

Mechanisms of Change in Cognitive Processing Therapy and Prolonged Exposure Therapy for PTSD: Preliminary Evidence for the Differential Effects of Hopelessness and Habituation

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Abstract The present study examined two potential mechanisms of change, hopelessness cognitions and habituation, in a randomized controlled trial of cognitive processing therapy (CPT) and prolonged exposure therapy (PE) for posttraumatic stress disorder (PTSD). Participants were 171 adult women with a current primary diagnosis of sexual assault related PTSD. The potential mechanisms were examined by evaluating the intraindividual change in hopelessness within the course of both treatments and subjective units distress (SUDS) ratings (a proxy for habituation) within the course of PE. The effects of intraindividual change in the proposed mechanisms were then examined on within-treatment changes in PTSD symptoms. Findings indicated that the participants assigned to the CPT treatment had significantly greater pre-post reductions in hopelessness than those assigned to PE and that the changes in hopelessness predicted changes in PTSD symptoms ($R^2 = .24$). Intraindividual changes in SUDS ratings for participants in the PE treatment condition also predicted changes in PTSD symptoms and did so independently of the effect of changes in hopelessness. Future research should examine these mechanisms using more intensive methods of data collection that would permit the demonstration of temporality of change.

Keywords PTSD · Trauma · Mechanism · Mediation · Hopelessness · Habituation

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Introduction

Cognitive processing therapy (CPT; Resick et al. 2002) and prolonged exposure therapy (PE; Foa et al. 2007) are two of the most widely studied psychological treatments for posttraumatic stress disorder (PTSD). Both CPT and PE have been demonstrated to produce clinically significant change in PTSD symptoms in multiple randomized controlled trials (e.g., Foa et al. 2005; Marks et al. 1998; Monson et al. 2006). CPT and PE have both been classified as having “strong research support” by the APA Division 12 list of Empirically Supported Treatments and both CPT and PE are currently being widely disseminated within the Veteran Affairs Healthcare system. Despite the extensive evidence in support of the effectiveness of CPT and PE, less is known about the mechanisms by which these treatments produce change.

Although CPT and PE have been shown to have equivalent outcomes, the two treatments are proposed to promote recovery from PTSD via different processes (Resick et al. 2002). Both CPT and PE have clearly stated theoretical explanations for how the treatments produce decreases in PTSD symptoms. The hypothesized mechanisms of change of PE are outlined in the emotional processing theory developed by Foa and Cahill (2001), Foa and Kozak (1986), Rauch and Foa (2006). According to this model, PE is proposed to facilitate recovery from PTSD via a habituation process that occurs through repeated imaginal and in vivo exposure exercises. The repeated exposures activate the fear structures associated with the trauma and provide corrective information that ultimately leads to the modification of the pathological fear structures that serve to maintain PTSD.

CPT is proposed to promote recovery from PTSD by directly modifying maladaptive cognitions that have

developed following the traumatic incident. These maladaptive cognitions can include erroneous interpretations of the event (e.g., self-blame) or distorted views of the self or world (e.g., “nobody can be trusted”). By repeatedly challenging the maladaptive cognitions through the use of cognitive restructuring techniques, individuals are able to develop more balanced and healthy appraisals of the traumatic event, themselves, and the world. The restoration of adaptive appraisals promotes recovery from PTSD.

Thus, CPT and PE propose different routes to the same outcome. Although many common factors are likely shared between the two treatments, the differences in the focus of the two treatments (i.e., maladaptive cognitions in CPT vs. exposures exercises in PE) would suggest that the outcomes may be achieved by different mechanisms. Although CPT also includes two written narratives of the traumatic event which some might conceptualize as exposure to the traumatic event, the primary focus on imaginal and in vivo exposure exercises in PE should result in habituation being more of a causal mechanism of change in PE than CPT. Similarly, although some cognitive changes occur during the course of PE (Paunovic and Ost 2001), the relative emphasis on targeting cognitive distortions in CPT should result in cognitive changes being more of a causal mechanism of change in CPT than PE.

One particular cognitive schema that may be important in promoting recovery in CPT is hopelessness. Previous research has demonstrated that lower levels of hope are associated with increased PTSD symptoms in Vietnam combat veterans (Irving et al. 1997; Kashdan et al. 2006), survivors of Hurricane Katrina (Glass et al. 2009), and female victims of interpersonal violence (Scher and Resick 2005). The instillation of hope is proposed to be a common mechanism of change of cognitive behavior therapies (Snyder et al. 2000), and the instillation of hope may specifically promote recovery from PTSD by increasing a personal sense of agency that increases individual’s use of approach, rather than avoidant, coping techniques (Chang 1998; Glass et al. 2009; Irving et al. 2004). In support of this hypothesis, a recent study demonstrated that CPT produced an increase in individual levels of hope and that mid-treatment levels of hope predicted post-treatment PTSD symptom severity (Gilman et al. 2011). Although this previous study did not directly compare the effects of CPT and PE on hope, the increased emphasis on cognitive factors in CPT should lead to greater changes in levels of hopelessness for individuals who complete CPT than those who complete PE. It should be noted that hope/hopelessness is not directly challenged as part of the CPT protocol, but an increase in hopeful cognitions could result from changes in cognitions that are the focus of the CPT protocol such as control, self-blame, issues with trust, self-esteem, intimacy etc. For example, many individuals with

PTSD have distorted views of their degree of control over and role during their traumatic experiences and develop a generalized sense of helplessness as a result. By helping clients to develop more accurate and balanced appraisals of the extent to which they can control outcomes, CPT may help to restore the foundation for clients to develop more hopeful expectations for achieving future goals.

Research to date has not examined whether CPT and PE do, in fact, promote recovery from PTSD via differential mechanisms. The identification of mechanisms of change is a crucial step in the progression of developing empirically supported treatments, but the study of mechanisms of change of empirically supported treatments remains relatively rare throughout treatment outcome research (Kazdin 2007). Given that previous research has indicated that CPT and PE result in equivalent outcomes on PTSD (Resick et al. 2002), a crucial question is whether these treatments achieve these similar outcomes via differential mechanisms. Without evidence of differential mechanisms, it is difficult to determine whether treatments that produce equivalent outcomes are truly distinct or are merely repackaging.

The present study explored four research questions using data from a previously published RCT examining the relative efficacy of CPT and PE (Resick et al. 2002). First, do current empirically supported treatments for PTSD (CPT and PE) produce changes in hopelessness? Second, does CPT produce larger decreases in hopelessness than PE given the emphasis on cognitive determinants of PTSD in CPT? Third, are hopelessness cognitions a specific mechanism of CPT relative to PE in changes in PTSD symptoms? Fourth, is habituation a specific mechanism of change in PE that is independent of hopelessness? We hypothesized that (1) both CPT and PE would produce decreases in levels of hopelessness, (2) CPT would produce larger decreases in hopelessness than PE, (3) hopelessness cognitions would function as a specific mechanism of change of CPT, and (4) habituation would function as a specific mechanism of change of PE that would be independent of the effects of changes in hopelessness.

Methods

Participants and Procedure

See Resick et al. (2002) for a detailed description of the original study. Data are presented for the 171 women (mean age = 32, SD = 9.9) who comprised the intent-to-treat sample. The racial background of the sample was 71% Caucasian, 25% African American, and 4% other. Although participants were recruited based on PTSD symptoms related to a rape, the majority of participants

(85.8%) had experienced at least one other major crime victimization in addition to the index rape. Participants were randomly assigned to CPT, PE, or a minimal attention (MA) condition. The PE and CPT treatments were completed within 6 weeks, the length of the MA condition. Following this 6 week period, MA participants were randomly assigned to receive either CPT or PE. For the present study, data from the participants who received the MA condition first were collapsed into the CPT or PE groups for all analyses.

Measures

Clinician Administered PTSD Scale (CAPS; Blake et al. 1995) The CAPS is a structured interview for PTSD that has been demonstrated to have excellent reliability and validity. Clinicians rate the frequency and intensity of each symptom of PTSD using a scale from 0 to 4. Pre- and post-treatment total severity scores were computed by summing the frequency and intensity scores for each of the seventeen PTSD symptoms. Internal consistencies for the pre- and post-treatment total severity scores were $\alpha = .91$ and $\alpha = .90$, respectively.

Beck Hopelessness Scale (BHS; Beck et al. 1974) The BHS is a 20-item self-report measure of hopelessness. Scores range from 0 to 20, with higher scores indicating more severe levels of hopelessness. Example items include: “Things just won’t work out the way I want them to”. Internal consistencies for the pre- and post-treatment total severity scores were $\alpha = .90$ and $\alpha = .91$, respectively.

Subjective Units of Distress (SUDS; Wolpe 1958) SUDS ratings were completed by participants in the PE treatment condition at 5–10 min intervals within each exposure session. The SUDS ratings provide a holistic evaluation of the emotional distress elicited by the memory of the traumatic experience. For the present study, the difference between the mean of the SUDS ratings in the first exposure session and the mean of the SUDS ratings in the last exposure session was used as a measure of habituation. SUDS ratings are not collected in the CPT protocol because high levels of emotion during recall, and the habituation of arousal via repeated exposures are not the focus of CPT.

Data Analytic Strategy

Missing Data Imputation

As would be expected, there was a moderate amount of missing data at the posttreatment assessment due to participant attrition. In order to minimize the impact of missing data due to treatment dropout or failure to

complete assessments, missing data was first imputed following modern missing data recommendations (Enders 2010). The PRELIS software was used to impute missing data using Markov Chain Monte Carlo procedures. All analyses were conducted using the resulting imputed data set.

Modeling Intraindividual Change

Within-treatment intraindividual changes in hopelessness, PTSD, and SUDS ratings were examined using difference scores. Although difference scores were once considered to be highly unreliable, and thus to have little validity, it has been demonstrated that difference scores can be highly reliable and valid measures of intraindividual change (King et al. 2006). Specifically, as the correlation between scores on two occasions decreases, the reliability of the difference score increases. For the present study, the reliability of the difference scores for the CAPS and BHS were .87 and .82, respectively.

Mediation

The extent to which cognitive change in hopelessness functions as a mechanism of change of CPT relative to PE was evaluated by examining the indirect effect of treatment condition (CPT vs. PE) on intraindividual changes in PTSD symptoms via intraindividual changes in hopelessness. This indirect effect was calculated using Preacher and Hayes (2008) SPSS macro, which provides bias-corrected and accelerated bootstrapped confidence intervals of indirect effects. Bootstrapped confidence intervals are currently considered a best practice method of testing mediation (Preacher and Hayes 2008). When using this method, statistical significance of the indirect effect is concluded when the confidence interval of the indirect effect does not include 0.

Results

Descriptive Statistics and Correlations

The means, SD, and between treatment condition effect sizes (Cohen’s d) for the pre, post, and difference scores in PTSD symptoms, hopelessness, and SUDS ratings are presented in Table 1. As can be seen in Table 1, and previously described elsewhere (Resick et al. 2002), CPT and PE both produced noticeable improvements in PTSD symptoms, and the effects of CPT and PE on PTSD symptoms were roughly equivalent. There were no pre-treatment differences in levels of hopelessness between the

Table 1 Descriptive statistics and between treatment effect sizes (Cohen's *d*)

Variable	PE (<i>n</i> = 88)		CPT (<i>n</i> = 83)		<i>d</i>	95% CI <i>d</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
<i>Hopelessness</i>						
Pre treatment	9.53	5.33	9.70	5.47	−.033	−.33:.28
Post treatment	5.32	4.34	3.49	3.05	.501	.20:.81
Pre-post change	4.22	4.82	6.20	4.78	.426	.12:.73
<i>PTSD (CAPS)</i>						
Pre treatment	74.48	19.53	73.76	19.35	.038	−.26:.34
Post treatment	25.34	18.67	23.10	14.27	.139	−.16:.44
Pre-post change	49.14	22.90	50.66	20.71	.072	−.23:.37
<i>SUDS</i>						
1st Exposure mean	65.15	12.56	–	–	–	–
1st Exposure max	86.27	10.77	–	–	–	–
Last exposure mean	45.66	16.08	–	–	–	–
Last exposure max	57.95	18.26	–	–	–	–
Pre-post mean change	19.49	16.85	–	–	–	–
Pre-post max change	28.15	20.22	–	–	–	–

CPT and PE treatment conditions. However, the mean level of hopelessness post-treatment was significantly lower for those who had received CPT relative to PE ($d = .50$, 95% CI .20:.81).

The correlations between hopelessness and PTSD symptoms at pre-treatment and post-treatment were ($r = .38$, $P < .001$) and ($r = .54$, $P < .001$), respectively. These correlations indicate that there was a moderate to strong association between levels of hopelessness and PTSD symptoms, which is consistent with past research that has demonstrated that hopelessness is associated with increased PTSD symptoms (Glass et al. 2009; Irving et al. 2004; Scher and Resick 2005). The association between pre-treatment PTSD symptoms and post-treatment PTSD symptoms was ($r = .28$, $P < .001$). The association between pre-treatment hopelessness and post-treatment hopelessness was ($r = .48$, $P < .001$). These correlations indicate significant intraindividual variability in levels of PTSD and hopelessness, which provides support for the use of difference scores in the present study.

Changes in Hopelessness During Treatment

After determining that hopelessness was associated with PTSD, we next examined whether (1) hopelessness changes during treatment for PTSD, and (2) whether within-treatment changes in hopelessness are greater for individuals treated with CPT than for individuals treated with PE. The within treatment changes in hopelessness were examined using confidence intervals of the standardized mean gain effect size (ES_{Sg}).

As hypothesized, results indicated that across both treatment conditions, there were significant within-treatment decreases in levels of hopelessness: $ES_{Sg} = 1.11$ (95% CI .94:1.27). Results also indicated that the within-treatment change in hopelessness was much larger for individuals in the CPT condition ($ES_{Sg} = 1.40$, 95% CI 1.13:1.68) than for individuals in the PE condition ($ES_{Sg} = .87$, 95% CI .66:1.08). The difference between these effect sizes can be considered statistically significant because the effect size for the PE condition is outside of the confidence interval for the CPT effect size. These results indicate that the magnitude of the within treatment change in levels of hopelessness was greater for individuals treated with CPT.

Are Hopelessness Cognitions a Mediator of the Effect of CPT on PTSD Symptoms?

After determining that CPT produced greater changes in hopelessness than PE, we next examined whether improvement in hopelessness cognitions were a mediator of the effect of CPT on PTSD. This was done by evaluating the effect of treatment condition (CPT = 1, PE = 0) on intraindividual changes in hopelessness (*a*) and the effect of intraindividual changes in hopelessness on intraindividual changes in PTSD (*b*). The bias-corrected and accelerated bootstrapped confidence intervals of the product of the *a* and *b* parameters was calculated using the Preacher and Hayes (2008) SPSS macro.

The results of this analysis can be seen in Fig. 1. The effect of treatment on change in hopelessness (*a*) was

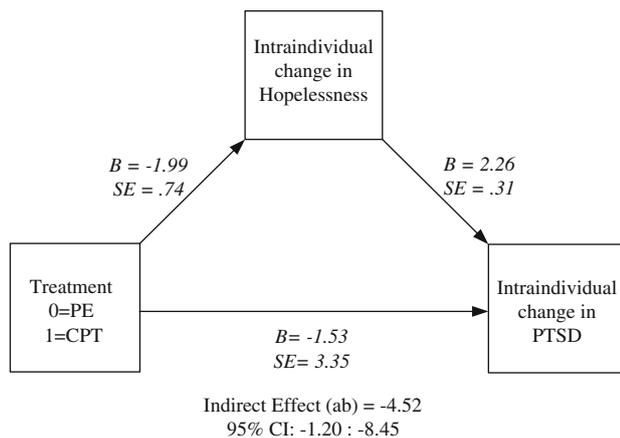


Fig. 1 Results of the mediation model examining whether intraindividual changes in hopelessness are a specific mechanism of change of cognitive processing therapy

statistically significant ($B = -1.99$, $SE = .74$, $P < .01$). The effect of change in hopelessness on change in PTSD (b) was also statistically significant ($B = 2.26$, $SE = .305$, $P < .001$). The indirect effect of CPT on intraindividual changes in PTSD via intraindividual changes in hopelessness was statistically significant ($ab = -4.52$, $SE = 1.84$, 95% CI -1.20 – -8.45). The proportion of variance in intraindividual changes in PTSD predicted by this indirect effect was large ($R^2 = .25$). These results suggest that hopelessness cognitions may be a specific mechanism of CPT (relative to PE) in predicting intraindividual changes in PTSD.

Is Habituation a Mechanism of Change of Prolonged Exposure Therapy?

We next examined whether habituation as measured by changes in mean SUDS ratings would predict changes in PTSD symptoms for individuals in the PE condition. As seen in Table 1, there was a significant decrease between the mean SUDS rating in the first exposure session and the mean SUDS rating in the last exposure session. As hypothesized, a greater within treatment decrease in the mean SUDS ratings was associated with a greater decrease in PTSD symptoms ($r = .24$, $P < .05$). Consistent with our theoretical predictions, the amount of habituation as measured by within-treatment change in mean SUDS ratings was uncorrelated with the within-treatment changes in levels of hopelessness ($r = .01$, $P = .95$). Furthermore, changes in SUDS ratings predicted changes in PTSD symptoms ($B = .35$, $SE = .136$, $P < .05$) after controlling for the effect of changes in hopelessness. These results suggest that habituation is a mechanism of change in PE that may be distinct and independent from the effects of changes in hopelessness cognitions.

Discussion

The results of the present study provide preliminary evidence of how CPT and PE may promote recovery from PTSD via differential mechanisms. CPT has been proposed to promote recovery from PTSD by targeting maladaptive cognitive schemas related to traumatic experiences. Consistent with previous research (Gilman et al. 2011), the results of the present study suggest that hopelessness may be one important cognitive schema affected by CPT. Given that hopelessness was not directly targeted in CPT, it does provide some evidence that focusing on maladaptive cognitions about causes and effects of the clients' traumas may affect cognitive functioning more generally. The present study also provided promising evidence that habituation, as measured by intraindividual changes in SUDS ratings, is an important mechanism of change in PE. These results therefore provide theoretically consistent evidence for how the two treatments may achieve equivalent outcomes via differential mechanisms.

One of the contributions of this study is the demonstration that equivalent outcomes in a randomized controlled trial do not preclude the examination of mechanisms of change. The focus on modeling intraindividual change on the proposed mechanisms and PTSD symptoms is also important because previous mechanisms research has often used methods of data analysis that focus on interindividual change and which do not adequately model intraindividual change (Molenaar and Campbell 2009). The use of intraindividual methods of data analysis is crucial in order to permit appropriate conclusions regarding change processes in longitudinal research (Selig and Preacher 2009).

The primary limitation of the present study is the timing of the measurements of the proposed mechanisms of change. An important step in identifying mechanisms of change is the use of an assessment schedule that permits the demonstration of temporality of change (Kazdin 2007). The absence of within-treatment assessments of hopelessness prevented an examination of the temporality of change so it will be important for future research to demonstrate that changes in hopelessness precede changes in PTSD symptoms. The use of latent variable techniques for modeling intraindividual change (e.g., latent difference scores; Selig and Preacher 2009) would also permit more accurate modeling of intraindividual mechanisms of change within the course of treatment. The sample used in the present study was relatively homogeneous (all women with rape as index trauma) so it will be helpful for future research to explore mechanisms of change of CPT and PE in different populations.

The present study was also limited to the study of hopelessness as a potential differential mechanism of change of CPT and PE as we were also unable to directly compare the effects of the two treatments on habituation

due to the absence of SUDS ratings in the CPT treatment protocol. It will be important for future research to include assessments of multiple potential mechanisms so that the role of hopelessness can be directly compared to habituation and other relevant constructs (e.g., self-efficacy, perceived control). The examination of multiple mechanisms in conjunction will also allow for more rigorous tests of theoretical models of recovery. For example, it may be possible to demonstrate that the habituation process that occurs during exposure exercises in PE has a direct effect on avoidance behaviors/tendencies while the cognitive strategies in CPT may influence avoidance behaviors/tendencies more indirectly by first promoting hopefulness and instilling a greater sense of personal agency.

PE and CPT are two of the most widely studied and well-supported treatment protocols for PTSD. Despite the extensive evidence supporting these treatments, little research has been conducted examining the potential mechanisms by which these treatments promote recovery. The results of the present study provide preliminary evidence regarding the differential mechanisms by which CPT and PE produce equivalent treatment outcomes. The evidence of habituation and changes in hopelessness cognitions as two independent and theoretically consistent mechanisms of change indicates that CPT and PE may provide two different routes towards recovery from PTSD.

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