

Clinical Correlates of Poor Sleep Quality in Posttraumatic Stress Disorder

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Sleep disturbances (SD) are a core clinical feature of PTSD. The goal of the study was to determine the influence of patient-related characteristics, disorder-related characteristics, and psychiatric comorbidity on the severity of SD in PTSD outpatients ($n = 367$) who were not recruited for a sleep study. Increased severity of SD paralleled increasing overall PTSD severity. The severity of SD did not differ according to gender, age groups, types of trauma, PTSD chronicity, or psychiatric comorbidity. The severity of SD paralleled PTSD severity. Results suggest that age, gender, and psychiatric comorbidity have minimal impact on sleep quality in this PTSD sample. The inclusion of PTSD patients who were not specifically seeking treatment for SD reinforces the study findings.

KEY WORDS: sleep; insomnia; posttraumatic stress; Pittsburgh Sleep Quality Index.

Sleep disturbances (SD) are a core clinical feature of PTSD and often complicate PTSD outcomes. In individuals with PTSD who seek specific treatments to alleviate SD, the severity of SD is comparable to or exceeds the levels observed in other sleep-disordered and psychiatric samples (Krakow, Germain, et al., 2001). Subjective SD and objectively measured sleep disruption occurring early after trauma exposure predict the development of PTSD at follow-up (Koren, Arnon, Lavie, & Klein, 2002; Mellman, Bustamante, Fins, Pigeon, & Nolan, 2002). In addition, PTSD patients who report significant SD also report more substance use and abuse, more severe health-related complaints, depression, and suicidality (Clum, Nishith, & Resick, 2001; Krakow, Artar, et al., 2000; Nishith, Resick, & Mueser, 2001; Saladin, Brady, Dansky, & Kilpatrick, 1995). Interventions aimed at reducing SD are associated with clinically significant improvements in overall PTSD symptoms, psychological well-being, and daytime

functioning (e.g., Germain & Nielsen, 2003; Gillin et al., 2001; Krakow, Hollifield, et al., 2001; Neylan et al., 2003; Raskind et al., 2003). There is growing evidence that comorbid sleep disorders including insomnia, nightmares, and sleep disordered breathing are frequent in a significant portion of PTSD patients (Krakow, Germain, et al., 2000; Krakow, Hollifield, et al., 2001; Krakow et al., 2002) who undergo standard diagnostic sleep evaluations. Together, these observations support the suggestion that SD are a core clinical feature of PTSD, and raise the possibility that adjunctive sleep-focused assessments and intervention strategies may facilitate care management and enhance treatment response in PTSD. Thus, a comprehensive characterization of the clinical correlates of self-reported SD in PTSD may provide new directions to help identify patient groups who may require formal diagnostic sleep evaluations or who may be more likely to benefit from sleep-focused clinical strategies.

Sleep quality may be influenced by a variety of patient- and disorder-related characteristics such as age, gender, type of trauma, PTSD chronicity and severity, and psychiatric comorbidity. Thus, elucidating the influence of these characteristics on the severity of subjective SD in PTSD may be an important step in the development of evaluation and intervention strategies for SD in

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PTSD patients. Gender and age significantly influence sleep quality in both healthy and psychiatric samples (e.g., Bixler, Vgontzas, Lin, Vela-Bueno, & Kales, 2002; Buysse et al., 1991; Doi, Minowa, Uchiyama, & Okawa, 2001). In general, women report more sleep complaints than men do, and older individuals report more sleep complaints than younger cohorts. Thus, age and gender may provide early identifiers of the need for adjunct sleep-focused interventions in PTSD patients.

It is plausible that disorder-related characteristics defined in this study as the type of trauma (e.g., sexual abuse, war exposure, motor vehicle accident, natural disaster), PTSD chronicity, and PTSD severity may also influence sleep quality in PTSD patients. To date, empirical evidence indicates that the severity of SD is elevated and of comparable magnitude in survivors of natural disasters, sexual abuse, and Holocaust, and war veterans with PTSD (e.g., Krakow, Germain, et al., 2000; Mellman, David, Kulick-Bell, Ashlock, & Nolan, 1995; Mellman, David, Kulick-Bell, Hebding, & Nolan, 1995; Rosen, Reynolds, Yeager, Houck, & Hurwitz, 1991). Poor sleep quality and severe SD also appear to be independent of PTSD chronicity (e.g., Koren et al., 2002; Rosen et al., 1991; Schreuder, Kleijn, & Rooijmans, 2000). However, a direct comparison of sleep quality and severity of SD across trauma types or PTSD chronicity using a validated measure of sleep quality is not yet available. There is some evidence that PTSD severity influences the severity of SD. In sexually abused women with PTSD who seek treatment for posttraumatic insomnia and nightmares, increased severity of SD parallels increases in overall PTSD severity (Krakow, Hollifield, et al., 2001). The generalizability of these observations to men and women with PTSD who do not specifically seek help for SD, however, remains uncertain.

Psychiatric comorbidity may also influence sleep quality in PTSD. As many as 88% of men and 79% of women with a lifetime history of PTSD exhibit another psychiatric disorder (Kessler, Sonnega, Bromet, Hughes, & Nelson, 1995). The most common comorbid Axis I disorders in PTSD are substance use disorders, mood disorders, and anxiety disorders (Creamer, Burgess, & McFarlane, 2001), which are all characterized by poor overall sleep quality and SD (Breslau, Roth, Rosenthal, & Andreski, 1996; Ford & Cooper-Patrick, 2001; Ohayon & Shapiro, 2000). Therefore, psychiatric comorbidity is likely to be associated with more severe complaints of poor sleep quality and SD in PTSD patients in a manner analogous to that reported in medical and psychiatric samples (Gentili, Weiner, Kuchibhatil, & Edinger, 1997; Katz & McHorney, 2002; Moul et al., 2002). A recent study indeed showed that PTSD patients presenting with

another psychiatric disorder complained of nightmares and insomnia more frequently than patients with PTSD only (Leskin, Woodward, Young, & Sheikh, 2002).

The goal of the present study was to assess the influence of patient characteristics (i.e., gender and age), disorder-related characteristics (i.e., trauma type, PTSD chronicity and severity), and psychiatric comorbidity on sleep quality and the severity of self-reported SD in a sample of PTSD patients who were not specifically recruited for sleep difficulties.

Methods

Participants

Data used in the present study were derived from two multicenter, double-blind, randomized, placebo-controlled studies that investigated the efficacy of sertraline in outpatients with a primary diagnosis of PTSD (Davidson, Rothbaum, van der Kolk, Sikes, & Farfel, 2001; data on file, Pfizer Inc.). Only methods and data pertinent to the pretreatment baseline period are reported here. Patients were recruited from outpatient clinical settings using flyers and newspaper and radio advertisements. Eligible patients were included if they presented with a primary diagnosis of PTSD. They were excluded if they had (1) a current or past history of bipolar disorder or any psychotic disorder; (2) a primary diagnosis of major depression (patients were not excluded if major depression was secondary to the diagnosis of PTSD); (3) current organic mental disorder, factitious or malingering disorder; (4) a history of alcohol or substance abuse or dependence in the past 6 months; (5) current significant medical conditions; and (6) current use of any medication (except occasional use of chloral hydrate for insomnia) with clinically significant psychotropic properties. Three hundred and sixty-eight PTSD outpatients age 18 and older participated in these studies. All participants provided written informed consent. The studies were approved by local or national Institutional Review Boards at each collaborating site.

Measures

At study entry, all subjects underwent structured clinical interviews conducted by research clinicians (psychologist, psychiatric nurse, physician). Group sessions were conducted using videotaped and case studies to ascertain interrater reliability. The Clinician-Administered PTSD Scale-1 (CAPS-1; past month version; Blake et al.,

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1990) was used to confirm PTSD status according to the DSM-III-R criteria for PTSD. On the CAPS-1, a minimal CAPS-1 score of 50 was required. The minimum required duration of PTSD was 6 months. The type of trauma and PTSD chronicity were established with the CAPS-1. The Structured Clinical Interview for DSM-III-R (SCID; Spitzer, Williams, Gibbons, & First, 1992) was used to assess the presence of comorbid psychiatric disorders.

Patients then underwent a 1-week single-blind placebo lead-in period. At baseline (end of lead-in period), the CAPS-2 (past week version) was administered and scores were used to confirm PTSD diagnosis and PTSD severity. To be included in the studies, a score of 50 or greater on the CAPS-2 was required at baseline. CAPS-2 scores were used for all study analyses. All eligible patients then completed the Pittsburgh Sleep Quality Index (PSQI; Buysse et al., 1989). The 19-item self-report PSQI simultaneously assesses seven clinically relevant components of sleep quality (subjective sleep quality, sleep latency, duration, efficiency, disturbances, use of sleep medication, and daytime dysfunction) in the preceding month. Each component is rated on a 0–3 scale referring to the composite score derived from the frequencies of each disturbance, where 0 = *not in the past month*, and 3 = *three or more times a week*, with a global score range from 0 to 21. A cut-off score of 5 has been shown to discriminate between good and bad sleepers (Buysse et al., 1989). Acceptable internal consistency (Cronbach's $\alpha = .83$), test-retest reliability ($r = .85$), and validity have been demonstrated in sleep disordered, psychiatric, and medical samples (e.g., Backhaus, Junghanns, Broocks, Riemann, & Hohagen, 2002; Buysse et al., 1989; Carpenter & Andrykowski, 1998; Doi, Minowa, Uchiyama, Okawa, Kim, et al., 2000). PSQI scores have been shown to correlate with prospective sleep diary data and polysomnographic measures (e.g., Backhaus et al., 2002, Buysse et al., 1989). Height and weight were collected during the baseline physical examination and used to derive each patient's body mass index (BMI). BMI strongly moderates the relationships between PTSD and sleep-disordered breathing (Krakow, Germain, et al., 2000, Krakow et al., 2002), which is associated with increased severity of self-reported sleep disturbances (e.g., Buysse et al., 1989).

Data Analyses

Data from the two study samples were combined for all statistical analyses described below. All ANOVA models included study as a covariate.

Demographic and Clinical Data

Pearson correlations were conducted to assess the relationship between BMI and PSQI global scores for the total sample and across PTSD severity groups. ANOVA using PTSD severity group (as defined below) and BMI as the dependent variable were conducted to determine whether mean BMI differed across groups. Chi-square tests were conducted to determine whether PTSD severity and PTSD chronicity differed between men and women.

Patient-Related Characteristics

Mean PSQI global scores were compared between men and women and across five age groups (18–29 years old; 30–39 years old; 40–49 years old; 50–59 years old; ≥ 60 years old) using ANOVAs. When groups significantly differed on global scores, ANOVAs were conducted on each PSQI component to identify the specific nature of the group differences.

Disorder-Related Characteristics

ANOVAs were conducted to assess group differences on the mean PSQI global score for the following variables: (1) five types of trauma, (2) three PTSD severity groups, and (3) five groups based on PTSD chronicity. The types of trauma were sexual or physical abuse; being in a war or combat; seeing someone hurt or die; serious accident/fire/injury; other events. The three PTSD severity groups were determined using standard CAPS classification (Weathers, Keane, & Davidson, 2001) as Moderate PTSD (CAPS-2 scores ranging from 50 to 59), Severe PTSD (CAPS-2 scores ranging from 60 to 79), and Extremely Severe PTSD (CAPS-2 scores ≥ 80). Finally, five groups of PTSD patients based on the examination of the frequency distribution of PTSD chronicity were arbitrarily identified: 6 months to 2 years; 3–9 years; 10–19 years; 20–29 years; 30 years and longer. When PSQI global scores differed across groups, ANOVAs were conducted to further identify group differences on each of the PSQI components.

Psychiatric Comorbidity

Mean PSQI global score was compared using ANOVAs across four groups of PTSD patients based on the presence or absence of secondary comorbid mood or anxiety disorders as determined by the SCID: Patients with PTSD alone were compared to PTSD patients with comorbid mood disorder, anxiety disorder, and mood +

anxiety disorders. When groups differed on global PSQI score, ANOVAs were conducted to identify further group differences on each of the PSQI components.

Finally, post-hoc testing for statistically significant difference among categories was supplemented by Cohen's *d* effect sizes. The latter procedure was conducted to determine the clinical meaningfulness of statistical findings.

The statistical level of significance was adjusted at $p = .006$ to limit the probability of type I error (.05/8 comparisons, or PSQI global score and seven component scores).

Results

One hundred and ninety women and 177 men from the two multicenter double-blind randomized placebo-controlled studies were included in the present data set (Davidson et al., 2001; Data on file, Pfizer Inc.). Men ($M = 45.44$, $SD = 10.84$) were significantly older than women ($M = 36.46$, $SD = 9.86$), $t(362) = 4.91$, $p < .001$. The majority of the sample was Caucasian (77.66%; 156 women), and African American (15.80%; 23 women). The remainder of the sample was composed of Asian or individuals who described themselves as of

other ethnicity (11 women). Baseline PTSD severity did not differ between women ($M = 73.83$, $SD = 16.52$) and men ($M = 72.86$, $SD = 18.89$), $\chi^2(1, n = 367) = 0.00$, *ns*, but men presented more chronic PTSD (18.49 + 12.61) than women did (11.69 + 11.15), $\chi^2(1, n = 367) = 25.86$, $p < .001$. At baseline, 10 patients (2.7%) were using chloral hydrate for sleep. Regarding past psychiatric medication history, 27.9% of participants ($n = 99$) had previously taken antidepressants, 13.6% had taken benzodiazepines, 3% had taken tranquilizers, and 6% had taken other medications including hypnotics (e.g., zolpidem; 1.6%), miscellaneous anticonvulsants/anxiolytics (1.1%), stimulants (0.5%), opiate agonists (0.5%), and antimanic agents (0.3%). Traumatic events reported in this combined sample, PTSD chronicity, and psychiatric comorbidity data are presented in Table 1. The correlation between BMI and PSQI global score was negligible ($r = .01$) and nonsignificant. BMI did not differ across PTSD severity groups, $F(2, 362) = .48$, *ns*.

Women did not report more severe SD than men on the PSQI (Table 1). Similarly, mean PSQI global scores did not differ across age groups. Mean PSQI global scores did not differ across types of trauma (Table 1). Similarly, mean PSQI global scores did not differ across the five PTSD chronicity groups, nor across the four groups based

Table 1. Mean Global PSQI Scores Across Subgroups of PTSD Patients

Category	<i>n</i>	%	<i>M</i>	<i>SD</i>	<i>F</i>	<i>df</i>
Gender					0.19	1,364
Women	190	51.77	11.88	3.58		
Men	177	48.23	12.21	3.70		
Age groups					1.91	4,361
18–29	74	20.16	11.85	3.70		
30–39	81	22.07	12.63	3.18		
40–49	150	40.87	11.79	3.51		
50–59	43	11.72	12.66	4.27		
>60	19	5.18	10.79	4.29		
Trauma type					0.91	4,361
Sexual/Physical abuse	150	40.87	11.89	3.70		
Witnessing someone die	38	10.35	11.29	3.26		
Involved in serious accident	26	7.08	12.38	3.64		
Combat exposure	127	34.60	12.48	3.73		
Other events	26	7.08	11.53	3.22		
PTSD chronicity (years)					0.50	4,361
0.5–2	44	12.00	11.84	3.98		
3–9	123	33.51	11.73	3.75		
10–19	57	15.53	12.19	2.92		
20–29	101	27.52	12.48	3.34		
≥30	42	11.44	11.90	4.43		
Psychiatric comorbidity					1.26	3,362
PTSD only	172	46.87	11.66	3.79		
PTSD + Mood disorder	124	33.79	12.39	3.57		
PTSD + Anxiety disorder	16	4.36	12.23	4.04		
PTSD + Mood + Anxiety disorders	55	14.99	12.40	3.11		

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Table 2. Mean PSQI Global and Component Scores Across PTSD Severity Groups^a

Variable	Moderate PTSD (M)			Severe PTSD (S)			Extreme PTSD (E)			<i>F</i>	<i>df</i>	Post-hoc comparison
	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>			
PSQI global	84	10.63	3.78	151	11.37	3.42	132	13.71	3.14	25.88**	2,363	E > M, S
Sleep quality	84	1.64	0.79	151	1.90	0.83	132	2.36	0.74	23.61**	2,363	E > S > M
Sleep latency	84	1.88	1.03	152	2.06	1.04	131	2.42	0.85	8.99**	2,363	E > M, S
Sleep duration	84	1.73	0.97	152	1.99	0.92	132	2.36	0.84	13.15**	2,364	E > S > M
Sleep efficiency	84	1.64	1.30	150	1.59	1.31	132	1.73	1.28	0.41	2,362	
Sleep disturbances	76	1.75	0.68	147	1.81	0.63	128	2.20	0.63	16.95**	2,347	E > M, S
Use of medications	84	0.62	1.06	151	0.48	1.00	132	0.76	1.19	2.33	2,363	
Daytime dysfunction	84	1.43	0.73	152	1.67	0.84	132	2.00	0.69	15.07**	2,364	E > S > M

^a Moderate PTSD = CAPS-2 score = 50–59; Severe PTSD = CAPS-2 score = 60–79; Extremely severe PTSD = CAPS-2 score ≥ 80.

** $p < 0.001$.

on the presence or absence of comorbid mood or anxiety disorders (Table 1).

Mean PSQI global scores significantly differed across the three PTSD severity groups (Table 2). Patients with extremely severe PTSD showed significantly higher PSQI global scores (i.e., poorer overall sleep quality) than the moderate and severe groups ($d = .89$ and $d = .71$, respectively), and the severe PTSD group showed slightly higher PSQI global scores than the moderate PTSD group ($d = .22$). Examination of group differences on mean PSQI component scores revealed that the extremely severe PTSD group reported poorer subjective sleep quality ($d = 1.06$ and $d = .66$), longer sleep latency ($d = .55$ and $d = .33$), shorter sleep duration ($d = .77$ and $d = .47$, respectively), more sleep disturbances ($d = .61$ and $d = .67$), and more daytime dysfunction ($d = .86$ and $d = .40$) than the moderate and severe groups. Mean scores on sleep efficiency and sleep medication components did not statistically differ across the three groups, and effect sizes were $< .30$. The moderate and severe groups significantly differed on subjective sleep quality ($d = .38$), sleep duration ($d = .32$), and daytime dysfunction components ($d = .40$).

Discussion

The present findings provide further empirical support for the notion that poor sleep quality characterizes PTSD, and that SD are a clinically significant component of PTSD. Poorer sleep quality and more severe SD were associated with increased PTSD severity. Although PSQI global scores significantly differed across the three PTSD severity groups, mean PSQI global scores in the three groups largely exceed the clinical threshold score of 5 on the PSQI, indicating significant sleep disturbances in all PTSD severity groups. Despite the well-documented significant effects of gender, age, and psychiatric comorbid-

ity on sleep quality, these factors appear to have minimal effect on sleep quality severity in this sample of PTSD patients. Additionally, sleep quality and the severity of SD did not differ across types of trauma or PTSD chronicity. These findings suggest that SD are a core clinical feature of PTSD, regardless of patient-related characteristics, other disorder-related characteristics, and psychiatric comorbidity. The robustness of the present results is reinforced by the inclusion of PTSD patients who were not recruited for sleep difficulties and were not specifically seeking treatment for SD. The findings raise the possibility that PTSD patients may benefit from adjunct sleep-focused treatments.

Consistent with a prior study conducted in sexual assault survivors with poor sleep and seeking sleep-focused treatment (Krakow, Germain, et al., 2001), sleep quality decreased with increasing PTSD severity in the present sample. Of note, even PTSD patients who presented moderate PTSD symptoms endorsed a mean global PSQI score of 10.6, indicating severe SD (Buysse et al., 1989). In general, mean PSQI global scores for all subgroups were similar or higher than those reported for PTSD patients seeking treatment for SD (Krakow, Germain, et al., 2001; Krakow, Johnston, et al., 2001; Krakow et al., 2002), depressed individuals (Buysse et al., 1989), and patients suffering from insomnia and excessive daytime sleepiness (Buysse et al., 1989). Combined with the observations that both poor sleep and PTSD are independently associated with increased mortality and morbidity, as well as substantial care management costs (e.g., Dew et al., 2003; Marshall, Jorm, Grayson, & O'Toole, 2000), the present findings suggest that increased clinical attention to sleep may facilitate the development and implementation of comprehensive and cost-efficient intervention strategies for PTSD.

The results of this study suggest that PTSD overrides the well-established influences of gender, age, and psychiatric comorbidity on subjective sleep quality. In general,

women, older adults, and individuals with psychiatric comorbidity (especially mood disorders) report poorer sleep quality than men, younger adults, and healthy individuals (Bixler et al., 2002; Buysse et al., 1991; Doi, Minowa, Uchiyama, Okawa, et al., 2001; Gentili et al., 1997; Katz & McHorney, 2002; Moul et al., 2002). In this sample of PTSD patients, we did not observe an effect of age, gender, or psychiatric comorbidity on the severity of SD. The present findings also clarify the unresolved question regarding the effect of types of trauma and PTSD chronicity on sleep quality and SD. Specifically, the severity of SD did not differ across types of trauma or subgroups of PTSD chronicity. The range of means for the subgroups of trauma and PTSD chronicity were comparable to mean PSQI scores reported in rape victims ($M = 12.4$, $SD = 4.0$; Krakow, Hollifield, et al., 2001), crime victims ($M = 14.5$, $SD = 3.6$; Krakow, Johnston, et al., 2001), and hurricane survivors ($M = 9.5$, $SD = 5.0$; Mellman, David, Kulick-Bell, Hebding, et al., 1995) who were recruited to participate in sleep studies. These observations suggest that severe SD are germane to PTSD, regardless of trauma type or duration of symptoms. Of note, however, the minimal PTSD chronicity in the present study was 6 months. Therefore, the present findings do not rule out the possibility that the severity of SD rapidly increases from time of trauma to 6 months. Combined with recent evidence that subjective SD and sleep disruption occurring early after the trauma predict PTSD (Koren et al., 2002; Mellman et al., 2002), the present results underline the need for further investigations on the onset and development of SD, as well as on the mediating role of SD in the maintenance of PTSD symptoms in individuals who experience traumatic stress.

Certain limitations must be acknowledged. SD were retrospectively assessed for frequency in the past month. The accuracy of reports provided by PTSD patients, therefore, cannot be ascertained. In addition, it remains possible that night-to-night variability in sleep quality (rather than global subjective reports) is associated with some of the patient- and disorder-related characteristics examined in the present study. Inclusion of prospective sleep logs or ambulatory monitoring devices in future studies may clarify the latter possibility. The generalizability of the findings also needs to be ascertained with formal epidemiological studies, in nontreatment seeking samples, as the exclusion criteria used in the present study may have curtailed the study findings. Polysomnographic assessments were beyond the scope of the original study designs. However, polysomnographic studies are required to evaluate the presence and potential role of intrinsic sleep disorders, such as obstructive sleep apnea, on the severity of SD in PTSD. The negligible relationship observed between

BMI and PSQI global scores limits the possibility that the severity of SD reported by PTSD patients observed in the present study was substantially attributable to obesity, and indirectly, to the presence of obstructive sleep apnea, but does not rule out the possibility that other more subtle forms of sleep-disordered breathing may significantly contribute to poor sleep quality in PTSD. Ambulatory sleep studies, in particular, may provide more conclusive findings regarding the presence and nature of objective sleep anomalies in PTSD (e.g., Dagan, Zinger, & Lavie, 1997; Klein, Koren, Arnon, & Lavie, 2003; Lavie, Katz, Pillar, & Zinger, 1998), as prior laboratory-based sleep studies in PTSD patients have failed to find a PTSD-specific constellation of sleep anomalies.

Despite these limitations, the present study provides further empirical evidence that poor sleep quality and severe SD are a clinically significant component of PTSD. In this sample, poor sleep quality appeared to be a feature of PTSD regardless of age, gender, psychiatric comorbidity, type of trauma, or PTSD chronicity. Several recent studies show that PTSD patients who seek sleep-focused treatment can significantly benefit from sleep-focused cognitive-behavioral and pharmacological interventions (e.g., Germain & Nielsen, 2003; Gillin et al., 2001; Krakow, Germain, et al., 2001; Krakow, Johnston, et al., 2001; Neylan et al., 2003; Raskind et al., 2003). The present findings raise the possibility that adjunctive sleep-focused interventions in the context of PTSD-focused interventions may benefit some PTSD patients.

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