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Paradoxical cardiovascular effects of implementing adaptive emotion regulation strategies in generalized anxiety disorder

Amelia Aldao [a,1], Douglas S. Mennin [b,*]

[a] Department of Psychology, Yale University, 2 Hillhouse Ave, New Haven, CT 06520, USA
[b] Department of Psychology, Building 611HN, Hunter College, City University of New York, 695 Park Avenue, New York, NY 10065, USA

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ABSTRACT

Recent models of generalized anxiety disorder (GAD) have expanded on Borkovec's avoidance theory by delineating emotion regulation deficits associated with the excessive worry characteristic of this disorder (see Behar, DiMarco, Hekler, Mohlman, & Staples, 2009). However, it has been difficult to determine whether emotion regulation is simply a useful heuristic for the avoidant properties of worry or an important extension to conceptualizations of GAD. Some of this difficulty may arise from a focus on purported maladaptive regulation strategies, which may be confounded with symptomatic distress components of the disorder (such as worry). We examined the implementation of *adaptive* regulation strategies by participants with and without a diagnosis of GAD while watching emotion-eliciting film clips. In a between-subjects design, participants were randomly assigned to accept, reappraise, or were not given specific regulation instructions. Implementation of adaptive regulation strategies produced differential effects in the physiological (but not subjective) domain across diagnostic groups. Whereas participants with GAD demonstrated *lower* cardiac flexibility when implementing adaptive regulation strategies than when not given specific instructions on how to regulate, healthy controls showed the opposite pattern, suggesting they benefited from the use of adaptive regulation strategies. We discuss the implications of these findings for the delineation of emotion regulation deficits in psychopathology.

Background

Generalized anxiety disorder (GAD) is characterized by excessive and uncontrollable worry (APA, 2000). According to Borkovec's *avoidance theory*, worry is a verbal/linguistic process that, although associated with heightened subjective distress, is negatively reinforced through the facilitated avoidance of unpleasant somatic activation and imagery (Borkovec, Alcaine, & Behar, 2004). Recent theories have expanded upon the avoidance perspective by detailing the role of emotional components that reinforce the worry process. These conceptualizations commonly view worry as a dysfunctional regulatory response to various aspects of emotional experience (e.g., Mennin & Fresco, 2010; Mennin, Heimberg, Turk, & Fresco, 2005; Mennin, Holaway, Fresco, Moore, & Heimberg, 2007; Newman & Llera, 2011; Roemer, Orsillo, & Salters-Pedneault, 2008; for a recent review see Behar et al., 2009). Moreover, worry has shown strong associations with other maladaptive emotion regulation strategies that are positively correlated with psychopathology (Aldao, Nolen-Hoeksema, & Schweizer, 2010), such as suppression (e.g., Robichaud, Dugas, & Conway, 2003) and rumination (e.g., Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008).

Implementing adaptive emotion regulation strategies

Although there is increased interest in examining the role of worry as a maladaptive regulatory response in GAD, it has been difficult to determine whether emotion regulation is simply a useful heuristic for the avoidant properties of worry or an important extension to conceptualizations of GAD. Some of this difficulty may arise from a focus on purported maladaptive strategies, which may be confounded with symptomatic distress components of the disorder (such as worry), and therefore erroneously redefined as "dysregulation" without any clearly established regulatory deficit. In order to more directly test whether individuals with GAD fail to regulate emotions in clinically meaningful ways, it is important to look beyond maladaptive strategies that may be confounded with pathology and examine failure to utilize *adaptive* regulatory strategies that are purportedly reflective of normative processing and at the core of successful interventions.

* Corresponding author. Tel.: +1 212 772 5567.
E-mail addresses: amelia.aldao@yale.edu (A. Aldao), dmennin@hunter.cuny.edu (D.S. Mennin).
[1] Tel.: +1 203 432 7352.

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Determining the processes by which individuals with GAD encounter difficulties when utilizing adaptive strategies may help elucidate the extent to which the disorder can be characterized by compromised emotion regulation.

Examination of the subjective endorsement of adaptive emotion regulation strategies in GAD has derived largely from trait level indices, such that individuals with this disorder have endorsed lower scores on measures of cognitive reappraisal (e.g., Mennin, Aldao, & McLaughin, 2009; Zlomke & Hahn, 2010), as well as acceptance (e.g., Farach, Mennin, Smith, & Mandelbaum, 2008; Salters-Pedneault, Roemer, Tull, Rucker, & Mennin, 2006). However, self-report measures can confound the extent to which each item is endorsed with the number of items endorsed, therefore providing little information on the functional process by which individuals deploy such strategies – or fail to do so. This suggests that a comprehensive accounting of emotion regulation will require a multi-modal assessment approach. However, little is known about the role of other modalities such as physiological indices during adaptive strategy implementation in GAD. This is of particular importance, since this disorder and worry have been associated with low cardiac flexibility, as measured by heart rate variability (HRV; Llera & Newman, 2010; Lyonfields, Borkovec, & Thayer, 1995; Thayer, Friedman, & Borkovec, 1996), an index of brainstem mediated parasympathetic influences on the heart, which has been associated with flexible and adaptive regulation (e.g., Friedman, 2007; Porges, 2007). Therefore, in this investigation, we sought to adopt a much-needed comparative approach to examine the subjective and physiological effects of implementing adaptive strategies in response to a, well-validated and utilized, emotion elicitation paradigm consisting of watching emotion-eliciting film clips (Rottenberg, Ray, & Gross, 2007).

We focused on acceptance and reappraisal because they are two adaptive strategies central to current psychotherapeutic treatment approaches. Specifically, cognitive reappraisal, conceptualized as the ability to modify one's thinking about a potentially emotion-eliciting event in order to modify its emotional impact (Gross, 2002), is an explicit central target of traditional cognitive behavioral therapy (CBT; Beck, Rush, Shaw, & Emery, 1979; Hofmann & Asmundson, 2008). Similarly, acceptance, conceptualized as openness to internal experience and the willingness to remain in contact with this experience without trying to change it, control it, or avoid it (Hayes et al., 1999), is an explicit central target in many third-wave CBT approaches such as Acceptance and Commitment Therapy (ACT; Hayes et al., 1999) and Acceptance-Based Behavioral Therapy (AABT; Roemer et al., 2008). Dialectical Behavioral Therapy (DBT; Linehan, 1993) and mindfulness-based approaches (e.g., Mindfulness-Based Cognitive Therapy; MBCT; Segal, Williams, & Teasdale, 2002) appear to target both types of regulatory strategies given the content heterogeneity of these approaches. Importantly, these strategies have not been compared to each other as well as to a No Regulation Instructions condition (*c.f.* Hofmann, Heering, Sawyer, & Asnaani, 2009), which is critical, as such an approach may help elucidate mixed findings that have been found on the subjective and physiological effects of acceptance (i.e., some studies finding that acceptance leads to increases in subjective and physiological processes and others suggesting it results in decreases; e.g., Dunn, Billotti, Murphy, & Dalgleish, 2009; Eifert & Heffner, 2003; Hofmann et al., 2009; Levitt, Brown, Orsillo, & Barlow, 2004).

Hypotheses

At the subjective level, we predicted that when participants were instructed to utilize reappraisal in response to emotion-eliciting film clips, they would be able to achieve reductions in the experience of negative affect, relative to the Acceptance condition, which would produce similar levels to the No Regulation Instructions condition. This hypothesis is consistent with previous work showing that cognitive reappraisal effectively results in downregulation of negative affect (e.g., Gross, 2002) and the conceptualization of acceptance as consisting of allowing, rather than modulating, emotional states (although, as pointed out earlier, the evidence is mixed). We also predicted a main effect of diagnostic group such that participants in the GAD group would report elevated emotional reactivity across regulatory conditions (e.g., Mennin et al., 2005). We did not predict an interaction between regulation strategy and diagnostic group on subjective experience. In other words, given prior subjective state-level findings showing that individuals with anxiety disorders achieved similar magnitudes when down-regulating negative affect (e.g., Campbell-Sills et al., 2011), we expected strategies to have similar effects on the subjective domain in participants with GAD and healthy controls. Lastly, we expected no main effects of emotion film type or interactions involving this variable (i.e., disgust, anxiety, or sadness film clips).

Physiologically, to the extent that reappraisal and acceptance have been conceptualized as adaptive regulation strategies that facilitate flexible responses to environmental demands, they should be associated with elevated HRV. Indeed, recent work examining HRV and adaptive strategies suggests this to be the case (for reappraisal see, Butler, Wilhelm, & Gross, 2006; Denson, Grisham, & Moulds, 2011, and for mindfulness, which includes acceptance as a component, see Delgado et al., 2010). Therefore, we predicted that in the control group, the Acceptance and Reappraisal conditions would lead to higher HRV (i.e., more cardiac flexibility) than the No Regulation Instructions condition. In the GAD group, however, since this disorder has consistently been characterized by blunted HRV (e.g., Llera & Newman, 2010; Lyonfields et al., 1995; Thayer et al., 1996) and, at the trait level, individuals with this disorder endorse difficulty implementing adaptive strategies (e.g., Salters-Pedneault et al., 2006), we predicted that the attempts at regulation would result in lower HRV than the No Regulation Instructions condition. In addition, we measured a recovery phase after each video as we expected differences to be most pronounced there, reflecting sustained regulatory difficulty (e.g., Fredrickson & Levenson, 1998). As was the case with subjective emotion, we predicted no main effect of emotion film type or interaction involving this variable.

Methods

Participants

Participants were recruited from an urban community surrounding a large private university in the northeast United States. In order to qualify for the study, they had to be between the ages of 21 and 65, not be college students, be fluent in English, and have no history of heart conditions or diabetes. In addition, participants were excluded if they reported current substance use or abuse (with the exception of nicotine), pertinent medical conditions (e.g., heart condition, epilepsy) and use of medications that directly affect cardiac functioning (e.g., beta blockers).

Following this screening procedure, participants were assessed for the presence of mood and anxiety disorders using the Structured Clinical Interview Diagnosis (SCID; First, Spitzer, Gibbon, & Williams, 2002). Interviews were conducted by advanced clinical psychology graduate students and post-baccalaureate research assistants. Both were trained rigorously over a 6-month period in diagnostic interviewing with the SCID. As part of their training, students had to achieve reliability (with expert diagnosticians) in their diagnoses of patients in a departmental clinic or with individuals from the community. Reliability was determined via the