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Mindful Emotion Awareness Facilitates Engagement with Exposure Therapy: An Idiographic Exploration Using Single Case Experimental Design

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Abstract

Exposure therapy works through inhibitory learning, whereby patients are exposed to stimuli that elicit anxiety in order to establish safety associations. Mindful emotion awareness, or nonjudgmental and present-focused attention toward emotions, may facilitate engagement in exposures, which may in turn enhance therapeutic outcome. This study utilizes a single-case experimental design ($n = 6$) to investigate the effect of mindful emotion awareness training on the use of avoidant strategies during exposures, distress during exposures, overall mindfulness, experiential avoidance, and symptom reduction in a sample of participants with social anxiety disorder. Data were analyzed using a combination of visual inspection and quantitative effect size metrics commonly applied in single-case experimental designs. To further investigate the relationship between distress and avoidant strategy use, contemporaneous and cross-lagged correlations were run. Results

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highlight individual differences in responses to mindful emotion awareness training and exposure exercises. Given these individual differences, repeated assessment and monitoring over the course of treatment may help clinicians most effectively identify treatment skills that will be most helpful for individual patients.

Keywords
mindfulness, exposure therapy, social anxiety disorder, idiographic, single-case experimental design

Introduction

Anxiety disorders are prevalent and debilitating conditions that represent a significant public health burden (DuPont et al., 1996). Decades of research have established cognitive-behavioral therapy (CBT) as an efficacious treatment for these disorders (Hofmann, Asnaani, Vonk, Sawyer, & Fang, 2012). Much of its evidence base comes from randomized controlled trials demonstrating clinically significant symptom reduction for individuals suffering from a range of anxiety-related diagnoses. More recently, however, clinical research has shifted focus toward the study of treatment mechanisms, or the processes by which therapeutic interventions achieve symptom reduction. Identifying treatment mechanisms allows us to understand how effective treatments work as well as how interventions may be optimized to most efficiently and effectively target these processes (Kazdin, 2007).

Conditioned fear, a state of distress linked to stimuli that are perceived as threatening, has been implicated as a primary psychopathological mechanism in the development and maintenance of anxiety disorders (Grillon, 2008; Mineka & Oehlberg, 2008). In other words, some individuals learn over time to associate particular stimuli, such as public speaking in social anxiety disorder or physiological arousal in panic disorder, with catastrophic consequences, prompting strong emotional reactions. Moreover, correlational and experimental research has shown that individuals with anxiety disorders are more likely to allocate attention toward threatening cues than neutral cues (i.e., attention bias; Matthews & Wells, 2000; Mogg & Bradley, 2002). Attending to such cues can produce rapid increases in distress and negative affect (Andrews, 1990), leading to in-the-moment coping strategies aimed at avoiding or suppressing these emotional experiences (i.e., experiential avoidance; Hayes, Wilson, Gifford, Follette, & Strosahl, 1996). Unfortunately, avoidance of feared stimuli prevents individuals from learning that predicted catastrophic consequences do not occur, maintaining negative beliefs and increasing the likelihood that similar reactions will occur in future situations.

In contrast, repeated exposure to conditioned stimuli (i.e., stimuli that are perceived as threatening and that produce fear) has consistently been shown to reduce the intensity of fear across animal and human studies (for reviews, see Bouton, 2004 and Hermans, Craske, Mineka, & Lovibond, 2006); indeed, considerable empirical evidence supports the use of exposure-based procedures for the treatment of anxiety disorders (Barlow, Allen, & Basden, 2007; Foa & McLean, 2016). Exposure has been traditionally thought to work through extinction learning, whereby repeatedly encountering conditioned stimuli without the occurrence of feared consequences gradually leads to a reduction in distress (Foa & Kozak, 1986). More recent advancements have suggested that anxiety reduction following exposure may be due more specifically to inhibitory learning, or the creation of new safety associations that compete with, and eventually override, learned fear associations (Craske, Treanor, Conway, Zbozinek, & Vervliet, 2014). Thus, the creation of this new learning may be a primary mechanism by which exposure exercises lead to a reduction in anxiety symptoms.

Craske et al. (2014) outlined several strategies that can be utilized during exposures to enhance inhibitory learning. For example, patients must focus their attention on the feared stimulus throughout each exposure, as this highlights the mismatch between feared outcome and actual outcome (i.e., "expectancy violation"), which is crucial to effective exposures. Additionally, therapists should discourage reliance on safety behaviors, which are avoidant behaviors meant to alleviate the negative impact of a situation or emotional state. Safety behaviors may be obvious (such as the presence of a trusted person, a water bottle, or medication), or they may be more difficult to observe (such as distraction or thought suppression). Finally, it may be helpful to establish retrieval cues. Extinction learning is context-dependent (Bouton, 2004), meaning that treatment gains made through exposures may not easily generalize across settings. A retrieval cue is a signal that becomes associated with the context in which extinction learning occurs; this cue can be used in subsequent extinction trials to stimulate recall of the original extinction context (Brooks & Bouton, 1994). For example, Mystowsky, Craske, Echiverri, and Labus (2006) found that asking participants with spider phobias to recall the laboratory context in which they underwent exposure was associated with less return of fear (ROF), or reappearance of a previously extinguished fear, when participants encountered spiders in a novel context. As these strategies suggest, it is important for patients to be fully present during exposures and attend to feared stimuli without relying on avoidance strategies in order to yield maximum benefit from new learning.

Adoption of a mindful stance, defined as present-focused, nonjudgmental attention (Kabat-Zinn, 1994), during exposure may be one strategy for

promoting attention to feared stimuli without avoidance, in turn facilitating inhibitory learning. Indeed, Treanor (2011) offers two potential ways mindfulness may interact with learning processes to enhance exposure for anxiety disorders. First, evidence suggests that practicing mindfulness improves attentional capacity (Anderson, Lau, Segel, & Bishop, 2007; Jha, Krompinger, & Baime, 2007), allowing patients to direct their full attention to feared stimuli without safety behaviors designed to distract from these experiences. Second, Treanor (2011) suggests that mindfulness may act as a retrieval cue to facilitate generalizing treatment gains across contexts; as a result, continuing to engage in mindfulness across exposure exercises may facilitate the generalization of treatment gains. Treanor's proposed benefits of mindfulness during exposure practice are consistent with Craske's et al (2014) suggestions for optimizing inhibitory learning: maintaining focus on feared stimuli, removal of safety behaviors, and establishing retrieval cues.

Although research supports the benefits of mindfulness for individuals with anxiety disorders (Hofmann, Sawyer, Witt, & Oh, 2010), little work has examined the specific effect of combining mindfulness practice with exposure to enhance its mechanism of action: the acquisition of new learning. Related work has, however, demonstrated that mindfulness-based emotion regulation strategies can improve individuals' performance on emotionally-provoking behavioral tasks. For example, laboratory studies have found that approaching an aversive carbon dioxide challenge with present-focused, nonjudgmental attention results in lower levels of self-reported anxiety and less avoidance during the task compared to avoidance-based emotion regulation strategies such as suppression (e.g., Eifert & Heffner, 2003; Levitt, Brown, Orsillo, & Barlow, 2004). Additionally, in a study that asked participants to alternate between practicing mindfulness or suppressing emotional reactions across six sessions of anxiety exposures, participants reported higher overall distress during mindfulness-based exposures, but greater decreases in distress across repeated mindful exposures (Brake et al., 2016). This is consistent with the hypothesis that greater attention to feared stimuli, while increasing negative emotions in the short-term, can facilitate the inhibitory learning necessary to promote extinction of distress over time.

Aims

The primary aim of this study was to evaluate whether practicing mindful emotion awareness, or the application of mindfulness to one's emotional responses, during exposure therapy is associated with increased emotional acceptance and decreased reliance on avoidant strategies while engaging in these procedures. We also sought to explore whether mindful emotion

awareness, practiced in the context of exposures, leads to increases in general levels of self-reported mindfulness. A second aim of this study was to evaluate whether adopting a mindful stance during emotional exposure procedures was associated with reduced in-session distress, general levels of emotional avoidance, and anxiety symptoms, compared to engaging in exposure procedures without mindful emotion awareness instruction (i.e., each patient relying on his/her own typical emotion regulation strategies). We hypothesized that mindful emotion awareness training would lead to increases in self-reported mindful strategy use during emotion exposures as well as greater overall mindfulness, and that increases in mindful strategy use would be associated with reductions in subjective distress, overall symptom severity, and experiential avoidance.

Method

Participants

Participants were recruited from a pool of individuals seeking treatment for anxiety, depression, and related disorders at the Center for Anxiety and Related Disorders (CARD) at Boston University (BU), a university-based community mental health clinic. This study was reviewed and approved by the Institutional Review Board at BU. Participants were included if they met diagnostic criteria for social anxiety disorder. Though mindful emotion awareness has been suggested as a transdiagnostic mechanism of change (Brake et al., 2016), designing effective exposure activities is a highly individualized process, necessitating vastly different stimuli across diagnostic classes. In order to establish consistency in study procedures, the current study was limited to individuals with social anxiety disorder as their principal (i.e., most distressing or interfering) diagnosis. Social anxiety disorder was selected because the conduct of in-session exposures is generally quite feasible for this condition (e.g., giving a speech, holding a small-talk conversation with a confederate).

Diagnoses were made using the Anxiety Disorders Interview Schedule for DSM-5-Lifetime Version (ADIS-5-L; Brown & Barlow, 2014; see below for description). To increase generalizability of findings, individuals with comorbid emotional disorder diagnoses (including other anxiety disorders, obsessive compulsive disorder, and/or depression) were included, as were individuals currently on psychotropic medications if they agreed to maintain a stable dosage throughout the entirety of the study. Furthermore, participants were required to be at least 18 years of age, fluent in English, able to provide informed consent, and able to complete all study procedures. Individuals

were excluded from the study if they presented with clinical conditions warranting immediate or alternative treatment, such as DSM diagnoses of bipolar disorder, schizophrenia, schizoaffective disorder, or organic mental disorder, as well as current suicidal risk and current or recent history of substance abuse or dependence within the previous three months. Finally, individuals were asked to discontinue other psychotherapy during the study period.

A total of seven individuals consented to procedures. One individual withdrew from the study after session five and was excluded from data analysis. Study completers consisted of four males and two females with a mean age of 29.17 years (standard deviation = 6.62, range = 20-36 years). The sample was primarily Caucasian (66.67%; $n = 4$), with one participant identifying as Asian (16.67%) and one participant who did not provide race/ethnicity data (16.67%). Although all individuals were diagnosed with social anxiety disorder as their principal diagnosis, three individuals (50%) also met diagnostic criteria for a current comorbid emotional disorder at a clinically significant level, specifically obsessive-compulsive disorder ($n = 1$), persistent depressive disorder ($n = 1$), and generalized anxiety disorder ($n = 1$). In addition, three participants (50%) reported taking psychotropic medications at the time of their intake.

Measures

Diagnostic ratings. The ADIS (Brown & Barlow, 2014; DiNardo, Brown, & Barlow, 1994) is a semi-structured clinical interview that assesses anxiety, mood, somatoform, and substance use disorders and screens for other disorders. Principal and comorbid diagnoses receive a clinical severity rating (CSR) on a dimensional scale from 0 (no symptoms) to 8 (extremely severe symptoms). A rating of 4 (definitely disturbing/disabling) or higher represents the clinical threshold for meeting DSM diagnostic criteria. The ADIS was used to confirm eligibility prior to study enrollment. The ADIS demonstrates acceptable to excellent interrater reliability for anxiety and mood disorders (Brown et al., 2001).

Self-report measures

Exposure ratings. The Responses to Emotions Questionnaire-Revised Version (REQ; Campbell-Sills, Barlow, Brown, & Hofmann, 2006) is an eight-item scale designed to assess the use of emotion regulation strategies during emotion-eliciting tasks. The REQ consists of four items pertaining to different ways of avoiding or changing emotional experiences (e.g., “I tried to hold back or suppress my emotional reactions”) and four items relating to awareness and acceptance of emotional experiences (e.g., “I recognized what I was

feeling during the exercises but didn't try to change what I was feeling"). Participants are instructed to rate their degree of strategy use from 0 (not at all) to 10 (all the time). In the current study, the REQ was modified to include an additional item: "The percentage of time I was aware of and accepting my emotions was:" followed by a scale from 0% to 100% in increments of 10. This item was designed to directly assess the amount of time during each exposure exercise that the participant utilized the mindful strategy.

The Subjective Units of Distress Scale (SUDS; Wolpe, 1969) is a rating scale designed to measure current distress and anxiety severity. Participants rate their subjective feelings of distress from 0 to 100 during and across exposure sessions. In this study, SUDS ratings within exposures were averaged for each participant.

Weekly ratings. The Southampton Mindfulness Questionnaire (SMQ; Chadwick et al., 2008) is a 16-item measure that assesses an individual's mindful approach to distressing thoughts and images. All items begin with, "Usually, when I have distressing thoughts or images" and continue with a mindfulness-related emotion regulation strategy such as "I judge the thought/image as good or bad." Items are rated on a 7-point Likert-type scale from 0 (disagree totally) to 6 (agree totally). The SMQ exhibits good internal consistency, convergent validity, discriminant validity, and sensitivity to change after mindfulness-focused training (Chadwick et al., 2008). In the current study, the SMQ is included to measure overall reliance on mindful strategies in patients' everyday experiences as opposed to just within study-related exposure exercises.

The Overall Anxiety Severity and Impairment Scale (OASIS; Norman, Cissell, Means-Christensen, & Stein, 2006), a brief 5-item questionnaire, was used as a continuous measure of anxiety-related symptom severity and impairment. The OASIS was developed to be used across anxiety diagnoses, with multiple anxiety disorders, and with subthreshold anxiety symptoms. It has demonstrated good psychometric properties (Norman et al., 2006) and sensitivity to changes in anxiety severity and impairment across treatment (Boswell, Anderson, & Barlow, 2014; Joesch et al., 2013).

The Multidimensional Experiential Avoidance Questionnaire (MEAQ; Gámez, Chmielewski, Kotov, Ruggero, & Watson, 2011) was used to assess experiential avoidance, or the tendency to avoid negative internal experiences such as thoughts, emotions, and physical sensations. The MEAQ contains 62 items that are organized into six subscales: behavioral avoidance, distress aversion, procrastination, distraction and suppression, repression and denial, and distress endurance. The present study only includes the distress aversion (DA; 13 items) and distraction/suppression (D/S; 7 items) subscales.

The measure has demonstrated good internal consistency, convergent validity, and discriminant validity (Gámez et al., 2011). While the measure's sensitivity to change has not yet been validated, Gámez et al. have noted that the subscales may be sensitive to change across targeted treatment approaches.

Procedure

The present study utilizes single-case experimental design (SCED), a within-subjects approach in which each participant is presented with all study phases, which are organized in a multiple baseline across subjects design. In Phase A, participants completed exposure exercises with instructions to utilize their typical emotion regulation strategies ("typical strategy"). Next, during Phase B, participants were instructed to utilize mindful emotion awareness during exposures ("mindful strategy"). Whereas a traditional nomothetic design may randomize individuals to either the typical or mindful strategy condition in order to detect a between-group effect, participants in SCEDs complete both conditions in order to determine whether idiographic improvement on the variables of interest coincide with a change in phase. This design allows each participant to serve as his or her own control and maximizes internal validity.

In the present study, participants were assigned to spend either three or five weeks in Phase A (i.e., "typical strategy" phase) in order to facilitate the functional analyses in a multiple baseline design. During the first session of this phase, all participants worked with a clinician to construct an exposure hierarchy consisting of personally-relevant emotion-provoking situations. Each situation was rated on a 0-10 scale ("no distress" to "extreme distress"); completed hierarchies consisted of 12 situations that patients rated as at least 5 ("definite distress"). Participants then completed one exposure exercise. During subsequent Phase A sessions, participants completed imaginal or situational exposures from their exposure hierarchies while relying on their own "typical" emotion regulation strategies. Based on logistical considerations for the items on each individual's hierarchy (i.e., how long each exposure was expected to last), some sessions consisted of one exposure while other sessions consisted of two. When sessions consisted of two exposures, the first was always a repeat of the last exposure from the previous session.

Following Phase A, participants entered Phase B and completed either nine (for those in the three-week Phase A condition) or seven (those in the five-week Phase A condition) weeks of exposure sessions utilizing mindful emotion awareness, resulting in 12 total sessions for each participant. Mindful emotion awareness training consisted of an introduction to the concept of mindful emotion awareness and a guided meditation to provide participants a

chance to practice nonjudgmentally observing their emotional experiences without engaging in efforts to diminish or escape them. At the start of every session in this experimental phase, clinicians provided instructions to remind participants to engage in mindful emotional awareness during exposures. Similar to Phase A, participants completed 1-2 exposures per session.

Throughout the course of the study, participants were asked to complete exposures between sessions for homework, using their typical strategy during Phase A and the mindful strategy during Phase B. Notably, there was one deviation from standard study procedures; participant 03 was randomized to three-week Phase A, but actually remained in this phase for four sessions before being taught mindful emotion awareness at the start of session five.

For all participants, SUDS ratings were collected throughout each in-session exposure and the REQ was completed after each in-session and homework exposure. To capture trends in symptom severity, experiential avoidance, and overall mindfulness over time, the OASIS, MEAQ, and SMQ were completed at the start of each weekly session.

Data Analytic Plan

Analysis for the current study was conducted using a combination of statistical methods and visual inspection, consistent with established guidelines for analyzing data from single-case experimental designs (Barlow, Nock, & Hersen, 2009; Manolov, Solanas, Sierra, & Evans, 2011). To test the first hypothesis, visual inspection was used to analyze longitudinal trends in mindful strategy use during exposures, as reflected in REQ scores, as well as in overall mindfulness, as reflected in SMQ scores. To test the second hypothesis, visual inspection was used to analyze patterns of relationships between mindful strategy use and secondary study variables. In all analyses, visual inspection was focused on identifying a treatment effect (i.e., determining whether changes in study variables were associated with the introduction of mindful emotion awareness in Phase B after varying lengths of Phase A. Descriptive statistics and effect size estimates were calculated to supplement visual inspection. Finally, post hoc correlational analyses were run to quantitatively characterize relationships between study variables.

Results

Improvements in Study Variables as a Function of Phase

Mean differences. First, we examined mean differences in study variables across phases for each participant. Consistent with the primary hypothesis,

the introduction of mindful emotion awareness (i.e., the transition between phases) was associated with decreases in avoidant strategy use, as measured by the REQ, as well as increases in overall mindfulness, as measured by the SMQ, for the majority of patients (i.e., 5 of 6). On average, avoidant strategy use during exposures decreased between phases for participants 01, 02, 03, 05, and 06 (see Table 1 for average scores in each condition for each participants). Similarly, on average, overall mindfulness increased between phases for participants 01, 02, 04, 05, and 06.

Next, we examined mean differences across phases on secondary study variables. On average, scores on MEAQ Distress Aversion decreased for all six participants. Scores on MEAQ Distraction/Suppression decreased for participants 01, 02, 05, and 06. All participants exhibited a decrease in average OASIS scores across phases. Conversely, only participants 01 and 04 exhibited a decrease in average SUDS between phases.

Effect sizes. It is worth noting that many of these mean differences are quite modest in magnitude and are thus not readily interpretable. Analysis of single-case data is often bolstered by effect size estimates such as percentage of non-overlapping data (PND; Tarlow & Penland, 2016). PND refers to the percentage of data points in a given study phase that does not overlap with data points in the previous phase. This produces a percentage value that represents "new" observations only occurring after a new phase has been initiated. PND offers a useful metric of statistical significance, as mean difference calculations alone cannot estimate significance. Table 2 contains PND values and associated *p* values.

Mindful emotion awareness instruction was associated with a statistically significant decrease in avoidant strategy use during exposures for participants 01, 03, and 06, as assessed using PND. Similarly, mindfulness instruction was associated with a significant increase in overall mindfulness for participants 01, 02, 05, and 06. PND values also suggested a treatment effect on both MEAQ subscales (i.e., Distress Aversion and Distraction/Suppression) for participants 01, 02, and 05. Finally, PND values suggest a significant effect of mindfulness training on OASIS for participants 04 and 05 and a trend toward significance for participant 01. Mindful emotion awareness instruction was not associated with significant decreases in SUDS for any participants.

Visual inspection. While examining mean differences and calculating PND are common strategies to analyze data in single case research, both techniques suffer from some limitations (Parker, Vannest, & Davis, 2011). First, they assume data stability during the first phase. For example, if data points

Table 1. Mean Scores (and Standard Deviations) for Study Variables Across Baseline ("Typical") and Intervention ("Mindful") Phases.

ID	Strategy	Avg SUDS	REQ	% Time Accept	SMQ	DA	D/S	OASIS
01	Typical	5.25 (0.50)	39.75 (3.95)	65.00 (5.77)	30.67 (3.06)	4.18 (0.19)	4.48 (0.16)	12.00 (0.00)
	Mindful	4.72 (0.75)	27.33 (7.76)	82.22 (6.47)	51.10 (9.05)	2.18 (0.97)	2.86 (0.65)	8.9 (3.28)
	Difference	−0.53 (0.25)	−12.42 (3.81)	17.22 (0.70)	20.43 (5.99)	−2.00 (−0.78)	−1.62 (0.49)	−3.10 (3.28)
02	Typical	2.80 (0.84)	19.80 (9.76)	86.00 (5.48)	43.33 (2.52)	2.56 (0.04)	3.48 (0.44)	4.33 (1.15)
	Mindful	4.56 (0.62)	15.17 (4.94)	91.11 (4.71)	60.00 (9.44)	2.06 (0.23)	2.29 (0.75)	2.80 (0.42)
	Difference	1.76 (−0.22)	−4.63 (−4.82)	5.11 (−0.77)	16.67 (−6.92)	−0.50 (−0.19)	−1.19 (0.31)	−1.53 (−0.73)
03	Typical	4.50 (1.29)	51.75 (4.57)	45.00 (17.32)	50.75 (7.63)	4.39 (0.20)	3.61 (0.65)	8.75 (0.96)
	Mindful	5.75 (1.58)	40.75 (6.61)	43.75 (15.98)	47.11 (4.46)	4.36 (0.09)	4.02 (0.39)	8.00 (0.71)
	Difference	1.25 (0.29)	−11.00 (2.03)	−1.25 (−1.34)	−3.64 (−3.17)	−0.03 (−0.11)	0.41 (−0.26)	−0.75 (−0.25)
04	Typical	3.80 (1.64)	26.80 (6.87)	42.00 (28.64)	29.60 (4.34)	3.26 (0.16)	2.89 (0.37)	12.4 (0.55)
	Mindful	2.93 (1.14)	35.43 (5.09)	40.71 (13.28)	33.13 (2.64)	3.23 (0.08)	3.21 (0.60)	10.5 (0.20)
	Difference	−0.87 (−0.50)	8.63 (−1.78)	−1.29 (−15.36)	3.53 (−1.70)	−0.03 (−0.08)	0.32 (0.23)	−1.90 (−0.35)
05	Typical	1.75 (0.88)	27.29 (13.56)	81.43 (13.45)	53.00 (9.75)	3.02 (0.65)	3.00 (0.39)	4.60 (2.30)
	Mindful	2.22 (1.27)	13.75 (8.69)	86.67 (12.25)	79.38 (5.32)	1.85 (0.19)	1.95 (0.41)	1.13 (1.13)
	Difference	0.47 (0.39)	−13.72 (−5.06)	5.24 (−1.20)	26.38 (−4.43)	−1.17 (−0.46)	−1.05 (0.02)	−3.47 (−1.17)
06	Typical	6.20 (0.84)	38.40 (5.68)	74.00 (11.40)	52.40 (1.34)	2.38 (0.36)	2.23 (0.22)	6.60 (2.30)
	Mindful	6.43 (1.13)	27.00 (4.55)	81.43 (3.78)	55.63 (5.50)	2.27 (0.06)	2.02 (0.05)	5.63 (0.92)
	Difference	0.23 (0.29)	−11.40 (−1.14)	7.43 (−7.62)	3.23 (4.16)	−0.11 (−0.30)	−0.21 (−0.17)	−0.97 (−1.38)

Note: SUDS = Subjective Units of Distress Scale; REQ = Reponses to Emotions Questionnaire-Revised; SMQ = Southampton Mindfulness Questionnaire; DA = Multidimensional Experiential Avoidance Questionnaire, Distress Aversion subscale; D/S = Multidimensional Experiential Avoidance Questionnaire, Distraction/Suppression subscale; OASIS = Overall Anxiety Severity and Impairment Scale.

Table 2. Percentage of Non-Overlapping Data.

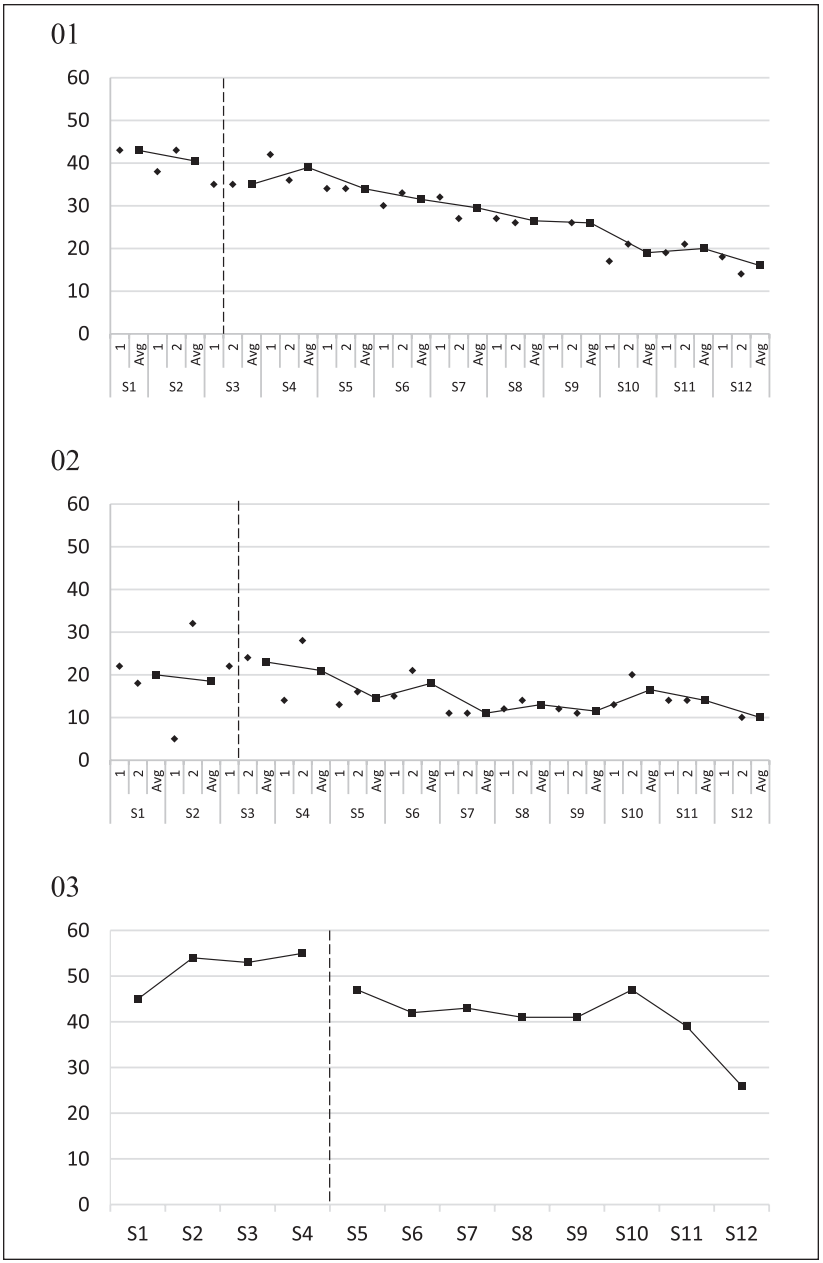
ID	Avg SUDS	% Time Accept	REQ	SMQ	DA	D/S	OASIS
01	44.44	88.89*	83.33*	90.00*	100.00*	100.00*	70.00†
02	00.00	16.67	00.00	100.00*	90.00*	80.00*	00.00
03	00.00	00.00	75.00*	00.00	00.00	00.00	11.11
04	7.14	00.00	00.00	12.50	00.00	12.50	75.00*
05	00.00	00.00	37.50†	100.00*	100.00*	87.50*	62.50*
06	00.00	00.00	71.43*	75.00*	00.00	00.00	00.00

*$p < .05$ †$.05 < p < 0.10$.

steadily increase throughout both phases, the mean difference and PND may be very high despite a lack of a treatment effect (i.e., a steady slope that does not change across phases). Furthermore, if data points steadily decrease during Phase A but steadily increase during Phase B, the mean difference and PND may be very low despite a clear treatment effect (i.e., a reversal of slope). Second, these strategies assume that there are no data outliers in Phase A. An extreme outlier during Phase A will skew the Phase A mean and may prevent data from Phase B from being classified as "non-overlapping." Thus, visual inspection was conducted to detect treatment effects, defined as instances whereby mindful emotion awareness instruction at the start of Phase B appears to change data trends established during Phase A.

Treatment effects on avoidant strategy use during exposures were detected for participants 01, 02, 03, 05, and 06. In general, participants appeared to benefit most strongly after continuing to practice mindful emotion awareness for several sessions after initial instruction. Participant 04 did not evidence a consistent downward trend in avoidant strategy use; in fact, even after mindful emotion awareness training, he appeared to rely increasingly on strategies to avoid or suppress emotions during subsequent exposures. Figure 1 includes graphs of each participant's REQ scores at each time point.

Visual inspection suggested that mindful emotion awareness training resulted in a change in overall mindfulness for participants 01, 03, 04, and 06. Participant 01 demonstrated the clearest treatment effect. Participants 03 and 04 demonstrated modest treatment effects, as evidenced by a reversal of Phase A deterioration. Participant 06 also exhibited a modest treatment effect, with gains most evident in the latter half of Phase B. Participants 02 and 05 evidenced strong increases in mindfulness as well, but these increases cannot be fully attributed to mindful emotion awareness instruction, as their scores



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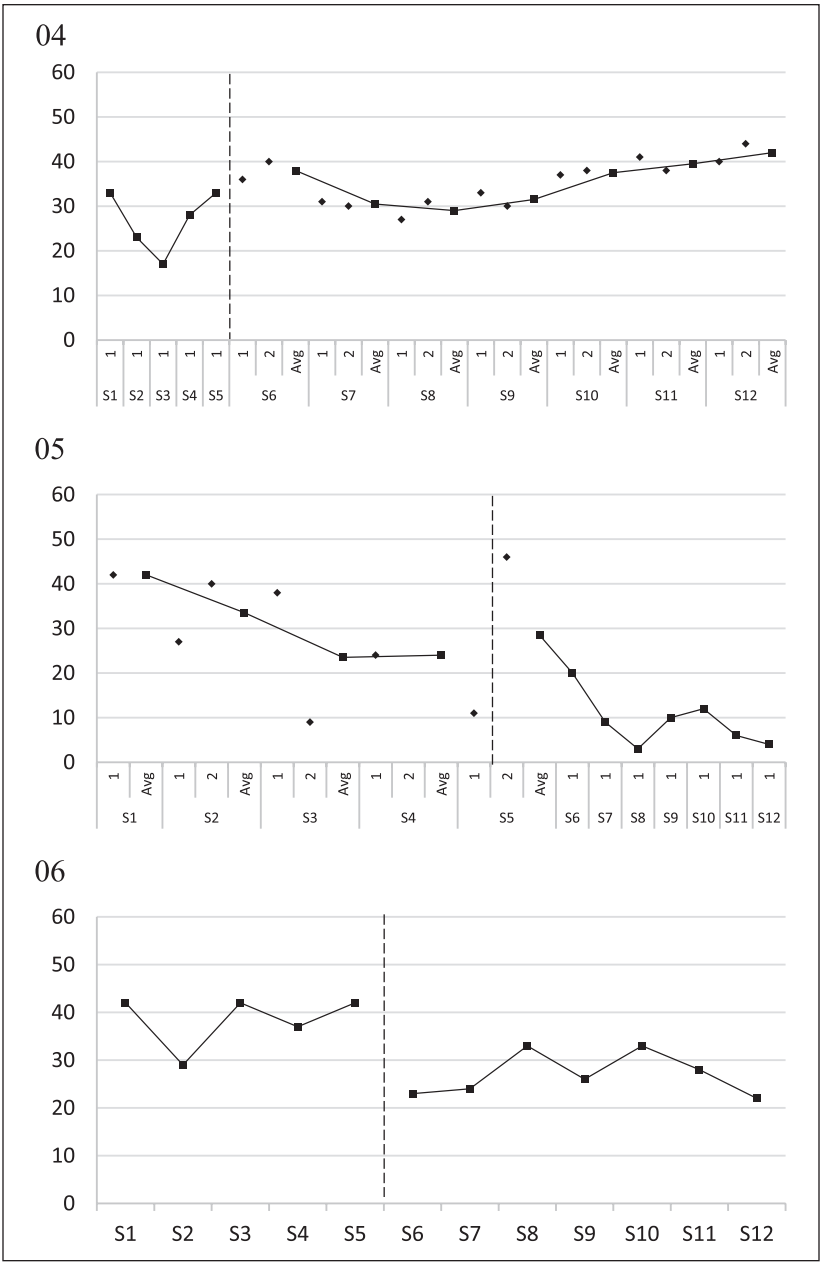

Figure 1. *(continued)*

Figure 1. Avoidant strategy use during each exposure measured by the REQ, by participant.
Note. REQ = Responses to Emotions Questionnaire-Revised Version (Campbell-Sills et al., 2006). When participants underwent two exposures per session, individual points represent REQ scores for each exposure and points connected by lines represent average REQ score per session. When participants underwent one exposure per session, points connected by lines represent scores for that one exposure. All points to the left of the dotted line refer to ratings in Phase A; all points to the right refer to ratings in Phase B.

increased across Phase A as well. Figure 2 includes graphs of each participant's SMQ scores at each time point. Figures for the remaining measures are available upon request.

On the MEAQ Distress Aversion subscale, a modest treatment effect was seen for participant 02. Strong improvements on this scale were observed for participants 01 and 05, though unstable data patterns during Phase A preclude causal inferences from being drawn. On the MEAQ Distraction/Suppression subscale, favorable treatment effects were observed for participants 01, 02, and 05. Interestingly, participant 04 exhibited a clear treatment effect in the opposite direction than expected; mindful emotion awareness training immediately preceded a strong deterioration trend. Participants 03 and 06 exhibited very little change on this measure.

With regard to anxiety symptoms, treatment effects on OASIS scores were observed for participants 01, 02, and 04. Participants 05 and 06 also evidenced strong improvements on OASIS scores, but their improvements were established before mindful emotion awareness training. Participant 03 did not exhibit a pattern of improvement on OASIS. Additionally, because the OASIS is the only direct measure of anxiety symptoms in the current study, Table 3 contains each participant's first and last symptom rating (i.e., rated at the beginning of the first session and one week after the final session).

Visual inspection suggested that mindful emotion awareness training was associated with a very modest decrease in average SUDS ratings between phases for participant 01, but a very modest increase in SUDS ratings for participant 02. For all other participants, SUDS ratings did not appear to be strongly related to mindful emotion awareness training.

Relationship between Mindfulness and SUDs

While we did not propose an *a priori* hypothesis on the relationship between mindful strategy use during exposures and SUDS ratings, an interesting pattern emerged during visual inspection. Specifically, there appears to be an inverse relationship between the self-reported percentage of time spent being mindful during exposures and subjective distress ratings. In fact, all

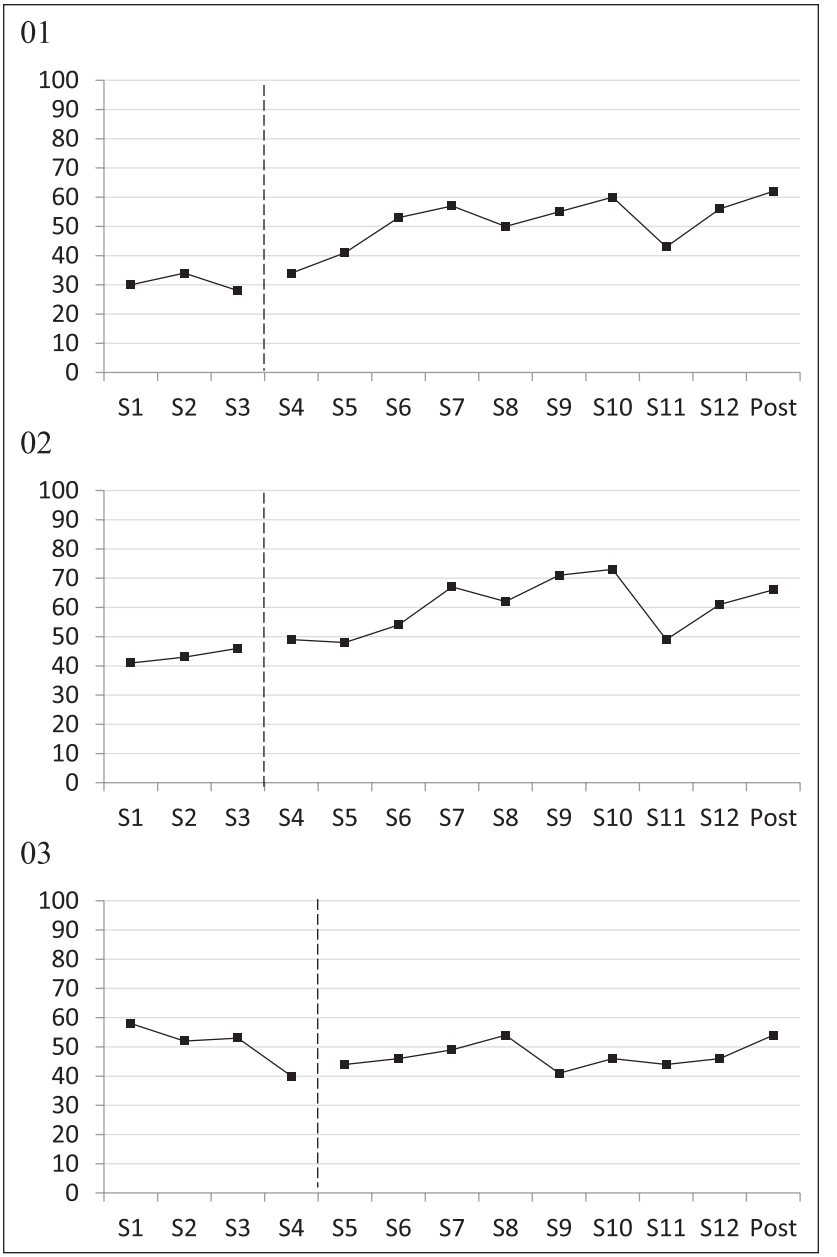

Figure 2. *(continued)*

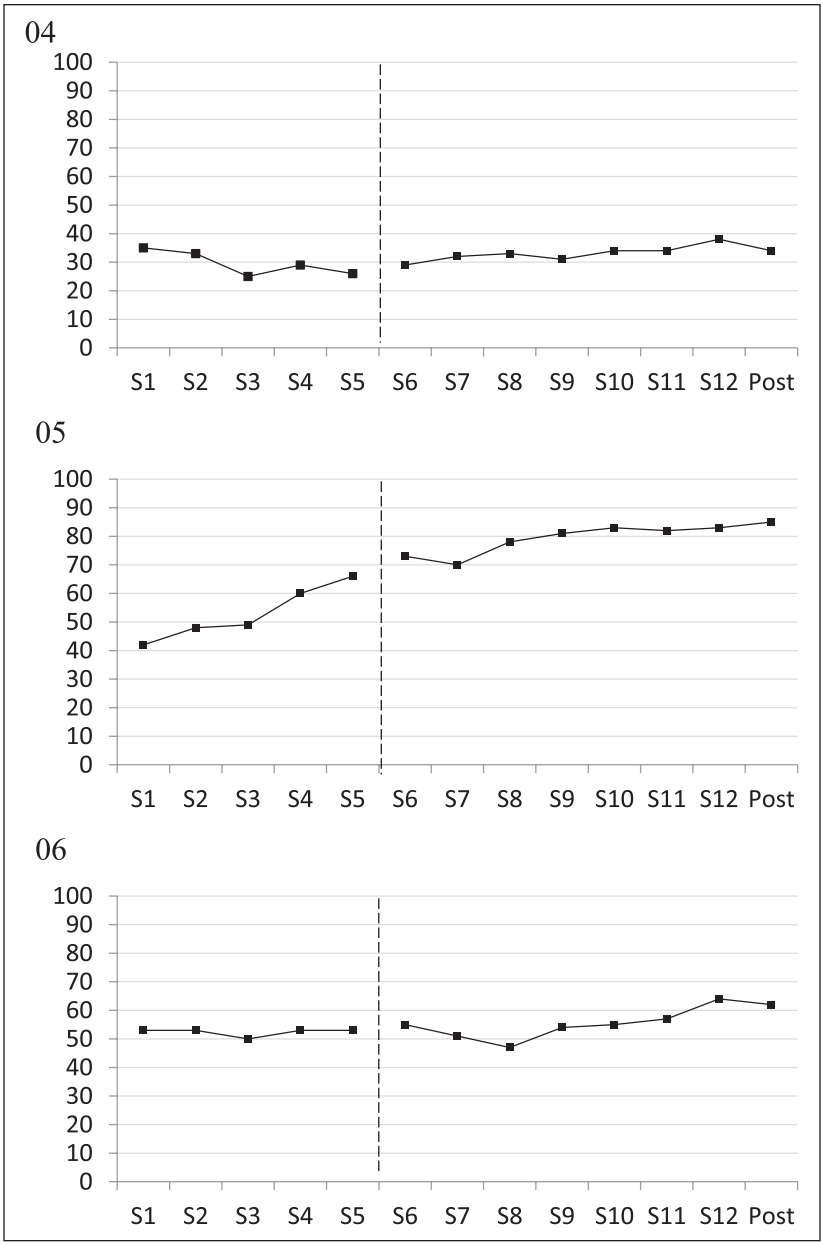

Figure 2. *(continued)*

Figure 2. Overall weekly mindfulness measured by the SMQ, by participant.
Note. SMQ = Southampton Mindfulness Questionnaire (Chadwick et al., 2008); post = one week after session 12. All points to the left of the dotted line refer to ratings in Phase A; all points to the right refer to ratings in Phase B.

Table 3. Pre-Treatment and Post-Treatment OASIS Scores.

ID	Pre-treatment	Post-treatment
01	12	3
02	4	2
03	8	9
04	13	9
05	8	2
06	8	5

participants except participant 06 demonstrated a clear inverse relationship such that average SUDS ratings for each session were higher when they spent a smaller percentage of their exposures in each session being mindful, while average SUDS ratings were lower when they spent a larger percentage of their exposures being mindful. This relationship was then examined at a within-session level for the three participants who participated in two exposures per session (01, 02, and 04). Participant 04 demonstrated a consistent pattern whereby SUDS increased across exposures within each session, while time spent being mindful decreased across exposures within each session. Participants 01 and 02 did not demonstrate a clear within-session relationship between SUDS and time spent being mindful.

The relationship between SUDS and time spent being mindful was assessed quantitatively in order to substantiate the above visual inspection findings. Correlations were run using Simulation Modeling Analysis (SMA; Borckardt & Nash, 2014), a statistical program that analyzes short, single-case time series data. SMA calculates autocorrelations for each time series and utilizes these autocorrelations and the number of observations to generate random simulated data streams, each of which complies to the same parameters as the data (i.e., autocorrelation coefficients, number of observations). This process is a similar approach to Monte Carlo analysis. The current models were set to run 10,000 simulations. Of note, the analyses require intervals between observations to be equivalent; thus, for individuals who completed two exposures per session, ratings of SUDS and time spent being mindful were averaged across the two exposures and session average values were analyzed, as sessions were held weekly.

Table 4. Spearman's Rho Correlations between Session Average Suds Ratings and Percent Time Spent Being Mindful.

ID	Spearman's rho	*p*
01	−0.50*	.046
02	0.37	.118
03	−0.77*	.001
04	−0.75*	.003
05	−0.32	.146
06	−0.30	.167

*Corresponding p values for each Spearman's rho value are in the column on the right.

The analysis of session averages is consistent with the visual inspection trends reported above. Correlations were calculated in the Spearman's Rho metric, which is a non-parametric test that does not assume normal distribution of data, accounts for serial dependence present in single-case data, and is appropriate for use when $n \geq 4$ (Corder & Foreman, 2014). Results are reported in Table 4. Session ratings of SUDS and time spent being mindful during exposures were significantly correlated in participants 01, 03, and 04.

Due to the relationship between SUDS and time spent being mindful that was suggested by visual inspection and confirmed by Spearman correlations for some participants, cross-lagged correlations were run to assess temporal precedence and investigate whether changes in SUDS precede changes in time spent being mindful or vice versa. SMA was used to run Spearman cross correlations at a time lag of one session; in other words, for each individual, Spearman correlations were run between SUDS ratings at time K and ratings of time spent being mindful at time $K - 1$, time K, and time $K + 1$. Because each analysis involved three tests, Bonferroni corrections were performed in order to correct for multiple comparisons. Bonferroni corrections involved dividing the standard threshold for statistical significance by the number of comparisons being made in each test (i.e., .05 divided by 3), and the resultant value represents a more appropriate threshold for determining statistical significance at the .05 level. As with the previous Spearman correlations, 10,000 simulations were run.

Results are reported in Table 5. One cross correlation model, the model for participant 02, was significant. For that participant, SUDS ratings and ratings of time spent being mindful during exposures were significantly correlated with a lag of one session. Specifically, changes in SUDS preceded changes in percent of time spent being mindful, such that a lower SUDS rating in a particular session was associated with more time spent being mindful during exposures in the subsequent session.

Table 5. Cross-Lagged Correlations between Session Average Suds Ratings and Percent Time Spent Being Mindful.

ID		Spearman's rho	*p*
01	SUDS > % Time	−0.37	.337
	% Time > SUDS	−0.36	.344
02	SUDS > % Time	0.75*	.004
	% Time > SUDS	0.16	.251
03	SUDS > % Time	0.45	.039
	% Time > SUDS	0.30	.436
04	SUDS > % Time	−0.10	.606
	% Time > SUDS	−0.46	.296
05	SUDS > % Time	0.25	.134
	% Time > SUDS	0.07	.278
06	SUDS > % Time	0.17	.157
	% Time > SUDS	0.43	.051

Note. Due to multiple comparisons, Bonferroni corrections were performed on all analyses. In order to reach statistical significance at a .05 level, *p* values must be lower than .0167.

Discussion

The results largely support the hypothesis that mindful emotion awareness training, conducted during a course of exposure therapy, is associated with decreased avoidant strategy use during exposure exercises and increased general levels of mindfulness. Visual inspection revealed a treatment effect in the predicted direction on both of these outcomes for a majority of the six participants.

In addition, for some participants, training was also associated with changes in anxiety symptoms, subjective distress ratings during exposures, and facets of experiential avoidance. For other individuals, consistent improvement on study variables was seen both before *and* after mindful emotion awareness training. This suggests that for some participants explicit instruction in mindful emotion awareness may not have been necessary, as exposure exercises may have been sufficient to promote change in mindfulness, distress aversion, and anxiety symptoms.

Exploratory idiographic correlations suggest that, for four of six participants, the amount of time participants reported spending being mindful during exposure exercises was inversely related to their subjective distress ratings. For three of these individuals, these were contemporaneous correlations, whereas for one individual, a higher average SUDS rating in a particular session was associated with a lower percentage of time spent being

mindful in the following session. This may mean that this participant modulated his engagement in a given session (as indicated by the percent of time he reported accepting his emotions during the exposure exercises) based on his experience in the previous session (as indicated by his subjective distress ratings). However, as described earlier, these were post hoc analyses conducted after visual inspection suggested a potential inverse relationship between these constructs; thus, no *a priori* hypotheses had been established based on existing theory or empirical evidence. Given the substantial inter- and intra-person variability in the distress reported during these individually-tailored exposure exercises, these results should not be interpreted as a proxy for inhibitory learning nor as an indicator of clinical benefit.

One participant, participant 04, did not evidence change on most study variables in the expected direction. Single case data analysis affords the opportunity to explore factors relating to an individual's pattern of response. First, we examined this participant's first session scores on study variables to see if he reported particularly high or low scores on any variables. His OASIS score of 13 in session one, and the average of his OASIS scores across all five Phase A sessions, which was 12.4, were the highest of all participants, though participant 01 reported only slightly lower session one and average Phase A OASIS scores (both 12), suggesting his pattern of response was likely unrelated to baseline levels of anxiety. Second, we examined his pattern of response during Phase A. He exhibited the least stable patterns of responses during Phase A, reporting high emotional acceptance during exposures in his first two sessions (spending an average of 70% of those sessions accepting his emotional experience) and low emotional acceptance during the latter two sessions of Phase A (spending an average of 15% of those sessions accepting his emotional experience); similarly, he reported lower distress ratings across the first two sessions (an average of 2.5) compared to the last two Phase A sessions (an average of 5.5). Exposures appeared to become much more challenging for him during Phase A, and the addition of mindful emotion awareness practice, while associated with a modest reversal of deterioration of overall mindfulness, was also associated with greater in-session avoidant strategy use. Despite inconsistent engagement with exposure exercises, across methods of analysis, his OASIS scores appear to indicate a small degree of stable improvement over the course of treatment (see Table 3 for pre-treatment and post-treatment anxiety symptom outcomes).

The present findings provide some support for mindful emotion awareness as a potential mechanism of symptom reduction; however, not all patients may need to spend time formally learning this skill. Thus, the results of this study have important implications for the personalization of psychological treatments. Personalization may improve the effectiveness

and efficiency of evidence-based mental health treatments by guiding the selection of therapeutic skills that are most relevant to an individual patient's presentation. Modular treatments, which consist of a series of relatively self-contained treatment skills, lend themselves to such personalization strategies. Some patients may become more mindful simply as a function of participating in exposure treatment, whereas other patients may require more formal training or be instructed to practice mindful emotion awareness before engaging in exposures. Indeed, randomized controlled trials of cognitive-behavioral versus mindfulness-based treatments for social anxiety have found increases in self-reported mindfulness in both treatments, despite an absence of explicit mindfulness content in the CBT conditions (Goldin et al., 2016; Kocovski, Fleming, Hawley, Ho, & Antony, 2015).

The Unified Protocol for the Transdiagnostic Treatment of Emotional Disorders (UP) is a modular cognitive-behavioral treatment that was designed to reduce reliance on the avoidant coping that contributes to development and maintenance of symptoms across the full range of anxiety and mood disorders (Barlow et al., 2017). The UP consists of several modules that teach skills for cultivating approach-oriented emotion regulation, including mindful emotion awareness and exposure. In the UP, mindful emotion awareness is an early skill that is first taught through a guided meditation exercise; patients are then asked to practice applying mindful awareness to emotional experiences that come up in their daily lives. Toward the end of treatment, patients undergo emotion exposures, or exposure-based exercises designed to elicit specific aversive emotions. Notably, the UP is the only cognitive-behavioral anxiety protocol that intentionally applies mindfulness within the context of emotion exposures.

The UP's modular design and transdiagnostic framework are well-suited to the selection of treatment components based on individual patients' needs. However, future research will be needed to determine how to best predict which modules will be most beneficial for individual patients and the extent to which this improves treatment outcomes. For example, Boswell and Bugatti (2016) conducted an idiographic case study of two individuals diagnosed with comorbid depression and anxiety disorders who reported similar degrees of improvement on measures of symptoms and purported mechanisms (i.e., mindfulness, emotion avoidance, and cognitive flexibility) after 16 sessions of the UP. For one of these patients, mindfulness, emotion avoidance, and cognitive flexibility improved steadily across treatment, suggesting that individual treatment modules did not have specific effects on these variables. For the other participant, however, mindfulness increased the most during the exposure module, while emotion avoidance decreased the most

during the mindful emotion awareness module. This finding supports the notion that individuals with similar symptom presentations may yield different benefits from various intervention strategies. Furthermore, these results also support the current study's finding that mindful emotion awareness training may be effective in reducing avoidance, and that exposure exercises may be associated with increases in mindfulness for some individuals.

A number of important limitations to the current study should be highlighted. First, we are unable to account for variation in exposure exercises, as each participant constructed their own hierarchy with their own activities included as exposures. Thus, this study reflects how patients in clinical practice typically ascend their hierarchies from less feared to more feared situations. Also, we are unable to make any generalizable claims due to the mixed results and small sample size. Instead, our results demonstrate the importance of individualizing treatment in order to maximize therapeutic benefit.

Finally, the exploratory correlations between average SUDS ratings and percent of time spent being mindful during exposures should be interpreted in the context of several limitations. First, as discussed above, these tests were run post hoc as a means of statistically characterizing a pattern observed through visual inspection; given that the study team did not initially hypothesize an expected relationship between these constructs, interpretability is limited. Additionally, correlations were calculated without accounting for phase in order to maximize power. There is a chance that mindful emotion awareness training influenced this relationship, which would be obscured in the current analyses. After correcting for multiple comparisons, one individual showed evidence of temporal precedence of SUDS ratings; however, these analyses used average ratings of SUDS and time spent being mindful per session, which fails to account for how these may have changed over the course of individual exposure exercises. If there is a causal relationship between distress and mindful strategy use, it is more likely to be captured by examining change in these constructs within sessions rather than between sessions.

In summary, mindful emotion awareness training was associated with improvements in self-reported mindfulness, experiential avoidance, and anxiety symptoms for some individuals with social anxiety disorder undergoing exposure therapy, whereas other individuals showed improvements independently of mindful emotion awareness training. Future research should focus on identifying the characteristics that may distinguish individuals who will benefit from mindful emotion awareness training from those who are better suited to begin exposures without explicit instruction in other skills. One might hypothesize that individuals who report lower overall mindfulness or higher aversion to distress at baseline may be more

likely to benefit from learning additional skills to facilitate exposure; however, relying on simple data inspection, this conjecture does not hold true in the current data, as outcomes appear to not be contingent on baseline characteristics captured by the current assessment battery. Additionally, patients' preexisting attitudes toward mindfulness and/or exposure therapy may impact their outcome expectancies or engagement. A larger *n* study may be better suited to identify moderators of treatment response based on baseline characteristics (e.g., attitudes toward treatment or outcome expectancies) or process variables (e.g., between-session practice). Single-case experiments testing the interactive effect of other therapeutic elements (e.g. cognitive flexibility) on exposure efficacy may provide further evidence that patients with particular characteristics may benefit from a different combination of treatment skills. Developing idiographic assessment tools to measure these characteristics would facilitate the selection of treatment skills in personalized psychological interventions, potentially improving the effectiveness and efficiency of these treatments.

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