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Dosed versus prolonged exposure in the treatment of fear: An experimental evaluation and review of behavioral mechanisms

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ABSTRACT

Exposure-based treatments have proven effective in treating a range of fears and phobias and can be accounted for by mechanisms described in behavioral theory. Enhanced dosed and dosed-only exposure are promising new behavioral approaches for treating fears and phobias. Thirty-nine participants with speech anxiety were randomly assigned to a prolonged exposure (PE) condition, a positively enhanced dosed exposure (PDE) condition, a dosed-only exposure (DE) condition, or a negatively-supplemented dosed exposure (NDE) condition. Results indicated that both the PDE and DE conditions produced less measured aversive arousal and significantly more rapid arousal reduction than the tested alternatives. These techniques may represent an important advancement, in that the treatment gains of traditional exposure therapies might be achieved without the degree of aversive arousal (and possibly high drop out rates) typically seen in exposure therapies. Additionally, these data contradict prevailing opinion concerning the necessity for sustained aversive arousal during exposure-based treatment.

Exposure-based therapies are effective in treating a variety of fear-based problems, including agorophobia, panic, posttraumatic stress disorder (PTSD), social, and specific phobia (Chambless & Ollendick, 2001; Choy, Fyer, & Lipsitz, 2007; Hirai, Vernon, & Cochran, 2007; Parsons & Rizzo, 2008). According to behavioral theory, fears are principally acquired through a combination of respondent and operant conditioning (Barlow, 2002; Forsyth, Barrios, & Acheson, 2007; McAllister & McAllister, 1995; Todd & Pietrowski, 2007). Through respondent pairing, neutral stimuli acquire the evocative properties of conditioned stimuli. As such, fearful settings and physiological stimuli (CSs) may come to elicit fearful reactions (CR). Through stimulus generalization, other similar settings and physiological stimuli may also elicit the fearful reaction. One can also come to acquire fear in the presence of similar stimuli and contexts through the observation of fear responding in others.

From an operant conditioning perspective, the phobic/fearful situations may have stimulus functions beyond that of a conditioned stimulus (Spates & Rubin, 2007). The phobic/fearful situation may also serve as a conditioned establishing operation (CEO). More specifically, the phobic/fearful situation functions as a reflexive CEO which is correlated with a worsening in conditions and whose offset will function as reinforcement (Michael, 2004). Reflexive CEOs will evoke escape and avoidance behaviors that are then reinforced by the relatively immediate reduction or removal of that CEO. Thus, any behavior that reduces or removes the phobic/fearful situation or some aspect of this situation will be automatically reinforced.

Prolonged exposure is one evidence-based treatment for fear (Barlow, 2002; Boudewyns & Shipley, 1983; Richard, Lauterbach, & Gloster, 2007). An axiomatic feature of this treatment is the extended duration of 'exposure' or 'confrontation' with the real or imagined fear context while sustaining modest to high levels of aversive arousal. During therapy this is accomplished within a safe context and guided by a treatment rationale that has been explained to the client. The behavioral principle that most parsimoniously accounts for the success of this procedure is respondent extinction. Before treatment, the conditioned stimulus elicited a conditioned fearful emotional response (such as muscle contractions, sweating, increased heart rate, adrenal secretion, galvanic skin response, etc.). Since this conditioned stimulus is continuously presented without an unconditioned fear eliciting stimulus the conditioned stimulus loses its fear-evocative properties and becomes a neutral stimulus (McAllister & McAllister, 1995). During this process, others have argued that a significant alteration in information processing also occurs (Foa & Kozak, 1986).

Another treatment based on respondent extinction is graded exposure (Barlow, 2002; Richard et al., 2007). We distinguish graded exposure from prolonged exposure merely for conceptual reasons, recognizing that graded prolonged exposure often occurs

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during in vivo exposure interventions (Seim & Spates, 2008). Flooding, on the other hand, would look like prolonged exposure without grading. Although both procedures involve the repeated presentation of a fear eliciting conditioned stimulus, they differ in that graded exposure involves a progression from the least evocative conditioned stimulus to the most evocative conditioned stimulus. A hierarchy of stimuli is constructed based on their evocative properties and progression through the hierarchy occurs when at least partial extinction takes place on the earlier steps. For example, therapists only progress through later steps in the hierarchy if clients demonstrate a reduction in emotional responding at earlier steps.

Dosed exposure is yet another possible treatment for phobias (Pittman et al., 1996; Seim & Spates, 2008; Spates & Koch, 2003; Spates & Rubin, 2007; Waller, 2004). Unlike graded exposure, there is no progression through a hierarchy of feared stimuli. Like prolonged exposure, the fearful stimulus, either imagined or real, is presented at moderate to maximal strength. Unlike prolonged exposure however, the fearful stimulus is not presented for an extended continuous duration. Instead, clients are repeatedly exposed to the fearful stimulus for very short durations of time. There is a brief time period between exposures referred to here as the inter-trial interval, after which the feared stimulus is presented again. This cycle continues until extinction is complete. Thus, the extinction-relevant unpairing of the CS/US is more gradual and less dense with this procedure (i.e., it takes place over repeated trials rather than over a single continuous trial of exposure). It is hypothesized that such dosed exposure may be more acceptable to clients who are sometimes unwilling to go through a prolonged exposure treatment, and more acceptable to clinicians who are often unwilling to administer a strongly aversive procedure to clients (Zayfert & Black, 2000). Note that in all of the respondent extinction procedures, operant unpairing of the conditioned establishing operation is also likely occurring simultaneously. That is, the fear-arousing context is being presented in the absence of both a worsening of conditions (operant unpairing of the reflexive CEO) and the conditioned stimulus with which it was originally paired (respondent extinction) and presumably which gave rise to aversive properties. All involve repeatedly presenting a stimulus with acquired evocative properties (CEO, CS, CS_2) without the original or any other stimulus that has negative emotional evocative properties (UEO, US, CS_1, respectively).

Eye movement desensitization and reprocessing (EMDR) is another treatment for fears and phobias (Shapiro, 1989). EMDR involves induction of saccadic eye movements on the part of the client while they are asked to recall the feared situation or trauma (Spates, Koch, Cusack, Pagoto, & Waller, 2008; also see Shapiro, 1995 for a detailed description of EMDR). While the EMDR intervention package is an effective treatment (Chambless & Ollendick, 2001; Spates et al., 2008; Waller, Mulick, & Spates, 2000) the mechanism by which it achieves its effects has been debated (Foley & Spates, 1995; Lohr, Tolin, & Lilienfeld, 2000; Pittman et al., 1996; Renfrey & Spates, 1994; Spates & Koch, 2003; Spates, Waller, & Koch, 2000). As Spates and Koch note "many features of eye movement desensitization and reprocessing treatment play no essential role in the outcome, and that what is left after dismantling the components of treatment are core elements of exposure therapy, administered in a dosed fashion, rather than continuously, as is more typically done with exposure therapy." (pp. 72–73). Therefore, EMDR can be conceptualized as a dosed exposure procedure as described earlier.

Exposure-based treatments are listed as "Evidence Based" or "Efficacious" by the APA Task Force on the Identification and Dissemination of Efficacious Treatments (Chambless & Ollendick, 2001) and more recently by the Institute of Medicine in relation to the treatment of PTSD (IOM, 2008). These treatments have been relatively brief, with some instances consuming only a few treatment sessions. However, there are reported attrition rates as high as 40–50% with prolonged exposure treatments (Zayfert & Black, 2000). Although prolonged exposure has been endorsed as "empirically supported," such a high dropout rate is unacceptable on practical grounds. Hembree et al. (2003) have argued that the drop out rate for prolonged exposure is no different than for other treatments, and that much of the drop out associated with prolonged exposure occurs before the client has experienced a single therapeutic exposure. Implied therefore is that some patients drop out during either the rationale or extensive psycho-education phases of prolonged exposure. Arguably this makes the case even stronger concerning the potential aversive arousal generated by such procedures, even during the early description of what the patient 'will' experience. Although admittedly, client drop out can occur for many reasons unknown to the therapist or investigator. While much attention has been focused on prolonged exposure due to its well achieved stature, if other procedures addressing fear generate equal and high attrition, a similar conclusion can be reached regarding the need for continuing research to establish procedures that reduce such attrition while retaining effectiveness.

In addition to the high levels of attrition that are often seen during exposure-based therapies, there is another challenge that is potentially problematic. During exposure-based treatments, clients may engage in escape or safety behaviors such as leaving or avoiding the situation. Exposure to the situation operates as a reflexive CEO that evokes these behaviors, which in turn are negatively reinforced by the removal of the exposure (if they are successful), thus suggesting the importance of operant conditioning in the maintenance of phobias (Barlow, 2002; McAllister & McAllister, 1995). While therapists can often prevent the overt instances of such behavior (through response prevention), the covert instances are more problematic. For instance, the client may resort to distracting thoughts and images to avoid contact with the feared stimuli, especially when confrontation with the feared stimuli is prolonged and extensive. Such efforts may undermine the therapeutic process by preventing respondent extinction and operant unpairing from taking place. Research suggests strongly that such safety behaviors interfere with treatment success (Eun-Jung, 2005; Morgan & Raffle, 1999).

1. Focus of the present investigation

Public speaking anxiety is a form of social anxiety disorder that has been the topic of numerous research investigations (Ayres, 1988a,b; Foley & Spates, 1995; Hu, Bostow, Lipman, Bell, & Klein, 1992; Hu & Romans-Kroll, 1995). Hu et al. and Hu and Romans-Kroll demonstrated that individuals who have negative thoughts just prior to giving a public speech experience a higher level of anxiety both during and after the real or imagined speech than those individuals who have positive thoughts just prior to a speech. The implication is that during a course of exposure-based treatment, a more rapid diminution of anxiety might occur if episodes of contact with the feared speech context are interspersed with brief periods of positive imagery or positive self-statements, rather than prolonged contact with the fear-arousing speech imagery.

A variation of dosed exposure, called enhanced dosed exposure, addresses these implications (Vianna, Cammarota, Coitinho, Medina, & Izquierdo, 2003). The enhanced version differs in that supplemental stimuli are added during the inter-trial interval. For example, clients are asked to imagine a positive scenario such as winning the lottery or playing with their favorite pet. Thus, the enhanced version may involve a counter-conditioning component, depending on the nature of the supplemental stimuli.

Hu et al. (1992) and Hu and Romans-Kroll (1995) investigated this hypothesis. In one study (1995), participants were assigned to one of two conditions. Participants were asked to imagine either the contents of a paragraph that contained positive attitudes toward giving a speech or neutral attitudes toward giving a speech prior to actually giving a speech. Participants' heart rate and subjective reports of anxiety were measured while giving a speech. Results indicated that a speech-relevant positive attitude prior to speech delivery resulted in reduced subjective reports of anxiety and cardiovascular reactivity when compared to a speech-relevant neutral attitude condition.

In another study (Hu et al., 1992) individuals were exposed to positive thinking just before imagining giving a speech, while participants' subjective reports of speech anxiety and heart rate were evaluated. Thirty participants were recruited who reported a fear of public speaking based on a fear survey from a prescreening session. Participants were randomly assigned to one of three conditions. The three conditions consisted of being presented with 30 s of speech-relevant positive, negative, or neutral thinking just prior to the presentation of the target imagery (for 15 s duration), which involved imagining giving a speech to an audience (i.e., a dosed exposure arrangement).

Experimental sessions consisted of presenting a sentence in the participants' own voice played through a tape recorder. Participants were instructed to spend 30 s thinking about the sentence. When the 30 s ended, participants were instructed to imagine the public speaking scene for 15 s. After the 15 s had elapsed, participants were asked to rate the target fear image in terms of how much fear they felt. This process continued for 10 iterations. Results indicated that instructions for speech-relevant positive thinking prior to imagining a public speaking scene were related to a statistically significant reduction in both subjective ratings of fear and heart rate. Instructions for speech-relevant negative thinking prior to imagining a public speaking scene were related to increases in subjective reports of fear and heart rate.

The present investigation was designed as an extension of the Hu et al. study (1992). Although having many similar features, it was not conceptualized as a treatment study, given that participants were not treated for the full range of behaviors that typically constitute speech anxiety. This study focused instead on the respondent behaviors only along with subjective ratings of distress, and on a narrower range of the stimuli that elicit such responses in order to better isolate and examine variables for use in future treatment packages. In doing so, it attempted to address the relative benefits of dosed exposure and enhanced dosed exposure on process variables that we believe impact treatment success (i.e., moment-to-moment aversive arousal and subjective distress). The goal was to evaluate whether these approaches may be superior to the conventional prolonged exposure. Since the design entailed repeated observation and measurement, the question of whether any of these approaches result in a more rapid reduction of measured distress was answerable. Finally, we believe that the findings identify some of the underlying behavioral processes that may account for the success of treatment packages that include these components (i.e., EMDR).

The current study improved upon Hu et al. (1992) by recruiting individuals who were screened for public speaking anxiety using a structured questionnaire. It substituted more reliable dependent measures of autonomic arousal than were used in Hu et al. (1992). Further, the target fear imagery was held constant, as well as the temporal parameters of exposure. Instructions for the "positive" and "negative" imagery that were interspersed between episodes of imagining the target image were altered to achieve hypothesized stronger effects. Further, the putative "positive" and "negative" effects were specifically assessed as measured pre-experimentally by autonomic arousal in the presence of the referenced instructional and imagined stimuli. While the current study retained positive and negative experimental conditions, they differed from those used in Hu et al. (1992). Hu et al. utilized speech-relevant positive or negative inserts between target scene imagining. The current investigation used generalized positive and negative scenes (not speech-relevant) and also added two additional comparison groups: prolonged exposure and dosed only (indicating that the inter-trial interval is left free of any imagery). The present investigation was designed to test the impact of dosed versus prolonged exposure on subjective and physiological measures as well as to examine two varieties of dosed exposure (positive and negative).

2. Method

2.1. Participants

College students ($n = 39$) were recruited from classes and public postings. Participants were primarily white ($n = 28$), female ($n = 22$), who suffered from speech anxiety. The mean age of the participants was 21.92. They were screened using the Personal Report of Communication Apprehension (PRCA-24) (McCroskey, 1982). Participants were eliminated from the study if they scored below 18 on the public-speaking component of the PRCA-24. In addition, participants who were taking medications (excluding birth control), had heart problems, or any other diagnosed physical or psychiatric conditions were screened from the study in order to ensure that such conditions would not interfere with the dependent measures.

2.2. Setting

The experiment was conducted in a university laboratory in the psychology department with only the participant present and two experimenters. Two experimenters were present for 100% of sessions for the purpose of inter-observer agreement and independent variable integrity. The room contained only essential equipment (physiological monitoring equipment, printer, multi-level rack, two tables, two computers, and three chairs). In all experimental conditions the delivery of the auditory instructions and auditory stimuli were presented via computer. This helped to ensure that the independent variables were presented in a consistent manner. Experimenters only needed to start the appropriate computer program for each condition. The female voice used was kept constant across all conditions. The computer also presented a tone that prompted the participant to give a Subjective Units of Discomfort (SUDs) rating.

2.3. Apparatus/dependent measures

Facial electromyography (f-EMG) is a valence-specific measure of affect that assesses the electrical activity of the spontaneous or reflexive movements of specific facial muscles (Rotteveel, de Groot, Geutskens, & Phaf, 2001). It has been reported that this measure is able to detect minimal differences in specific muscle activity even in absence of an overtly visible expression. Facial EMG measures of the musculus zygomaticus for smiling and the musculus corrugator supercilii for frowning have been useful in the measurement of valenced states (Rotteveel et al., 2001). For this experiment, GS27 pre-gelled disposable sEMG electrodes and the Procomp 2 with BioGraph Infiniti software from Bio-Medical Instruments were used.

Facial EMG for negative emotions was recorded via small electrode pads placed near participants' inner left eyebrow. Facial EMG for positive emotions was recorded via small electrodes placed between participants' lower right cheek and mouth area.

Facial EMG was used in this investigation to permit a more discriminating measure of "positive" and "negative" emotion both pre-experimentally as an operational criterion of whether the nontarget imagery achieved its intended effects, and as a dependent measure of arousal. This measure replaced the heart rate physiological measure used in several previously referenced studies.

Subjective Units of Discomfort (SUDs) is a widely used measure of current arousal. It was used at the end of each period of target image confrontation. This consisted of 10 opportunities to provide ratings through the course of the experiment. SUDs scores ranged from 1 (*least amount of anxiety*) to 10 (*most amount of anxiety*).

2.4. Independent variables

Participants were randomly assigned to one of four experimental conditions: positively enhanced dosed exposure (PDE), negatively-supplemented dosed exposure (NDE), prolonged exposure (PE), and dosed exposure (DE). Total exposure time to the target imagery was 2.5 min across all conditions. Ten participants were assigned to all conditions except for the DE condition in which there were 9 participants. The specific conditions are outlined below.

The target public speaking scene participants were asked to imagine for 15 s was the same as that used in Hu et al. (1992) and is described as follows:

> "Imagine that you are about to present an important speech to a large audience in an auditorium. As you stand at the podium on the stage just before you begin speaking, you look out and see all of the faces in the audience looking at you, waiting for you to begin. As you stand there, you feel your legs are wobbly and your mouth and throat are dry."

This target public speaking scene was kept constant across all conditions and was presented in a human female voice via a computer recording. The same voice was also used in all conditions. After 15 s elapsed, participants were asked to rate their level of anxiety on the SUDs. This process continued for a total of 10 iterations. Between episodes of imaging the target scene, participants were exposed to one of the following conditions while continuous physiological measures were taken (f-EMG as described).

2.5. Negative condition (NDE)

Participants assigned to this condition were exposed to a selection process that involved identifying the sentence producing the most valence-specific arousal from among 10 sentences containing negative connotations (i.e., "Imagine that you just came home to find your window open and your pet missing," "Imagine that you received a failing grade in a class that you really enjoy.", etc.). For each sentence the participant was asked to imagine the situation described. Based on the f-EMG data, the sentence most aversive (as determined by corrugator activity) for each participant was selected for use in subsequent exposures. Participants then began the active intervention component of the condition. They were exposed to the selected negative sentence with 30 s of imagined exposure, which was then followed by the target public speaking scenario with 15 s of imagined exposure. Following this, a SUDs rating was collected again. This negative sentence/target public speaking/SUDs rating cycle continued for an additional 10 iterations.

2.6. Positive condition (PDE)

Participants assigned to this condition were exposed to a selection process that involved identifying the sentence producing the most valence-specific arousal from among 10 sentences containing positive connotations (i.e., "Imagine that you just won $1000 in lottery tickets and you are now at your favorite store spending the money," "Imagine that someone you are attracted to comments on how beautiful/handsome you are.", etc.). For each sentence the participant was asked to imagine the situation described. Based on the f-EMG data, the sentence most pleasant (as determined by elevated zygomaticus activity) for each participant was selected for use in subsequent exposures. Participants then began the active intervention component of the condition. They were exposed to the selected positive sentence with 30 s of imagined exposure, which was then followed by the target public speaking scenario with 15 s of imagined exposure. Following this, a SUDs rating was collected again. This positive sentence/target public speaking/SUDs rating cycle continued for an additional 10 iterations.

2.7. Dosed-only condition (DE)

In this condition, participants were asked to imagine the target public speaking scene for 15 s. After the 15 s has elapsed, participants were asked to rate their level of anxiety on the SUDs rating scale. After the 30 s has elapsed (without instructions to imagine any scenes), participants were then asked to imagine the target scene again for 15 s. This cycle continued for a total of 10 iterations.

2.8. Prolonged exposure (PE) condition

In this condition, participants were exposed to the target public speaking scene for 15 s followed by a SUDs rating. This cycle of target public speaking scene/SUDs rating continued for 10 iterations, all occurring consecutively within a 2.5-min period. This period of time is also the total amount of time that participants in the three other conditions were asked to imagine the target speech scene. Participants were then asked to rate their level of anxiety on the SUDs rating scale.

2.9. Inter-observer agreement

Two experimenters were present for all sessions. One experimenter was seated unobtrusively in the corner of the room whose assigned role was to monitor participants' faces for unusual movements such as coughing, sneezing, yawning, and scratching. Any such movements were recorded for the purpose of editing out unintended changes in the f-EMG readings. The other experimenter was seated in front of a computer that displayed the f-EMG data and whose assigned role was to monitor the equipment in case of equipment malfunction.

IOA was collected for 100% of sessions. IOA was calculated using point-by-point agreement ([agreements/agreements + disagreements] $\times$ 100). Two separate observers reviewed the f-EMG data and recorded the specific segments that should be calculated and reported as well as edited out due to unusual responses due to coughing, sneezing, etc. IOA was 92% and 93%, respectively. All disagreements were reviewed until an agreement was met.

2.10. Independent variable integrity

IVI was collected for 100% of sessions. Experimenters unobtrusively observed the experimental equipment to ensure that the computer was playing the auditory stimuli in the prescribed fashion. Any observations of equipment failure would have been immediately recorded and corrected. However, no such instances occurred.

Table 1
Summary table of dependent measures averages.

	Trial										
	Group[a]	1	2	3	4	5	6	7	8	9	10
SUDs rating	PDE	5.0	5.1	4.2	4.6	3.9	3.7	3.4	3.5	3.2	3.0
	NDE	6.9	6.8	6.3	6.0	6.7	6.4	6.2	5.6	4.9	5.0
	PE	6.4	6.3	6.1	5.6	5.5	5.4	5.2	5.3	5.0	5.1
	DE	5.3	5.1	4.7	3.9	4.3	3.8	3.3	3.6	3.4	3.1
Corrugator activity	PDE	6.58	7.19	6.96	7.52	7.74	6.44	6.84	6.71	6.42	7.18
	NDE	7.22	9.17	7.18	7.06	7.30	6.80	7.48	9.20	7.77	7.77
	PE	7.22	7.93	7.73	8.10	9.35	8.68	8.64	8.76	8.84	8.70
	DE	7.31	7.11	7.96	7.73	7.64	7.66	7.29	7.93	6.75	7.33

[a] PDE = positively enhanced dosed exposure.
NDE = negatively-supplemented dosed exposure.
PE = prolonged exposure.
DE = dosed-only exposure.

3. Results

Analyses of covariance through linear regression (which takes into account both time and group membership) were conducted on principal dependent measures to assess for group differences in both slope and level, using the trial number as the covariate. Tukey post hoc analyses were conducted to determine the source of variation. Table 1 displays averages of the dependent measures for all trials across groups and conditions. Fig. 1 displays the mean SUDs ratings during phobic scene trials. Table 2 describes the effect size comparisons for all permutations of experimental conditions.

An analysis of covariance through linear regression on SUDs ratings indicated a significant main effect for the treatment groups ($p < .001$). Tukey post hoc comparisons evaluated the source of variance (adjusted p value of .05). The PDE condition produced significantly lower SUDs ratings than both the NDE conditions and the PE conditions. The NDE condition produced significantly higher SUDs ratings than both the PE and DE conditions. The PE condition produced significantly higher SUDs ratings than the DE condition. There were no other significant differences between groups on this measure.

An analysis of covariance through linear regression on corrugator activity indicated a significant main effect for the treatment groups ($p < .001$). Fig. 2 displays the mean corrugator activity during phobic scene trials. As with SUDs ratings, Tukey post hoc comparisons were run to evaluate the source of variance (adjusted p value of .05). The PDE condition produced significantly lower corrugator activity than the NDE and PE conditions. The PE condition resulted in significantly higher corrugator activity than the DE condition. There were no other significant differences between groups on this measure.

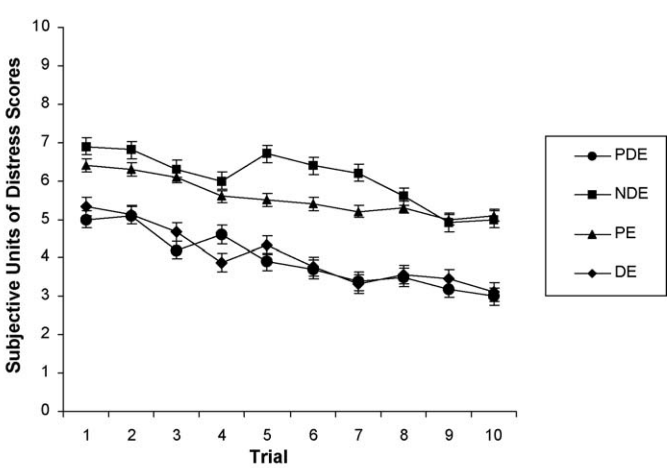

Fig. 1. Mean SUDs ratings during phobic scene trials.

Table 2
Summary of effect sizes.

Comparison	SUDs	Corrugator	Results
NDE vs. DE	0.94	0.11	DE > NDE, $p < .05$[a], *ns*[b]
NDE vs. PDE	0.86	0.39	PDE > NDE, $p < .05$
PE vs. DE	0.64	0.41	DE > PE, $p < .05$
PE vs. PDE	0.61	0.67	PDE > PE, $p < .05$
NDE vs. PE	0.19	−0.30	PE > NDE[a], $p < .05$[a] NDE > PE[b], *ns*[b]
DE vs. PDE	0.04	0.29	PDE > DE, $p < .05$[a], *ns*[b]

Note: NDE = negatively-supplemented dosed exposure, DE = dosed exposure, PDE = positively enhanced dosed exposure, PE = prolonged exposure. *Results*: (>) equals first condition has lower mean score than second condition and (<) indicates the opposite. *ns* = nonsignificant.
[a] SUDs scores only.
[b] Corrugator scores only.

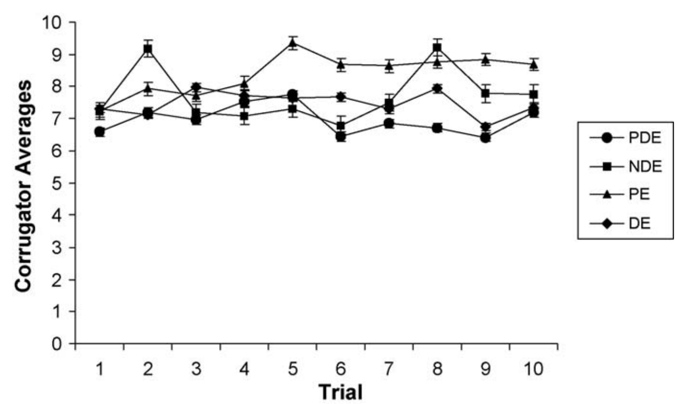

Fig. 2. Mean corrugator activity during phobic scene trials.

While zygomaticus activity was measured in this study, the data were considerably less consistent and interpretable than the corrugator activity, and thus is not reported here. Previous methodological reports on f-EMG have indicated that this site is also a less reliable measure of valenced arousal than the corrugator (Larsen, Norris, & Cacioppo, 2003). For this reason, only the data for the corrugator measures are reported here.

4. Discussion

SUDs ratings indicate that PDE and DE conditions were the most effective in reducing reports of distress. As Fig. 1 demonstrates, all conditions show reductions in reported distress over time; however, the DE and PDE conditions were consistently lower at every trial including the final trial. This interpretation is confirmed by the ANCOVA through linear regression and Tukey post hoc analyses.

On the corrugator measure, both PDE and DE conditions were less aversive than the PE condition. The corrugator measure, based on previous work, is quite sensitive to negative valenced arousal in regards to fear (Hu & Wan, 2003). The findings on the corrugator activity correspond to the findings on the SUDs measure across conditions.

Overall, both PDE and DE conditions appear to be promising developments for the treatment of fear inasmuch as both produced greater and more rapid reductions in aversive arousal—the core feature of fear. This study also contributes to the literature in that there have been few controlled studies on imaginal exposure (Choy et al., 2007). The current study suggests a treatment innovation that could potentially be much more acceptable to clients and may avoid the typical attrition rates associated with prolonged exposure.

However, this study also contained limitations that should be corrected in future studies. Namely, participants in both the PDE and NDE conditions were exposed to all ten emotion-valenced sentences prior the initial SUDs rating, whereas participants in the prolonged and dosed-only conditions (PE and DE) received no such advanced exposure. This was due to the study design that gave greater weight to preliminary functional assessments and accurately selecting emotionally valenced sentences to be used during the inter-trial interval for these groups. Nonetheless, an ANOVA on the means for the initial trial revealed no significant differences between groups on SUDs ratings and corrugator activity ($p = .194$ and .901, respectively), thus ruling out any undue influence of this prior exposure to independent variable scenes. Another limitation of this study, that primarily impacts external validity, is the lack of follow-up data. Future studies should include follow-up measures to assess the generalization and durability of the results.

While use of the PRCA in this study was an improvement over Hu et al. (1992), inclusionary criteria could be even more specific to ensure that participants are indeed diagnosable as socially anxious. Additional measures such as the Anxiety Disorders Interview Schedule (ADIS) (Brown, Di Nardo, & Barlow, 1994) could be included to increase the odds of selecting phobic individuals.

Another important difference between the current study and the studies conducted by Hu et al. concerns the nature of the supplemental stimuli. The basic paradigm in the studies conducted by Hu et al. involved participants imagining a positive/negative statement concerning speech giving prior to imagining or actually giving a speech. The paradigm used in the current study involved participants imagining a general positive/negative statement prior to imagining giving a speech. Whether or not this change in procedures made the intervention more or less effective is unknown.

Given that stimuli related to giving a speech are likely to be aversive to speech anxious individuals, it is possible that even positive thoughts about speech giving may be slightly aversive. Therefore, it is possible that general positive statements would be less aversive than positive statements concerning speech giving, potentially resulting in Hu's procedures being less effective than the procedures used in the current study. On the other hand, since positive statements about giving a speech are more relevant to the target imagery, it is also possible that positive statements such as Hu's would be more effective than general positive statements. Ultimately, it is unknown how these categories of positive statements would compare in terms of effectiveness. Future studies should examine direct comparisons of these positive statement categories.

Although there appears to be little outcome differences between PDE and DE conditions, we are lacking data on the acceptability of such procedures. Therefore, it is important for future studies to measure acceptability by participants of the respective procedures, and still further, to evaluate participant preference for the procedure(s). Of course, such evaluations should retain measures that evidence changes in subjective reports and physiological states. As others have noted, exposure-based treatments are an effective therapeutic tool, however, acceptance and retention are important considerations (Choy et al., 2007; Zayfert & Black, 2000).

Finally, because this is the first study that utilized the complete experimental procedures described and it differs from Hu et al. (1992) in potentially important ways, it is conceivable that the observed findings might be attributable to unknown and therefore unspecified method effects. All effort was made however to implement safeguards against such unintended systematic effects. Ultimately, replication of this study in ours and other laboratories should clarify this likelihood.

Positively enhanced dosed exposure and dosed exposure represent exposure-based therapies that, on the basis of this investigation, produce less aversive arousal and may be more acceptable to clients than traditional exposure-based treatments. Furthermore, the lessened aversive arousal may reduce the likelihood that clients will engage in safety behaviors (i.e., when clients feel less threatened, there is a reduced motivation to escape). Finally, if treatment gains of traditional exposure therapies can be achieved without the traditional drop out rates, this would represent a significant advancement in the treatment of fears and phobias.

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