facility for military personnel diagnosed with PTSD. Participants were randomized to either ABM or an attention control condition (ACC). While all participants experienced reductions in PTSD symptoms, participants in the ABM group experienced significantly fewer PTSD and depressive symptoms at post-treatment when compared to the ACC group. Moreover, change in plasticity of attentional bias mediated this change in symptoms and initial attentional bias moderated the effects of the treatment. These results suggest that ABM may be an effective adjunct treatment for PTSD.

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Post-Traumatic Stress Disorder (PTSD) is a common disorder affecting 3.5 percent of the United States population in any given year (Kessler, Chiu, Demler, & Walters, 2005). This figure is considerably higher for returning military personnel, with rates ranging from 5 to 20% (Ramchand et al., 2010). Hallmark symptoms of PTSD include re-experiencing symptoms and increased physiological arousal (DSM-IV-TR; American Psychiatric Association, 2000) leading to functional impairment (Schnurr, Lunney, Sengupta, & Waelde, 2003). Moreover, co-morbid depressive disorders and substance abuse are common, causing further distress and disability (Kessler et al., 2005).

Extant research suggests that individuals with PTSD are characterized by an information processing bias for threat-relevant information when compared to non-anxious individuals (e.g., for reviews see Bar-Haim, Lamy, Pergamin, Bakermans-Kranenburg, & van IJzendoorn, 2007; Buckley, Blanchard, & Neill, 2000). Moreover, this information processing bias toward threat relevant information may cause chronic hypervigilance and increased physiological arousal (Thomas, Goegan, Newman, Arndt, & Sears, 2013). Individuals with PTSD may not only experience hypervigilance toward threatening stimuli, but may also have difficulty disengaging their attention from threat following initial attentional capture (for a review see Aupperle, Melrose, Stein, & Paulus, 2012).

One intervention designed to reduce hypervigilance towards and enhance disengagement from threat-related information is attention bias modification (ABM), with several recent meta-analyses suggesting that ABM may result in significant reduction in anxiety symptoms (Beard, Sawyer, & Hofmann, 2012; Hakamata et al., 2010; Hallion & Ruscio, 2011). Given that ABM has demonstrated evidence of efficacy in tightly-controlled randomized controlled trials (RCTs) within laboratory settings (Amir, Beard, Burns, & Bomyea, 2009; Amir, Beard, Taylor, et al., 2009; Heeren,

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Reese, McNally, & Philippot, 2012; Schmidt, Richey, Buckner, & Timpano, 2009), it may be well-poised for effectiveness testing. Moreover, the brevity and low cost of this intervention makes it practical for delivery in real-world settings. Whereas efficacy trials are typically conducted in experimenter-controlled environments with standardized protocols for administration of the intervention and assessments, effectiveness trials examine the effects of the treatment under more typical conditions (Flay, 1986).

Several ABM studies have begun to move towards effectiveness testing. However, studies to date have produced mixed results. For example, some studies have failed to produce group differences between ABM and ACC conditions when delivered outside of traditional laboratory-based settings (e.g., internet, smartphone) (Boettcher, Berger, & Renneberg, 2012; Carlbring et al., 2012; Enock, Hoffman, & McNally, 2014; Neubauer et al., 2013). These studies examined the effect of ABM as a stand-alone treatment, however, real-world clinical settings often utilize multiple interventions concurrently for anxiety disorders (e.g., pharmacoptherapy with psychosocial therapy). Given that comorbid psychiatric disorders is the rule rather than the exception in PTSD (Brady, Killeen, Brewerton, & Lucerini, 2000), combined treatment in the community for individuals with PTSD is particularly prevalent (Foa, Keane, & Friedman, 2000).

Indeed, recent reviews of ABM have called for research examining the effect of ABM as an adjunctive treatment to existing interventions, such as cognitive behavior therapy (CBT) and pharmocotherapy (Beard, 2011; Hakamata et al., 2010; Hallion & Ruscio, 2011). Several research studies have examined whether ABM results in anxiety reductions over and above the effects of CBT alone (Britton et al., 2013; Rapee et al., 2013; Riemann, Kuckertz, Rozenman, Weersing, & Amir, 2013). One of these studies (Riemann et al., 2013) supported the use of ABM as an adjunctive treatment, while two did not (Britton et al., 2013; Rapee et al., 2013). Both studies that did not find an augmentation effect of ABM were conducted in the context of a research based laboratory setting using highly structured, standardized, and well-monitored provision of CBT. In contrast, ABM was found to augment the effects of CBT and pharmacotherapy when these treatments were administered per routine clinical practice in the context of a residential treatment facility for youth anxiety disorders (Riemann et al., 2013). Thus, there is a need for further study of the effect of ABM as an adjunctive treatment in real world clinical settings.

Although the setting in which attention training is delivered is one factor that may account for some of the discrepant results of ABM studies, factors more proximal to the theory of ABM may also affect outcome (Clarke, Notebaert, & MacLeod, 2014). For example, several studies suggest that level of attentional bias at pre-treatment moderates the effect of ABM, such that individuals with higher levels of attentional bias show greater treatment gains from the intervention (Amir, Taylor, & Donohue, 2011), even when ABM is delivered entirely in non-laboratory settings (Kuckertz et al., 2014). Moreover, ABM is predicated on the notion that change in attentional bias is causally implicated in the maintenance of anxiety symptoms. Consistent with this hypothesis, several studies both inside and outside of laboratory settings have demonstrated that change in attentional bias from pre- to post-treatment mediates the effects of ABM on symptom change (Amir, Beard, Taylor, et al., 2009; Heeren et al., 2012; Kuckertz et al., 2014). As such studies that do not show an effect of the ABM on the intended mechanism (i.e., attentional bias change) would not be expected to demonstrate a corresponding change in symptoms (for a review see Clarke et al., 2014). Indeed, studies that have failed to find group differences in symptoms also failed to find an effect of training on change in attentional bias (Boettcher et al., 2012; Carlbring et al., 2012; Neubaurer et al., 2013).

With few exceptions, studies examining attentional bias in the context of ABM (e.g., bias change, moderation, mediation) have conceptualized bias as a static measure over a given time point as the primary construct of interest. For example, the most commonly used bias calculation method is that introduced by MacLeod, Mathews, and Tata (1986). Using this method, researchers calculate attentional bias over a given time period by comparing participant's average response latency to identify a probe following the presentation of a threatening stimulus and the participant's average response latency when the probe follows a neutral stimulus. However, recent research suggests that alternate methods of conceptualizing attentional bias may increase our understanding of cognitive processing in anxiety and its effects on anxiety-related behavior. For example, Iacoviello et al. (2014) found that variability of attentional bias rather than attentional bias per is correlated with PTSD symptoms. Moreover, this variability in attentional bias differentiated individuals exposed to trauma who did and did not develop subsequent PTSD.

Other researchers have also utilized the concept of attentional bias malleability as a predictor of anxiety-related outcomes. For example, Clarke, Chen, and Guastella (2012) demonstrated that plasticity in attentional bias, defined as change in bias within a single session of ABM training, was predictive of treatment response to subsequent CBT, while attentional bias at a static time point was not. Moreover, Najmi and Amir (2010) found that plasticity in attentional bias within a single session of attention training mediated the effect of ABM training on behavioral approach toward feared objects in individuals with obsessive–compulsive symptoms. Thus, the extent to which attentional bias changes within a single session or is trained during ABM may relate to treatment outcome. As static attentional bias (Amir et al., 2011; Kuckertz et al., 2014) and/or plasticity in attentional bias across a single ABM session (Clarke et al., 2012) predict treatment outcome, additional research is needed examining when and for whom these different constructs predict outcome. Similarly, research is needed to clarify the role of these constructs in mediating treatment effects.

To our knowledge, only two studies have investigated the efficacy of ABM in patients with PTSD (Schoorl, Putman, & van Der Does, 2013; Schoorl, Putman, Mooren, van Der Weff, & van Der Does, 2014). Schoorl et al. (2013) administered eight 20-min sessions of ABM over the course of three weeks to 102 patients with PTSD and assessed PTSD symptoms and attentional bias before and after the treatment as well as at follow-up. ABM and the ACC were equally effective in reducing the symptoms of PTSD with similar effect sizes (ABM, $d = 0.66$; ACC, $d = 0.46$). However, as the authors point out, the ABM procedure was not effective in changing attentional bias in that study. In a second study, Schoorl et al. (2014) examined the effect of an eight session ABM program with ideographically selected stimuli for returning war veterans with PTSD in a case series design ($N = 6$). While the authors concluded that ABM was not effective because no participants experienced reductions in PTSD symptoms during the training, five of the six participants demonstrated clinically significant recovery one week following treatment.

To add to the research base on ABM in PTSD as well as to examine questions of moderation/mediation in a real-world setting, we conducted an initial pilot study in which we administered an attention training program in conjunction with a combination of individual, group, and pharmacological treatment to 23 active duty outpatients in a military clinic. After randomization to ABM or ACC, participants completed one session of attention