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Does prolonged exposure increase suicide risk? Results from an active duty military sample

Lily A. Brown[a,*], Carmen P. McLean[a,b], Yinyin Zang[a], Laurie Zandberg[a], Jim Mintz[c,d], Jeffrey S. Yarvis[e], Brett T. Litz[f,g,h], Alan L. Peterson[c,i,j], Craig J. Bryan[k,l], Brooke Fina[c], Julie Petersen[a], Katherine A. Dondanville[c], John D. Roache[c], Stacey Young-McCaughan[c], Edna B. Foa[a], for the STRONG STAR consortium

[a] Department of Psychiatry, University of Pennsylvania, 3535 Market St., Suite 600 North, Philadelphia, PA, USA
[b] National Center for PTSD, VA Palo Alto Health Care System, 795 Willow Rd., Menlo Park, CA, USA
[c] Department of Psychiatry, University of Texas Health Science Center at San Antonio, 8300 Floyd Curl Dr., San Antonio, TX, USA
[d] Department of Epidemiology and Biostatistics, University of Texas Health Science Center at San Antonio, 7703 Floyd Curl Dr., San Antonio, TX, USA
[e] Headquarters, Carl R. Darnall Army Medical Center, 36065 Santa Fe Avenue, Fort Hood, TX, USA
[f] Massachusetts Veterans Epidemiological Research Center, VA Boston Health Care System, 150 S Huntington Ave, Boston, MA, USA
[g] Department of Psychiatry, Boston University School of Medicine, 720 Harrison Ave., Boston, MA, USA
[h] Department of Psychological and Brain Sciences, Boston University, 64 Cummington Mall, Boston, MA, USA
[i] Research and Development Service, South Texas Veterans Health Care System, 7400 Merton Minter, San Antonio, TX, USA
[j] Department of Psychology, University of Texas at San Antonio, One UTSA Circle, San Antonio, TX, USA
[k] National Center for Veterans Studies, 332 S 1400 E, Building 73, Salt Lake City, UT, USA
[l] Department of Psychology, The University of Utah, 1721 Campus Center Drive Saec, 3220 S, Salt Lake City, UT, USA

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ABSTRACT

The efficacy of prolonged exposure (PE) on suicide ideation (SI) as a secondary outcome among individuals with posttraumatic stress disorder (PTSD) is unclear. The purpose of this study was to compare the efficacy of PE in two formats (spaced, S-PE, 10 sessions over 8 weeks, and massed, M-PE, 10 sessions over 2 weeks) to Present Centered Therapy (PCT) and minimal contact control (MCC) on SI exacerbation among patients without suicide intent or plans. Active duty military personnel (n = 335) were randomized to: (1) S-PE vs. PCT and (2) M-PE vs. MCC. All participants completed the Beck Scale for Suicide Ideation and the Beck Depression Inventory (Suicide item) at baseline, posttreatment, and follow-ups. S-PE and PCT had significant and comparable reductions in SI during treatment. M-PE had significantly steeper reductions in SI during treatment compared to MCC. Specifically, more participants in M-PE compared to MCC had reliable improvement versus reliable exacerbation. Reduction in PTSD symptoms was significantly associated with reduction of SI. PE was associated with significant reductions in SI over time that were comparable to PCT and superior to MCC. These findings suggest that both trauma- and non-trauma-focused treatments are associated with reductions in SI, and that trauma-focused treatments improve SI relative to waitlist.

Individuals with posttraumatic stress disorder (PTSD) are 2–6 times more likely to report suicidal ideation (SI) and suicide attempts (SA; Kessler, Borges, & Walters, 1999; Sareen, Houlahan, Cox, & Asmundson, 2005) and up to 9.8 times more likely to die by suicide (Gradus et al., 2010) than those without PTSD. The association between PTSD and suicide has been established across many samples, including active duty military personnel (Bryan & Corso, 2011). Given the increased likelihood of PTSD (Smith et al., 2008) and suicide risk (Bachynski et al., 2012) in military samples, the association between PTSD and SI may be of particular importance for this population.

Evidence-based PTSD treatments may be associated with reductions in SI among patients who deny suicide intent or plans. For instance, one randomized controlled trial (RCT) comparing Prolonged Exposure therapy (PE) and Cognitive Processing Therapy (CPT) for PTSD demonstrated significant reductions in PTSD and SI over time in both conditions, with greater reductions in PTSD symptoms associated with

* Corresponding author. Center for the Treatment and Study of Anxiety, Department of Psychiatry, University of Pennsylvania, 3535 Market St., Suite 600 North, Philadelphia, PA, 19104, USA.
E-mail address: lilybr@upenn.edu (L.A. Brown).

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greater reductions in SI (Gradus, Suvak, Wisco, Marx, & Resick, 2013). However, this study used only a single item to capture SI (the Beck Depression Inventory, BDI, item assessing SI; Beck, Ward, Mendelson, Mock, & Erbaugh, 1961), thereby reducing confidence in the validity and reliability of SI measurement. Both CPT and Present Centered Therapy (PCT) resulted in significant and comparable SI reductions in active duty military personnel with PTSD; gains were maintained up to 1 year after treatment (Bryan et al., 2016). New onset of SI was reported in 9–33% of cases in both treatment arms, and suicide exacerbation was reported in 9–37.5% of cases. In patients with PTSD and borderline personality disorder, an integration of dialectical behavior therapy (DBT; Linehan, 1993) and PE resulted in greater reductions in SA compared to DBT alone (Harned, Korslund, & Linehan, 2014). Finally, in active duty service members randomized to either PE, virtual reality, or waitlist, the combined PE/VR groups had a lower probability of endorsing suicidal ideation at post-treatment (Norr, Smolenski, & Reger, 2018). However, this study did not include a non-trauma-focused comparison condition, and it included only a single-item measure of suicide (BDI-II suicide item; Beck, Steer, & Brown, 1996). These preliminary findings highlight the potential safety of evidence-based PTSD treatment for patients with either SI (in the absence of suicide intent or plans) or in patients with BPD who receive concurrent DBT.

Naturalistic research has similarly demonstrated that PE implemented in the Veterans Health Administration resulted in significant reductions in both PTSD symptoms and SI (Cox et al., 2016). Of the 44% reporting baseline SI, 46% experienced at least some reduction in SI and 41% no longer reported SI by the final session. Furthermore, PTSD severity was a predictor of SI at a subsequent session, whereas the converse was not true. This is an important finding that clarifies the temporal relationship between PTSD symptom improvement and SI; specifically, improvements in PTSD symptoms preceded reduction in SI. However, SI was measured using a one-item response (BDI-II suicide item; Beck et al., 1996), and there was no active comparison to control for the passage of time alone.

Despite preliminary empirical support, many clinicians are hesitant to employ trauma-focused interventions in patients reporting SI. This hesitation is likely attributable in part to treatment manuals that recommend against using trauma-focused treatments for patients at risk for suicide. Such recommendations resulted in the exclusion of higher-risk individuals from many randomized controlled trials. For instance, in a review of 38 randomized controlled trials in the U.S. Department of Veterans Affairs or Department of Defense, 23 (60.5%) included suicide-related exclusion criteria, and 36 (94.7%) measured suicidal ideation but did not report on suicide outcomes (Bakalar, Carlin, Blevins, & Ghahramanlou-Holloway, 2016). Consequently, a survey of over 800 mental health providers indicated that the majority do not endorse using exposure for patients who are at risk for suicide (Becker, Zayfert, & Anderson, 2004). In addition, PTSD practice guidelines prescribe the exclusion of suicidal participants from PE (Forbes et al., 2007; Hudenko, Homaifar, & Wortzel, 2017). Despite this, a recent review found no evidence indicating that exposure therapy increases suicide risk (van Minnen, Harned, Zoellner, & Mills, 2012). Therefore, while preliminary evidence suggests that PTSD-focused treatments are safe for those with SI without suicide intent or plans, practice guidelines have not been updated in light of recent findings. Additional research comparing trauma- to non-trauma-focused treatments is necessary to enhance clinician confidence.

To address this gap, the current study compared changes in SI in active duty military personnel receiving PTSD treatment. The parent trial (Foa et al., 2018) compared the following conditions: Massed-PE (M-PE; 10 sessions over 2 weeks) to a Minimal Contact Control Group (MCC; a control condition, 10–15 min weekly therapist phone calls for 4 weeks), and Spaced-PE (S-PE; 10 sessions over 8 weeks) to Present Centered Therapy (PCT; an active control condition, 10 sessions over 8 weeks). This design allows for a comparison of PE to non-trauma-focused treatment (S-PE vs. PCT) and for a comparison of PE to waitlist (M-PE vs. MCC). Based on prior research, we hypothesized significantly greater reductions in SI in M-PE versus MCC and comparable SI reductions in S-PE and PCT. We also hypothesized that greater reductions in PTSD severity would be associated with greater reductions in SI over time.

1. Methods

1.1. Participants

Participants (n = 335) met criteria for current PTSD according to the *Diagnostic and Statistical Manual of Mental Disorders* (American Psychiatric Association, 2000), were military personnel at Fort Hood, Texas, and were exposed to a combat-related trauma. Average age was 32.5 years old (SD = 7.3), and participants were primarily male (89.3%) and white (61.2%).

1.2. Procedure

All study procedures were approved by the Institutional Review Boards at Brooke Army Medical Center, the University of Texas Health Science Center at San Antonio, and the University of Pennsylvania. Informed consent was obtained from all participants. Participants were randomized to either MCC (n = 40; weekly therapist phone calls for 4 weeks), massed PE (M-PE; n = 75; 10 sessions over 2 weeks), spaced PE (S-PE; n = 109; 10 sessions over 8 weeks), or PCT (n = 107; 10 sessions over 8 weeks). There were no demographic or clinical differences between groups at baseline. No participants reported imminent SI or plans to warrant exclusion from the study, though this was technically an exclusion criterion. For more information on the procedure, see Foa et al. (2018).

1.3. Treatments

1.3.1. Massed Prolonged Exposure (M-PE)

PE is a manualized cognitive-behavior therapy program consisting of two primary components: imaginal exposure (repeated recounting and processing of the traumatic memory) and in-vivo exposure (intentionally approaching distressing stimuli). Sessions were 90-min long and were audio-recorded for homework review. In M-PE, 10 sessions were administered over 2 weeks.

1.3.2. Minimal contact control (MCC)

MCC consisted of four weekly 15-min telephone calls with a study therapist. Participants were asked about their well-being, offered support as needed, and given contact information to use in case of worsened symptoms or distress.

1.3.3. Spaced Prolonged Exposure (S-PE)

S-PE was identical to M-PE, except that 10 sessions were administered over 8 weeks. Sessions 1 and 2 occurred during Week 1, followed by one treatment session per week during Weeks 2–7, and the final two treatment sessions in Week 8.

1.3.4. Present centered therapy (PCT)

PCT is a manualized treatment focused on current life problems that provides a credible comparison therapy to control for nonspecific therapeutic factors. Sessions were 90-min long and were provided at the same frequency as S-PE. The therapist's role was to listen actively, help identify daily stressors, and discuss stressors in a supportive and non-directive manner.

1.4. Measures

For S-PE and PCT, assessments were administered at baseline, after 3 weeks in treatment (“Mid-1”), after 5 weeks in treatment (“Mid-2”), at

post-treatment, 2-week follow-up, 3 month follow-up, and 6 month follow-up. For M-PE and MCC, assessments were administered at baseline, post-treatment, and 2-week follow-up. At this point in the study, MCC participants were offered their choice of treatment, but no subsequent assessments were gathered from them. M-PE had additional assessments at 3- and 6-month follow-up.

1.4.1. Beck Scale for Suicide Ideation (BSSI; Beck, Kovacs, & Weissman, 1979)

The BSSI is a 21-item self-report measure of SI and suicide behavior. Participants were given three statements per item describing types of SI, ranging in severity, and were asked to rate which of the four statements described past-week thoughts/feelings. It has excellent internal consistency ($\alpha = 0.96$) and strong convergent and divergent validity (Beck, Steer, & Ranieri, 1988).

1.4.2. Beck Depression Inventory-II suicide item (BDI-II-S; Beck et al., 1996)

The BDI-II is a 21-item self-report measure of depression that includes a suicide item (BDI-II-S) rated on Likert scale, ranging from 0 to 3 over the prior 2 weeks. Due to study inclusion criteria that required participants to score a 1 or lower on this measure, the item was considered a dichotomous measure for all analyses.[1]

1.4.3. PTSD symptom Scale–Interview (PSS-I; Foa, Riggs, Dancu, & Rothbaum, 1993)

The PSS-I is a 17-item clinical interview that evaluates frequency and severity of PTSD symptoms. Scores range from 0 to 51, with higher scores reflecting greater severity. It has excellent internal consistency ($\alpha = 0.91$), test-retest reliability (0.80), and inter-rater reliability ($K = 0.91$; Foa & Tolin, 2000).

1.4.4. Columbia suicide severity rating scale (C-SSRS; Posner et al., 2011)

The C-SSRS is a clinician-rated suicide measure with strong psychometric properties, including high sensitivity and specificity for suicidal behavior classification (Posner et al., 2011). For the purposes of the current study, only the suicidal behavior items were used, including SA, aborted attempts, interrupted attempts, and preparatory behavior, each rated as present or absent. Other subscales were not reported because of administration inconsistency.[2] The baseline assessment measured lifetime behavior and each subsequent assessment measured behavior since the last assessment.

1.5. Data analysis

To match comparisons on treatment duration, S-PE was compared to PCT and M-PE was compared to MCC using mixed effects multilevel modeling with observations nested within participants and maximum likelihood estimation. First, empty models were run to determine the intraclass correlation (*ICC*) for BSSI and BDI-II-S (S-PE vs. PCT: *ICC* = 0.28 & 0.59; M-PE vs. MCC: *ICC* = 0.42 and 0.59), justifying the inclusion of random intercepts. Random slopes were examined for inclusion with unstructured covariance matrices and were retained when models could converge with their inclusion. Then, linear, quadratic and piecewise (from pre- to post-treatment, then from post-treatment to follow-up) effects of Time were compared for model fit using Akaike's Information Criterion (AIC; Akaike, 1973). The *mixed* command was used for BSSI (continuous) or the *melogit* command for BDI-II-S (binary) outcomes. Nonsignificant quadratic terms of Time were dropped from the model. For the S-PE vs. PCT model, Time was centered at post-treatment and included baseline, mid-point 1 (3 weeks into treatment), mid-point 2 (5 weeks into treatment), posttreatment, 2-week follow-up, 3-month follow-up, and 6-month follow-up. Next, the main effect of Condition and the Time x Condition interaction were added to the model. In order to explore the effect of Condition on SI during treatment and follow-up period separately, piecewise models were calculated to represent these two periods. A similar procedure was followed for the M-PE vs. MCC comparison, except that Time represented baseline, posttreatment, and the 2-week follow-up assessment in these models, as data was not collected for MCC during the 3- and 6-month assessments. Cohen's *d* effect sizes (Cohen, 1988) were reported for interactions between time and group for linear outcomes (Feingold, 2013, formula 9), whereas odds ratios were reported for binary outcomes. Sensitivity analyses were then conducted by controlling for total BDI-II score (minus the suicide item) to determine whether the results held after accounting for depression.

In order to investigate the relationship between PSSI and BSSI reduction, mixed models were calculated to obtain estimates of the intercept and slope of PSSI for each participant. The extracted slope parameter was entered into a mixed model as three way interaction of Time × Condition × PSSI slope over and above the effect of PSSI intercept on BSSI. When this three-way interaction was not significant, a Time × PSSI slope interaction was included in a model, over and above the effect of PSSI intercept and Condition on BSSI.

Finally, the proportion of participants who denied SI at baseline and later reported any subsequent SI on the BSSI was reported for each group as was the proportion of participants who reported suicidal behavior. This analysis was followed by a calculation of reliable change to detect reliable exacerbation or improvement in suicidal ideation (Jacobson & Truax, 1991). A parametric test compared the proportion of reliable exacerbation and improvement by condition (S-PE vs. PCT and M-PE vs. MCC).

2. Results

2.1. Baseline differences

There were no differences by Condition in baseline BSSI (S-PE vs. PCT: $p = .78$; M-PE vs. MCC: $p = .09$) or BDI-II-S (S-PE vs. PCT: $p = .07$; M-PE vs. MCC: $p = .24$). There were also no differences in BSSI by gender (S-PE vs. PCT: $p = .23$; M-PE vs. MCC: $p = .87$) or age (S-PE vs. PCT: $p = .93$; M-PE vs. MCC: $p = .51$). There were no differences in BDI-II-S by gender (S-PE vs. PCT; $p = .17$; M-PE vs. MCC: $p = .06$) or age (S-PE vs. PCT: $p = .82$; M-PE vs. MCC: $p = .21$). Finally, there were no differences in lifetime history of suicidal behavior as measured by the C-SSRS (S-PE vs. PCT: $p = .934$; M-PE vs. MCC: $p = .255$).

2.2. BSSI

For S-PE vs. PCT, a piecewise function of Time best fit the data (linear Time: AIC = 4612.91; quadratic Time: AIC = 4589.43; piecewise Time: AIC = 4420.45). The inclusion of random effects of Time during treatment and Time during follow-up significantly improved model fit ($\chi^2 = 213.49$, $p < .001$) and were retained with an unstructured covariance matrix and robust standard error estimation. The Time in treatment × Condition (S-PE vs. PCT) interaction was not significant ($p = .413$, Cohen's $d = 0.20$) as was the Time in follow-up × Condition interaction ($p = .578$, Cohen's $d = 0.19$). When these interactions were removed from the model, the reduction in BSSI over Time in treatment was significant (B: −0.109, $CI_{95\%}$: −0.160, −0.060, *SE:* 0.026, $z = -4.26$, $p < .001$), and a test of the simple slopes for each Condition revealed a significant reduction for both S-PE ($z = -2.42$, $p < .05$) and PCT ($z = -3.61$, $p < .001$). There was a slight but significant increase in BSSI over Time in follow-up (B: 0.019, $CI_{95\%}$: 0.005, 0.032, *SE:* 0.007, $z = 2.68$, $p < .01$, see Fig. 1), with a marginally

[1] Only two participants scored a 2 on this item at any point in the study, and their scores were recoded to a 1 to maintain the dichotomous nature of the item.

[2] A subset of C-SSRS administrations deviated from the standard protocol for SI and intensity of ideation subscales, reducing their interpretability.

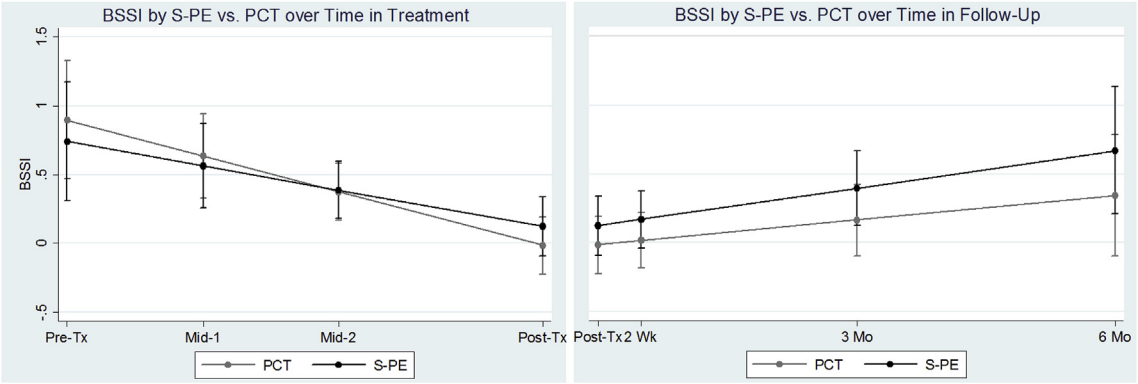

Fig. 1. Spaced Prolonged Exposure (S-PE) vs. Present Centered Therapy (PCT) on the Beck Scale for Suicide Ideation (BSSI).

significant increase for PCT ($z = 1.57$, $p = .116$) and a significant increase for S-PE ($z = 2.27$, $p < .05$). The main effect of Condition was not significant ($p = .487$), indicating that there were no differences between S-PE and PCT at post-treatment. These results held after covarying for baseline BDI total score (excluding the suicide item).

When the slope of PSSI was extracted and entered into a model predicting change in BSSI for S-PE and PCT over and above the influence of PSSI intercept, the Time in treatment × Condition x PSSI slope interaction was not significant ($p = .075$), and the Time in follow-up × Condition x PSSI slope interaction was not significant ($p = .092$). When these interactions and the non-significant Time x Condition interactions were removed from the model, the Time in treatment × PSSI slope interaction was significant (B: 0.311, $CI_{95\%}$: 0.059, 0.564, *SE:* 0.129, $z = 2.42$, $p < .05$); participants with a steeper reduction in PSSI experienced a steeper reduction in BSSI in treatment. The Time in follow-up × PSSI slope interaction was not significant ($p = .781$).

For PCT, 91 participants reported no baseline SI according to the BSSI, of whom 11 (12.1%) went on to report anything greater than 0 on the BSSI at a subsequent assessment. For S-PE, 83 participants reported no baseline SI according to the BSSI, of whom 11 (13.25%) went on to report anything greater than 0 on the BSSI at a subsequent assessment. In terms of reliable change, 4 participants (3.8%) in PCT and 7 participants (6.8%) in S-PE reported a reliable worsening in BSSI at any point after baseline. Of the 19 participants in PCT who reported any SI at baseline, 14 (74%) had a reliable improvement in symptoms at some point in treatment. Of the 27 participants in S-PE who reported any SI at baseline, 15 (56%) had a reliable improvement in BSSI at some point in treatment. There proportion of participants who had reliable exacerbation or improvement by Condition was not significantly different (Fisher's exact $p = .451$).

For M-PE vs. MCC, a piecewise effect of Time best fit the data (linear Time: AIC = 1155.40; quadratic Time: AIC = 1156.39; piecewise Time: AIC = 1133.85). A likelihood ratio test indicated that random effects of Time in treatment and Time in follow-up significantly improved model fit ($\chi^2 = 24.56$, $p < .0001$); however, the model would only converge with an independent covariance matrix. The Time in treatment × Condition (M-PE vs. MCC) interaction was not-significant ($p = .073$, Cohen's $d = 0.26$), and the Time in follow-up × Condition interaction was not significant ($p = .393$, Cohen's $d = 0.13$). When these interaction terms were removed from the model, the Time in treatment effect was significant (B = −0.182, $CI_{95\%}$: −0.345, −0.019, *SE*: 0.083, $z = -2.18$, $p < .05$), and a test of the simple slopes revealed that this effect of Time was driven by a significant reduction in M-PE ($z = -2.85$, $p < .01$, see Fig. 2) that was not present in MCC ($p = .93$). However, there was a non-significant trend toward higher BSSI at baseline in M-PE compared to MCC. Neither the Time in follow-up effect ($p = .479$), nor the main effect of Condition was significant ($p = .393$), indicating that there were not significant differences in BSSI between M-PE and MCC at post-treatment. These results held after covarying for baseline BDI total score (excluding the suicide item).

Data were not collected for MCC at 3- and 6-month follow-up assessments, preventing condition comparisons between these time-points. For M-PE, there was a trend toward an increase in BSSI score from 2-week to 3-month-follow up ($p = .07$) but not from 2-week to 6-month ($p = .68$).

When the slope of PSSI was extracted and entered into a model predicting change in BSSI for M-PE and MCC over and above the influence of PSSI intercept, the Time in treatment × Condition × PSSI slope interaction was not significant ($p = .280$), and the Time in follow-up × Condition × PSSI slope interaction was not significant ($p = .232$). When these interactions and the non-significant Time × Condition interactions were removed from the model, the Time in treatment × PSSI slope interaction was significant (B: 0.164, $CI_{95\%}$: 0.038, 0.289, *SE:* 0.064, $z = 2.55$, $p < .05$); participants with a steeper reduction in PSSI experienced a steeper reduction in BSSI in treatment. The Time in follow-up by PSSI slope interaction was not significant ($p = .807$).

For MCC, 35 participants reported no baseline SI on the BSSI, and of those, 3 (8.6%) went on to report anything greater than 0 on the BSSI at a subsequent time-point. For M-PE, 59 participants reported no baseline SI on the BSSI and of those, 4 (6.7%) went on to report anything greater than 0 on the BSSI at a subsequent time-point. In terms of reliable change, 3 participants (7.5%) in MCC and 4 participants (3.6%) in M-PE reported a reliable worsening in BSSI at any point after baseline. Of the 5 participants in MCC who endorsed any baseline SI, 1 (20%) reported a reliable improvement. Of the 24 participants in M-PE who endorsed any baseline SI, 21 (87.5%) reported a reliable improvement. The proportion of participants with reliable exacerbation or improvement in suicidal ideation by Condition was significant (Fisher's exact $p < .05$). Specifically, more participants in M-PE compared to MCC had reliable improvement versus reliable exacerbation.

2.3. BDI-II-S

For S-PE vs. PCT, a piecewise effect of Time best fit the data (linear Time: AIC = 590.54; quadratic Time AIC: 557.68, piecewise effect of Time AIC: 550.97). Random effects of Time resulted in model non-convergence and were therefore not included. The Time in treatment × Condition (S-PE vs. PCT) interaction was not significant ($p = .221$) and the Time in follow-up × Condition interaction was also not significant ($p = .822$). When these interactions were removed from the model, there was a significant reduction in BDI over Time in treatment (*OR:* 0.68, $CI_{95\%}$: 0.596, 0.776, *SE:* 0.046, $z = -5.72$, $p < .001$, see Fig. 3), and a test of the simple slopes for each Condition revealed a significant reduction for both S-PE ($z = -4.99$, $p < .001$) and PCT ($z = -3.23$, $p < .01$). There was a slight but significant increase in BDI over Time in follow-up (*OR:* 1.098, $CI_{95\%}$: 1.050, 1.149, *SE:* 0.025, $z = 4.06$, $p < .001$), with a significant increase for PCT ($z = 2.71$, $p < .01$) and S-PE ($z = 3.02$, $p < .01$). There was not a

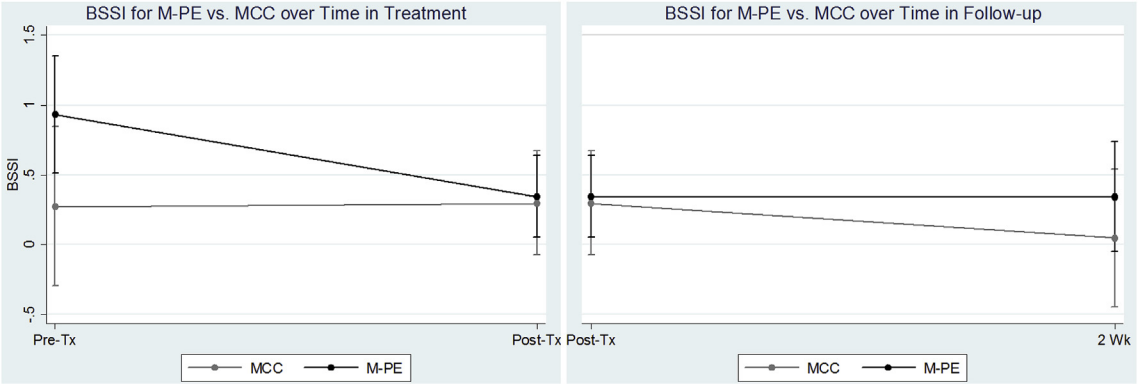

Fig. 2. Minimal Contact Control (MCC) vs. Massed Prolonged Exposure (M-PE) on the Beck Scale for Suicide Ideation (BSSI) over Linear Time.

main effect of Condition ($p = .368$), indicating that there were no differences between S-PE and PCT at post-treatment. These results held after covarying for baseline BDI total score (excluding the suicide item).

For M-PE vs. MCC, a piecewise model and quadratic model were identical in terms of model fit (linear Time: AIC = 190.34; quadratic Time: AIC = 186.61, piecewise Time: AIC = 186.61); a piecewise function of Time was included for consistency with other analyses. Random effects of Time caused model non-convergence and were therefore not included. The Time in follow-up × Condition interaction was not significant ($p = .425$) and when this interaction was removed from the model the Time in treatment × Condition interaction was significant (*OR*: 0.216, $CI_{95\%}$: 0.048, 0.962, *SE:* 0.165, $z = -2.01$, $p < .05$), with a significantly steeper reduction in M-PE in treatment relative to MCC (see Fig. 4). The reduction in M-PE during treatment was significant ($z = -3.04$, $p < .001$) whereas the reduction in MCC was not ($p = .348$). The main effect of Time in treatment was not significant ($p = .383$), nor was the main effect of Time in follow-up ($p = .457$) or of Condition ($p = .227$). These results held after covarying for baseline BDI total score (excluding the suicide item).

2.4. Suicide attempts

Generally, there was low frequency of suicidal behavior for all groups across all time points (see Table 1), though values cannot be statistically compared between groups due to low base-rates.

3. Discussion

Consistent with the first hypothesis and prior research (Bryan et al., 2016), spaced PE and PCT were associated with significant and comparable reductions in suicidal ideation. Findings were similar for two different self-report measures. Consistent with the second hypothesis, massed PE had a significantly steeper reduction in suicidal ideation, as measured by the BDI-II-S, during treatment compared to minimal supportive contact, but there were no differences in suicidal ideation during the 2-week follow-up period between these groups. Similarly, massed PE exhibited a trend toward a significant reduction in suicidal ideation as measured by the BSSI during treatment that was not present in minimal contact. However, this finding was confounded by a non-significant trend toward higher baseline BSSI in massed PE. Collectively, these findings provide support for the safety and efficacy of trauma-focused treatments in patients with suicidal ideation without intent or plans and indicate that PE is safe and effective in reducing suicidal ideation even when delivered in an intensive daily format.

Rates of reliable exacerbation in suicidal ideation were comparable in S-PE and PCT (7 and 4%, respectively) and were slightly lower than in another published trial where rates of exacerbation and new onset of suicidal ideation ranged from 9–37% and 9–33%, respectively (Bryan et al., 2016). Reliable improvement in suicidal ideation was also comparable in S-PE and PCT (56 and 74%, respectively) and was higher than in a prior report (46–50%; Bryan et al., 2016). Conversely, there was a significant difference in the rate of suicidal ideation exacerbation and improvement for M-PE compared to MCC. This effect was driven by significantly more participants reporting reliable improvement for M-PE (87.5%) compared to MCC (20%), whereas rates of reliable exacerbation were comparable for M-PE and MCC (4% and 8%, respectively). Relatedly, rates of suicidal behavior were generally low across all conditions (post-baseline range: 0–4% of each condition).

Consistent with prior research (Gradus et al., 2013) and the third hypothesis, quicker reductions in PTSD severity were associated with steeper reductions in suicidal ideation. The current study builds upon prior research by employing a more comprehensive measure of suicide risk, the BSSI. This association between reductions in PTSD severity and suicidal ideation suggests that for patients who feel that their suicidal

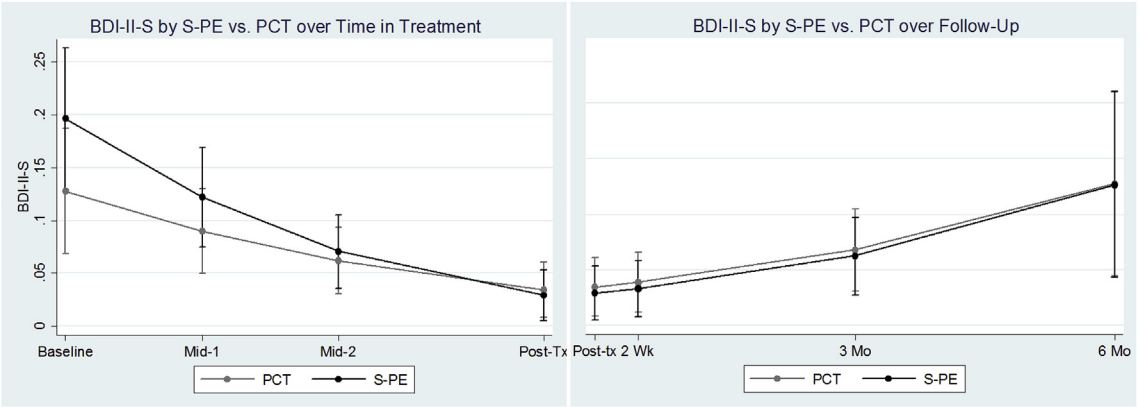

Fig. 3. Spaced Prolonged Exposure (S-PE) vs. Present Centered Therapy (PCT) on the Beck Depression Inventory-II Suicide Item (BDI-II-S).

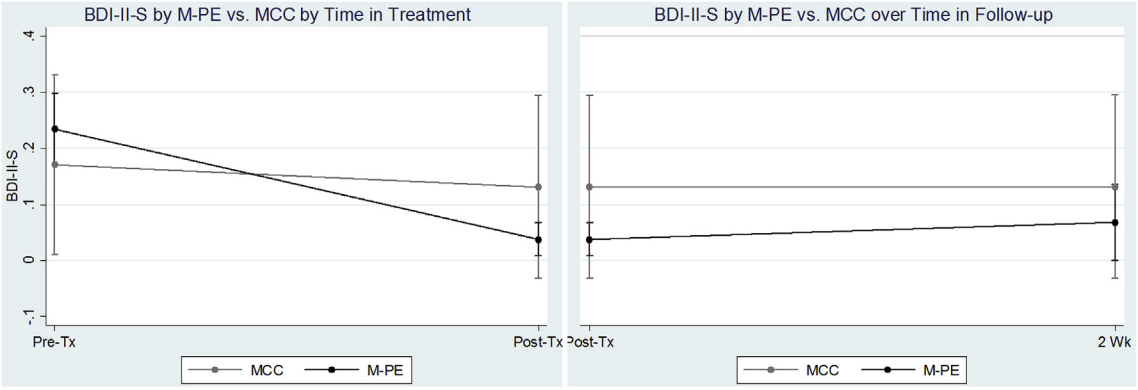

Fig. 4. Massed Prolonged Exposure (M-PE) vs. Minimal Contact Control (MCC) on the Beck Depression Inventory-II Suicide Item (BDI-II-S).

ideation is driven by their trauma-related distress, treating trauma-related distress using a variety of evidence-based treatments may reduce suicidal ideation.

Importantly, there were significant increases in SI across both measures from 3- to 6-month follow-up assessments for both S-PE and PCT and a trend toward a significant increase from 2-week follow-up to 3-month follow-up for M-PE. These findings indicate the importance of exploring integrations of trauma with suicide-focused treatments such as the Coping Long Term with Active Suicide Program (CLASP; Miller, Gaudiano, & Weinstock, 2016), brief cognitive behavioral therapy (Rudd et al., 2015), or crisis response planning (Bryan et al., 2017), particularly for patients who are at higher risk for suicide. Future research should examine whether an integrated approach to treating trauma and suicide results in enhanced gains or maintenance of SI and suicidal behavior reduction.

SI and SA are strongly associated with PTSD, yet most RCTs for PTSD do not report suicide outcomes (Bakalar et al., 2016). Additionally, most RCTs explicitly exclude participants with suicide intent or plans (Bakalar et al., 2016). Current practice guidelines discourage the inclusion of patients with significant suicide risk from PTSD-focused treatment, though there are no explicit recommendations about the level of suicide risk that would deem a patient ineligible for treatment (Forbes et al., 2007; Hudenko et al., 2017). Instead, therapists are encouraged to use clinical judgment to determine whether a patient's degree of suicide risk precludes exposure therapy (Hudenko et al., 2017). The current study suggests that PTSD-focused treatments reduce, rather than increase, suicidal ideation. Furthermore, PTSD-focused treatments improve suicidal ideation to a greater extent than minimal attention.

Several limitations of the current study should be noted. First, most participants reported low intensity of suicidal ideation. Therefore, the relationship between PE and suicide risk reduction may be altered in samples with more severe suicidal ideation. Second, while the BSSI measures some aspects of suicide behavior, we did not explicitly explore the effects of PE on suicide attempts or behavior due to low base rates. Given that prediction of suicide behavior is much more difficult than prediction of suicidal ideation (Klonsky, May, & Saffer, 2016), this is an important next step for future research. Third, the BDI-II-S measured suicidal ideation over the prior 2 weeks, which was the entire duration of the M-PE and MCC condition. Nevertheless, there was a significant time in treatment by condition interaction during this period. This suggests that while the posttreatment assessment collapsed over the entirety of treatment, M-PE reported greater reductions in suicidal ideation on this measure compared to MCC, which was similar to a waitlist comparison. Third, participants were mostly male active duty military personnel. The relationships between PTSD and suicidal ideation in this study may not generalize to civilian, veteran, or female samples. Fourth, because of some inconsistency in administration of the C-SSRS suicidal ideation and intensity of ideation subscales, these measures could not be included in analyses.

In conclusion, this study provides further evidence for the safety of PE and PCT in reducing suicidal ideation among active duty military personnel with PTSD. Despite current practice guidelines discouraging exposure-based treatments for samples with suicide risk, we found no evidence that suicidal ideation was exacerbated by PE relative to supportive counseling or minimal supportive contact. In fact, there was some evidence that PE reduced suicidal ideation relative to minimal contact during the active treatment phase. For all conditions, the degree of reduction of PTSD symptoms was associated with the degree of reduction in suicidal ideation. Therefore, exploring the effect of PTSD-focused treatments in patients with higher levels of suicide risk is justified for future research.

Table 1
Suicidal behavior over time.

	Suicide Attempts (*n*; %)				Interrupted Attempts (*n*; %)				Aborted Attempts (*n*; %)				Preparatory Behavior (*n*; %)			
	S-PE	PCT	M-PE	MCC	S-PE	PCT	M-PE	MCC	S-PE	PCT	M-PE	MCC	S-PE	PCT	M-PE	MCC
Baseline (i.e., lifetime)	10; 9.3%	10; 9.1%	10; 9.1%	3; 7.5%	4; 3.8%	6; 5.5%	5; 4.6%	0; 0%	6; 5.6%	6; 5.5%	11; 10%	2; 5%	3; 2.8%	2; 1.8%	5; 4.6%	2; 5%
Mid-Tx 1	0; 0%	0; 0%	–	–	0; 0%	1; 1%	–	–	0; 0%	2; 2%	–	–	1; 1%	0; 0%	–	–
Mid-Tx 2	0; 0%	1; 1%	–	–	0; 0%	1; 1%	–	–	0; 0%	1; 1%	–	–	1; 1%	0; 0%	–	–
Post-Tx	0; 0%	1; 1%	0; 0%	0; 0%	0; 0%	1; 1%	0; 0%	0; 0%	1; 1%	2; 2%	2; 2%	0; 0%	0; 0%	0; 0%	1; 1%	0; 0%
2-week FU	0; 0%	0; 0%	0; 0%	0; 0%	0; 0%	1; 1%	0; 0%	0; 0%	0; 0%	0; 0%	1; 1%	0; 0%	0; 0%	0; 0%	1; 1%	0; 0%
3-month FU	1; 2%	0; 0%	0; 0%	–	0; 0%	0; 0%	1; 2%	–	0; 0%	0; 0%	0; 0%	–	0; 0%	0; 0%	0; 0%	–
6-month FU	0; 0%	0; 0%	2; 4%	–	0; 0%	0; 0%	1; 2%	–	0; 0%	0; 0%	1; 2%	–	0; 0%	0; 0%	0; 0%	–

FU, FU, follow-up; MCC, minimal contact control; M-PE, Massed Prolonged Exposure; PCT, Present Centered Therapy; S-PE, Spaced Prolonged Exposure; Tx, treatment.

[a]Note that mid-treatment data was not collected for M-PE and MCC, and that 3- and 6-month follow-up data was not collected for MCC, as patients in this group could begin treatment after the 2-week follow-up.

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Appendix A. Supplementary data

Supplementary data related to this article can be found at https://doi.org/10.1016/j.brat.2019.04.003.

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