Published in final edited form as:

J Trauma Stress. 2017 April ; 30(2): 166–172. doi:10.1002/jts.22175.

Integrated Treatment of PTSD and Substance Use Disorders: Examination of Imaginal Exposure Length

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Abstract

Efforts to improve the efficiency of prolonged exposure (PE) therapy for posttraumatic stress disorder (PTSD) have demonstrated that reducing the length of imaginal exposures does not negatively affect treatment outcome. A recent adaptation of PE, called Concurrent Treatment of PTSD and Substance Use Disorders Using Prolonged Exposure [COPE], integrates substance use disorder treatment with PE in the same timeframe (twelve 90-minute sessions, 8 of which include imaginal exposure). The current study, which represents a subanalysis of a larger randomized controlled trial, examined how the length of imaginal exposures (nonrandomized and measured continually) related to PTSD, substance use, and depression in a sample of military veterans ($N=31$) who completed the COPE treatment. Participants completed an average of 11.5 of the 12 therapy sessions and 7.2 of the 8 imaginal exposures during treatment. Results of 3 linear mixed models indicate that PTSD, substance use, and depressive symptoms all improved over the course of treatment ($ps < .001$; η^2 ranged between .17 and .40), and that the length of imaginal exposures did not significantly interact with any outcome. Although preliminary, the findings suggest that it may be feasible to shorten imaginal exposures without mitigating treatment gains. Implications for treatment are discussed.

Posttraumatic stress disorder (PTSD) is a debilitating condition resulting in social, occupational, and psychological impairment (Rodriguez, Holowka, & Marx, 2012). It is the most common mental health diagnosis among veterans in the United States, affecting 13% of all U.S. veterans and 52% of veterans seeking mental health services (Seal, Bertenthal, Miner, Sen, & Marmar, 2007). Individuals with chronic PTSD are unlikely to improve without professional treatment (Santiago et al., 2013), underscoring the need to continue to develop and refine effective treatments for PTSD.

Prolonged exposure (PE; Foa, Hembree, & Rothbaum, 2007) is a gold-standard treatment for PTSD. Prolonged exposure results in improvement regardless of the nature of the traumatic event, war era, demographics, treatment delivery method (e.g., in-person vs. telehealth), and psychiatric comorbidity (Eftekari et al., 2013; Tuerk, Yoder, Ruggiero, Gros, & Acerno, 2010; van Minnen, Arntz, & Keijsers, 2002; Yoder et al., 2012). Meta-analyses suggest PE and other trauma-focused, exposure-based treatments are generally more effective than non-exposure-based PTSD treatments, suggesting that exposure may be a vital component to substantial improvement in PTSD (Powers, Halpern, Ferenschak, Gillihan, & Foa, 2010).

Although PE is an effective treatment for PTSD (Eftekari et al., 2013; Powers et al., 2010), there are several challenges that warrant attention. Specifically, the dropout rate is high (approximately 30%), the protocol is time consuming relative to other brief psychotherapies, and a substantial portion of patients do not improve despite completing treatment (van Minnen et al., 2002). Therefore, efforts have been made to modify PE to make it more efficient, effective, and/or reach a larger population. For example, several studies have attempted to augment PE with other evidence-based techniques (e.g., Foa, Rothbaum, & Furr, 2003). There appears to be no additional benefit of supplementing PE with cognitive restructuring (Foa & Rauch, 2004; Foa et al., 2005) or stress inoculation training (Foa et al., 1999), but adding imagery rescripting resulted in significantly decreased dropout rates and improved outcome among treatment completers (Arntz, Tiesema, & Kindt, 2007).

As efforts to add components to PE have generally resulted in minimal gains at best, other studies have attempted to make PE more efficient by shortening treatment length. This research is limited, but has generally focused on the effects of shortening the length of imaginal exposures. Although some literature suggests that more exposure therapy results in improved treatment (Abramowitz, 1996; Powers & Emmelkamp, 2008), this does not seem to be the case with PE. Van Minnen and Foa (2006) found that 30-minute imaginal exposures resulted in equivalent improvement in PTSD symptoms, depression, state anxiety, and functional impairment as 60-min imaginal exposures. More recently, Nacasch et al. (2015) found similar outcomes between participants receiving 20- versus 40-min imaginal exposures. These studies suggest that the traditional 90-min PE session, of which 45 min is devoted to conducting the imaginal exposure, could be reduced without sacrificing treatment effectiveness. Shorter treatments may be more cost effective for patients and providers, more feasibly delivered in a wider range of settings, and more easily disseminated than longer treatments (Cougle, 2012). Although promising, there is a need for more research to examine how to shorten treatments such as PE.

An additional issue that has been raised by researchers and clinicians using PE is the high rate of comorbid substance use disorders (SUDs) in the PTSD population. Some estimates indicate that nearly 50% of individuals with PTSD have a co-occurring SUD (Pietrzak, Goldstein, Southwick, & Grant, 2011). Comorbid patients with PTSD/SUDs are more likely to drop out of treatment, and are more likely to have psychological, medical, occupational, and social impairment than those with only PTSD (Rodriguez et al., 2012). Furthermore, clinicians express concerns about how to concurrently treat both (Adams et al., 2016; Back, Waldrop, & Brady, 2009).

To address this, an integrated treatment called COPE was developed by Back et al. (2014). COPE integrates PE with evidence-based treatment for SUDs. In addition to in vivo and imaginal exposure, COPE includes psychoeducation about the interrelationship between PTSD symptoms and substance use, the identification of triggers (including trauma-related triggers) for cravings and substance use, and relapse prevention training. Like PE, COPE is delivered in 12 sessions of 90 min each. COPE is based largely on the self-medication hypothesis (Khantzian, 1985), which posits that substance use problems emerge as a result of attempts to mitigate distressing psychological symptoms, and improvement in symptoms will lead to improvement in substance use. In support of this, Hien et al. (2010) found that change in substance use was driven largely by changes in PTSD symptoms, but change in PTSD symptoms was typically not driven by changes in substance use (e.g., Back, Brady, Sonne, & Verduin, 2006). This suggests that components of PE (i.e., in vivo and imaginal exposure) may indirectly result in a significant improvement in substance use. Because COPE retains the same session and treatment lengths as traditional PE while adding in SUDs treatment, it is necessary to determine the optimal use of time during sessions. No studies have done this with the COPE protocol.

Therefore, the current study was designed to replicate and expand upon previous research (Nacasch et al., 2015; van Minnen & Foa, 2006) by examining the relationships among the length of imaginal exposures and treatment outcomes with individuals with comorbid PTSD and SUDs. Consistent with previous research, it was expected that there would be no significant relationship between the length of imaginal exposures on PTSD or depressive symptoms. We also expected that the length of imaginal exposures would not be related to substance use outcomes. The data in the current study are part of a larger randomized controlled trial of COPE. These analyses were examined post hoc; therefore, authors were unable to randomize or control the length of imaginal exposures.

Method

Participants

All procedures were approved by the Institutional Review Board for Human Research at the Medical University of South Carolina in Charleston and by the Ralph H. Johnson Veteran's Affairs Medical Center Research and Development Committee (Charleston, SC).

Participants were recruited from flyers distributed throughout the community, newspaper advertisements, and clinician referral. Participants were provided with an informed consent form and they discussed this form with study personnel. Both verbal and written consent were obtained from the participants before any study procedures occurred.

The current study is based on a subsample of a larger randomized controlled trial examining the efficacy of COPE compared to relapse prevention in military veterans with PTSD and comorbid SUDs ($N = 54$). To be included in the subanalyses for the current study, participants had to have completed at least 8 of the 12 COPE sessions (e.g., Brady, Dansky, Back, Foa, & Carroll, 2001). There were 33 participants who completed COPE, but 2 participants did not have audio/video recordings of their sessions; therefore, we could not measure the length of imaginal exposures. Hence, the current study included 31 participants.

The mean age of the sample was 41.16 ($SD = 10.46$) years, and participants were predominately male (93.5%) and Caucasian (70.9%), followed by 25.8% African American and 3.2% Hispanic/Latino. Participants averaged 14.03 ($SD = 2.20$) years of education. They were mostly employed fulltime (29.0%), unemployed (29.0%), disabled (19.4%), or employed part time (16.1%).

Participants averaged 10 ($SD = 8.15$) years of military service and most (87.1%) reported an index trauma that occurred during military service. These included combat (29.0%), sudden death of someone close (16.1%), “other very stressful events” (12.9%), fire/explosion (9.7%), and physical assault (9.7%). There were four participants who had nonmilitary traumas: physical assault, assault with a weapon, serious accident, and fire/explosion.

The majority reported previous mental health treatment (74.2%) and/or SUDs treatment (77.4%). Over half (64.5%) of our participants were taking psychopharmacological medications at recruitment. They were advised to continue managing those medications with their prescribing providers.

Inclusion criteria for the larger study included (a) current PTSD, (b) current SUD, (c) a score of 50 or greater on the Clinician-Administered PTSD Scale (CAPS; Blake et al., 1995), and (d) a score of 20 or greater on the Mini Mental Status exam (Folstein, Folstein, & McHugh, 1975). Posttraumatic stress disorder diagnoses were confirmed using the CAPS; SUDs diagnoses were confirmed using the Mini-International Neuropsychiatric Interview (Sheehan et al., 1998). Of those coded as “completers,” most (83.8%) attended at least 11 of 12 sessions and 77.4% completed at least 7 imaginal exposures. Participants were excluded from the study if they were actively psychotic or suicidal during the time of study recruitment.

All participants presented with at least one comorbid disorder in addition to PTSD and SUD; nearly all (96.7%) presented with a second comorbid disorder. The most common secondary disorders were alcohol use disorder (58.1%), major depressive disorder (19.4%), and opiate use disorder (6.5%). The most common tertiary disorders included an additional substance use disorder (including opioids, stimulant, or alcohol; 48.4%), major depressive disorder (22.6%), and panic disorder (19.4%). Collapsed together, all participants met the criteria for alcohol use disorder (100.0%), over half (51.6%) met criteria for an anxiety disorder, and many had major depressive disorder (45.2%), cocaine use disorder (25.8%), or opioid use disorder (22.5%).

Measures

Participants completed the following measures: the Mini Mental Status Examination (Folstein et al., 1975), a 30-item, researcher-administered battery that assesses a range of cognitive abilities, including orientation to time/place, short-term memory, attention/executive functioning, and fine motor abilities; the CAPS (Blake et al., 1995), a semistructured interview for PTSD that was used to confirm PTSD diagnosis and evaluate symptom severity; and the Mini-International Neuropsychiatric Interview (Sheehan et al., 1998), a semistructured interview that assesses for a variety of psychological disorders.

The length of imaginal exposure sessions was coded by two trained coders following a standardized protocol. The length of time from beginning to end of the imaginal narrative was tracked. Any time spent not engaging in imaginal exposure during that interval was subtracted from the total time. Accuracy was confirmed by checking 25% of the values.

Participants completed the following self-report outcome measures at baseline and weekly during treatment.

Posttraumatic stress disorder symptoms were assessed using a modified version of the PTSD Checklist–military (PCL-M; Weathers, Huska, & Keane, 1991). It contains 17 items rated on a 1 (*not at all*) to 5 (*extremely*) scale. Wilkins, Lang, and Norman (2011) reported good psychometric properties of the PCL-M, including high internal consistency ($\alpha = .96$) and test-retest reliability ($r = .96$). Internal consistency across all sessions in this study ranged from .89 to .96 (average $\alpha = .93$) and test-retest reliability ranged from .71 to .97 between sessions, the length of which averaged 8.84 days. In the present study, participants were instructed to rate symptoms “since the last visit,” whereas the original measure uses a 2-week timeframe. To reflect this modification, it will be referred to herein as mPCL.

The Timeline Follow Back (TLFB; Sobell & Sobell, 1992) is a self-report measure of substance use that uses a calendar as a memory prompt. For the current study, we examined the percentage of days during which any substance was used (i.e., alcohol or illicit drugs). Test-retest reliability for the TLFB in this study ranged from .72 to .96.

Depressive symptoms were assessed using the Beck Depression Inventory, II (BDI-II; Beck, Steer, & Brown, 1996). The BDI-II is a 21-item measure in which items are rated on a 0 to 3 scale, with higher scores representing more severe depressive symptoms. It has high test-retest reliability ($r = .93$) after a 1-week interval, and correlates strongly with other measures of depression (r s ranging from .47 to .71; Beck et al., 1996). In the current study, the internal consistency for the BDI-II ranged from .92 to .97 and test-retest reliability ranged from .72 to .97, the length of which averaged 8.84 days.

Intervention

All participants received the COPE treatment protocol, as described by Back and colleagues (2014). The first three sessions began with psychoeducation about PTSD, substance use, and the direct interplay between the two; the rationale for integrated treatment; a description/rationale of treatment components; teaching the patient breathing retraining; and the development of a hierarchy for in vivo exposure sessions. Triggers for substance use were reviewed as well as techniques to manage cravings. In vivo exposures began at Session 3. Imaginal exposures began at Session 4 and were completed each session through Session 11 (8 sessions total). During Sessions 4 through 11, SUDs related components were also included (e.g., refusal skills, managing high-risk thoughts). The final session (Session 12) included a review of the initial treatment goals and progress made toward those goals, as well as a discussion of future plans. Therapists were encouraged to address PTSD, including the imaginal exposure, at the start of the session, and to address SUDs-related components in the latter half. The treatment was delivered by five doctoral-level psychologists who received 2- to 3-day training and 1 hour of weekly supervision.

Treatment fidelity was ensured by recording and rating adherence competencies based on those used in similar studies (e.g., Brady et al., 2001). Participants completed an average of 11.5 of the 12 treatment sessions ($SD = 1.2$) and 7.2 of the 8 imaginal exposures ($SD = 1.0$). They completed 89.9% of the homework assignments.

Data Analysis

There were no missing data in the current analyses. Changes in PTSD symptoms, depression, and substance use were examined with three linear mixed models based on recommendations by Shek and Ma (2011) using SPSS 23.0 software for Windows. Linear mixed models are robust to common issues in longitudinal research, such as missing data and unequal intervals between time points (Shek & Ma, 2011). Restricted maximum likelihood estimation was used.

Intercepts and linear slopes were initially examined in an unconditional model to ensure that mean symptom scores differed significantly from 0 (intercept $p < .050$) and changed over the course of treatment (slope $p < .050$). Next, a quadratic slope effect was added to each model and changes in model fit were examined through nested chi-square difference tests based on -2 restricted log-likelihood values. If the quadratic effect significantly added to the unconditional linear model, it was retained. Next, the length of imaginal exposures was added to the model. This main effect and its interactions with the linear and/or quadratic slopes were examined. Any interactions were probed using the prototypical values approach described by Singer and Willett (2003). In this approach, values are calculated for 1 SD above and below the mean of significant predictors in the interaction term and plotted to examine differing trajectories between groups.

Although the overall COPE treatment included 12 sessions, only data from Sessions 4 through 11 were examined because those were the sessions during which imaginal exposures occurred. That said, repeated measures analyses with all 13 time points (baseline + 12 sessions) indicated that the mPCL ($p < .001$; $\eta^2 = .40$), the TLFB ($p < .001$, $\eta^2 = .17$), and the BDI ($p < .001$, $\eta^2 = .35$) scores all significantly decreased throughout treatment.

The first session (Session 4) was coded as 0 for all participants, with each subsequent session dummy coded based on the average number of days between sessions (8.84). Imaginal exposure length was mean centered before being entered into each model. The unstructured covariance matrix was used for each model because it is parsimonious, relies on no assumptions about the structure of the error, and frequently results in the best fit (Singer, 1998).

Results

A series of t tests suggested that treatment completers did not have significantly different values from noncompleters ($n = 21$) on age, years of education, years of military service, or Mini-Mental State Examination (MMSE) score (all p s nonsignificant [ns]). Furthermore, they had similar distributions of sex, race, or trauma type (all p s ns), as evaluated with chi-square tests. Importantly, t tests also suggested that completers and noncompleters had equivalent baseline mean mPCL, CAPS, TLFB, and BDI scores, as well as equivalent

Session 4 mean mPCL, TLFB, and BDI scores (no CAPS was administered at Session 4; all *ps ns*). Imaginal exposure length and scores on outcome measures by session are presented in Table 1. The average length of imaginal exposures was 28.54 (*SD* = 5.84) min (range = 17.80 to 41.84 min).

Intercept and slope estimates for the mixed linear models can be found in Table 2. For each model, slopes were in the expected direction (negative). Intercepts and slopes were significant for unconditional and conditional models for each of the three outcome variables (all *ps* < .010). Unconditional growth models for mPCL, TLFB, and BDI can be found in Table 1. To reduce Type I error inflation, a Bonferroni correction was applied to the three models. Therefore, α was set at .017 (.05/3).

Table 2 provides β weights, standard errors, *t* values, and significance levels for each effect in each model. For the mPCL, the unconditional quadratic model resulted in significant improvement in model fit relative to the unconditional linear model ($\chi^2 = 9.68$, *df* = 1, *p* < .002); therefore, the conditional model included both linear and quadratic effects. This significant finding for a quadratic slope is likely driven by larger mean decreases around Sessions 6 and 7 flanked by more modest changes in earlier and later sessions (see Table 1). The conditional model resulted in another significant improvement in model fit ($\chi^2 = 167.94$, *df* = 3, *p* < .001). The linear (*p* < .001) effect was significant and the quadratic (*p* = .040) effect was not significant. The Length (*p* = .126), Length $\times$ Session interaction (*p* = .387), and Length $\times$ Session² interactions were not significant, suggesting that the length of imaginal exposures was unrelated to changes in PTSD symptoms over the course of treatment.

For TLFB (percentage of days using any substance since the last session), the unconditional quadratic model did not result in a significant change relative to the unconditional linear model, and therefore the conditional model only examined linear effects of time. The conditional model represented a significant improvement in model fit over the unconditional linear model ($\chi^2 = 196.19$, *df* = 2, *p* < .001). The linear effect was significant (*p* = .005), but the Length main effect and Length $\times$ Session interaction were not. Therefore, although substance use decreased from Sessions 4 to 11, the length of the imaginal exposures was unrelated to this change.

For BDI, the unconditional quadratic model was not significantly different than the linear model; therefore, the conditional model only included a linear time effect. This model was a significant improvement over the unconditional linear model ($\chi^2 = 111.66$, *df* = 2, *p* < .001). Neither the main effect of Length nor the Length $\times$ Session interactions was significant.

To ensure that this design had adequate power, a post hoc power analysis was conducted using GLIMMPSE software (Kreidler et al., 2013). The means and the variability of repeated measures and the predictor (imaginal length) were calculated and resulted in an observed power value of 1.000 with a Type 1 error rate of .017.

Discussion

The purpose of the current study was to examine the association between the length of imaginal exposures and treatment outcome for veterans receiving a novel, integrated treatment for comorbid PTSD and SUDs (Back et al., 2014). Between Sessions 4 and 11 (the sessions during which imaginal exposure sessions were conducted), participants experienced significant improvements in PTSD symptoms, depressive symptoms, and substance use. The length of imaginal exposures was not associated with symptom improvement for PTSD, substance use, or depressive symptoms.

The lack of association between imaginal exposure length and PTSD outcomes is consistent with two previous studies (Nacasch et al., 2015; van Minnen & Foa, 2006), although the current study expanded on these prior findings by examining the relationship between exposure length, substance use, and depression in the context of a new treatment, COPE (Back et al., 2014). The findings are particularly important because COPE adds treatment components for SUDs while maintaining the 90-min, 12-session length of traditional PE.

Prior research documents that imaginal exposure results in improvement, even as a standalone treatment (e.g., Arntz et al., 2007; Bryant, Moulds, Guthrie, Dang, & Nixon, 2003). However, these results suggest there is not necessarily a dose-response effect from imaginal exposure. If this is true, what are the underlying mechanisms of imaginal exposure that drive symptom change? Van Minnen and Foa (2006) ruled out within-session habituation as a potential mechanism of change. Participants who engaged in shorter imaginal exposures had significantly less habituation than those who engaged in longer imaginal exposures; however, the outcomes between the two groups were similar. Instead, the active ingredient of imaginal exposure may be more related to the replacement of threat-related beliefs with more benign ones while the patient's fear structure is activated (Foa & Kozak, 1986). Because the length of imaginal exposures did not predict change in this study, perhaps these reappraisals result from other treatment components. For example, in vivo exposures that place patients directly into feared situations may provide evidence that contradicts maladaptive beliefs.

Another component of PE that may drive changes in core beliefs is processing, during which the therapist and patient discuss the experience of and themes from the imaginal exposure. The therapist does not facilitate cognitive restructuring during processing, but instead lets the patient generate his or her own insights (Foa et al., 2007). However, little research has examined the specific benefits of processing.

Several limitations of the current study warrant consideration. It would have been ideal to have had the opportunity to randomly assign participants to either receive long or short imaginal exposures. By not randomizing, the length of imaginal exposure in our study could have varied for several reasons, including the length of the event being discussed, symptom severity, time constraints of the session, etc. Some of these factors are outside of researcher control in even the most rigidly controlled studies. Some of these factors would be interesting avenues for additional research. However, for the current study, data were examined post hoc after the completion of the first randomized controlled trial for COPE,

and therefore were not able to be controlled. Nonetheless, the range and mean lengths of imaginal exposures, as well as the clinical outcomes, are all consistent with other studies that did assign the length of exposures (Nacasch et al., 2015; van Minnen & Foa, 2006).

The study could have benefitted from (a) a larger sample, (b) more gender and racial diversity, and (c) additional methods of assessment in addition to self-report. However, the size, demographics, and most of the methodology are comparable to similar studies (e.g., $N = 15$ in Brady et al., 2001; $N = 39$ in Nacasch et al., 2015). Despite these limitations, the present study adds to the burgeoning literature suggesting that the use of shorter imaginal exposures may be equally as effective as longer imaginal exposures. These results could indicate a treatment modification that could reduce patient/therapist time and burden while maintaining effective outcomes. Moreover, this study is the first to demonstrate that shorter imaginal exposures resulted in significant reductions in both PTSD and substance use outcomes.

Acknowledgments

This project was supported through the National Institute on Drug Abuse (R01 DA030143 and K02 DA039229), and the National Institute on Alcohol Abuse and Alcoholism (T32 AA007474).

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Table 1

Mean (Standard Deviation) Length of Imaginal Exposures and Outcome Variables, Sessions 4–11

Session	Length (Min)		mPCL		TLFB (%)		BDI	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
4	32.03	-7.88	51.19	-2.24	23.69	-2.00	27.64	-5.18
5	32.92	-9.18	50.61	-2.60	21.93	-2.16	23.75	-5.75
6	31.20	-6.71	45.00	-2.62	20.79	-2.29	19.84	-4.70
7	28.30	-6.50	41.68	-3.02	18.24	-2.56	20.35	-4.65
8	30.25	-6.57	41.81	-2.75	18.17	-2.54	19.31	-5.28
9	29.51	-7.09	42.19	-3.05	17.41	-2.67	19.96	-4.87
10	26.27	-7.95	40.94	-3.28	16.93	-2.91	17.53	-4.97
11	26.27	-8.51	40.21	-3.24	14.00	-2.38	14.65	-4.18

Note. mPCL = PTSD Checklist-military version, modified for 1-week intervals; TLFB = Timeline Follow Back (% days used); BDI = Beck Depression Inventory-II.

Table 2

Conditional Growth Models

Variable & effect	<i>B</i>	<i>SE</i>	<i>t</i>
mPCL			
Intercept	50.84	2.57	19.78**
Session	-2.53	0.67	-3.75**
Session ²	.14	0.07	2.07
Length	.24	0.16	1.54
Length × Session	-.07	0.08	-.87
Length × Session ²	.00	0.01	.28
TLFB			
Intercept	25.44	5.42	4.69**
Session	-1.30	0.43	-3.03**
Length	.24	0.23	1.04
Length × Session	-.06	0.04	-1.61
BDI			
Intercept	22.91	1.93	11.90**
Session	-1.02	0.22	-4.68**
Length	.08	0.09	.89
Length × Session	-.03	0.02	-2.07

Note. *SE* = standard error; mPCL = PTSD Checklist-military version, modified for 1-week intervals; TLFB = Timeline Follow Back (% days used); BDI = Beck Depression Inventory-II.

**
p < .01.