Journal of Psychosomatic Research 79 (2015) 471–476

Contents lists available at ScienceDirect

Journal of Psychosomatic Research

Attachment security and pain — The disrupting effect of captivity and PTSS

Tonny Elmose Andersen [a,*], Yael Lahav [b], Ruth Defrin [c], Mario Mikulincer [d], Zahava Solomon [b]

[a] Department of Psychology, University of Southern Denmark, Denmark
[b] Bob Shapell School of Social Work, Tel Aviv University, Israel, Postdoc, University of Southern Denmark, Denmark
[c] School of Health Professions, Tel Aviv University, Israel
[d] New School of Psychology, Interdisciplinary Center (IDC), Herzliya, Israel

ARTICLE INFO

Article history:
Received 14 January 2015
Received in revised form 1 September 2015
Accepted 24 October 2015
Available online xxxx

Keywords:
Pain
Attachment
Posttraumatic stress
Captivity
POW
Trauma

ABSTRACT

The present study assesses the possible disruption effect of posttraumatic stress symptoms (PTSS) with regard to the protective role of attachment on pain, among ex-POWs. While secure attachment seems to serve as a buffer, decreasing the perception of pain, this function may be disrupted by PTSS. The study sample included 104 subjects who were combat veterans of the 1973 Yom Kippur War comprising of 60 male ex-prisoners of war (ex-POWs) and 44 comparable male combat veterans. Both attachment and pain were investigated experimentally in the laboratory and via questionnaires. We found that ex-POWs showed higher levels of clinical pain and attachment insecurities compared to controls. Moreover, attachment avoidance and soothing effect of attachment (SEA) were both associated with lower levels of clinical pain. Most importantly, PTSS moderated the associations between attachment and pain, as well as the mediation role of attachment between captivity and pain. The results imply that although attachment can be an important resource for coping with pain, it can be severely disrupted by PTSS among trauma survivors.

War captivity is an extreme traumatic experience that entails harsh physical and psychological abuse, such as torture, deprivation of basic needs, humiliation, threats and mock executions [1]. Even decades after repatriation, captivity often has long-term psychiatric (i.e., PTSD), somatic and interpersonal ramifications [e.g.,2,3]. The present study investigates the relationship between attachment, pain, and posttraumatic stress symptoms (PTSS) among ex-POWs and control veterans.

Pain, attachment and war captivity

Physical abuse during captivity might negatively affect pain [4,5]. Ex-POWs have been found to experience high levels of persistent clinical pain and altered pain perception [4,5]. Furthermore, research indicated that ex-POWs had dysfunctional pain modulation and higher levels of pain reporting when their pain threshold was reached [4,5].

The emotional abuse associated with captivity might impact the ability to trust others, manifested in attachment [e.g.,1]. Attachment orientations are cognitive-emotional schemas of the self and others [6]. Adult attachment can be conceptualized along two dimensions: attachment anxiety (worry over the availability and positive regard of others) and attachment avoidance (discomfort with closeness and dependence on others) [7]. Low levels on both dimensions indicate attachment security.

Attachment may change as a result of meaningful interpersonal life events [8]. While positive life events are associated with attachment security [9], negative life events are implicated with attachment insecurity [10]. As such, exposure to prolonged and deliberate interpersonal trauma, such as captivity, may undermine attachment [1]. Indeed, studies [11,12] revealed higher attachment insecurities, which increased over time among ex-POWs, compared to decreasing or unchanging attachment insecurities among controls.

Pain, attachment and PTSS

The mutual maintenance model [13] suggests that PTSD and pain are mutually maintained by a variety of psychological mechanisms, including elevated arousal, attention bias, reasoning bias, reminders of the trauma, and avoidant behaviours. Indeed, research indicates that PTSS are associated with higher clinical pain in both civilian and military samples [15–17]. Furthermore, traumatized individuals experienced more intense and widespread clinical pain, compared to healthy controls and patients with anxiety [18]. A more complex pattern was found with regard to experimental pain [14-16]. For example, a previous study indicated that traumatized individuals had higher pain thresholds (i.e., decreased sensitivity to pain). However, at the same

* Corresponding author at: Department of Psychology, University of Southern Denmark, Campusvej 55, DK-5230 Odense M, Denmark.
E-mail address: tandersen@health.sdu.dk (T.E. Andersen).

http://dx.doi.org/10.1016/j.jpsychores.2015.10.008
0022-3999/

time they reported elevated pain when the thresholds were exceeded [17].

Literature regarding PTSS and attachment implies a reciprocal relationship. The first direction implies that attachment might predict PTSS. Exposure to trauma activates attachment by recalling figures that provide a sense of protection [18]. This mobilization might act as a resilience factor, helping the individual cope and decrease the risk for PTSS. Moreover, even after the trauma, activation of the attachment system might ease the negative effects of PTSS, creating a soothing effect [18]. In line with this contention, a prospective study among Israeli undergraduates indicated a relationship between attachment before the Gulf War and the subsequent development of PTSS. Furthermore, research indicated a soothing effect of attachment (SEA), i.e., positive effect of secure representations on cognitive manifestation of PTSD [18]. Participants with PTSD had longer response times in identifying the color of trauma-related words, compared to negative or neutral words, indicating greater mental accessibility of the traumatic content [19]. However, priming with a security-related word reduced this heightened accessibility [18].

However, in the second direction of association, PTSS might detrimentally affect attachment. Symptoms such as avoidance or outbursts of anger, may lead to negative interpersonal events, which may heighten attachment insecurities [10]. Furthermore, it is suggested that while a healthy attachment system seems to serve as a buffer against emotional and physical stressors, it may be disrupted by traumatic reaction [2]. Specifically, Herman observed that prolonged captivity harms human relationships and leads to dysregulation of interpersonal functioning [1]. Likewise, Mikulincer et al. [2] noted that the reactivation of trauma, reflected in PTSS, might erode the sense of security and lead to disorganization of the attachment system over time, so that its functioning might be damaged.

Research supports both possibilities. Studies among ex-POWs found that PTSS predicted increased attachment insecurities over time [11,12]. Furthermore, ex-POWs with chronic PTSD exhibited disruptions in the soothing and healing functions of attachment [2]. Although ex-POWs searched for representations of a security provider, this activation of attachment failed to soothe them [2].

Attachment and pain

According to Bowlby [8], attachment motivates seeking proximity to significant others as a way of attaining security and comfort when in pain. The relationship between attachment and pain might also rely on affect regulation. It has been proposed that attachment insecurities might be related to persistent pain due to dysfunctional affect regulation and problematic adjustment to acute pain [20]. Research indicates associations between attachment insecurities and persistent clinical pain [20-23]. A number of experimental pain studies found attachment insecurities to be associated with both lower [23-26] and higher pain thresholds [22].

Although research on the effect of secure representations on pain is quite limited, studies suggest that attachment may have a buffering effect on the experience of pain. Pictures of attachment figures, compared to pictures of strangers, have found to lead to reductions in pain and pain related neural activity [27]. Likewise, priming mental representations of loved ones had a positive effect, leading to higher pain thresholds [28].

PTSS, captivity, attachment and pain

The documented associations between attachment and pain [e.g.,23, 27], as well as PTSS and pain [e.g.,17] raise two questions. The first regards the mediation role of attachment within the association between captivity and pain. Specifically, whether attachment acts as a mechanism, thereby explaining increased pain among ex-POWs. Exposure to captivity might damage attachment, leading to high attachment insecurities and low SEA. These negative effects on attachment may, in turn, predict amplified pain.

The second question regards the moderation role of PTSS between captivity, attachment and pain. While attachment as a buffer against pain is well documented, it is still unclear whether this function of attachment may be disrupted by traumatic response, i.e., PTSS. Specifically, PTSS may not only lead to increased attachment insecurities, it may also harm the protective function of attachment on pain. Hence, while attachment security and SEA might be associated with lower pain and act as a mechanism to help relieve the negative effects of captivity on pain, this process might be cancelled or overshadowed by the negative impact of high PTSS.

To the best of our knowledge both the mediation role of attachment between captivity and pain, as well as the moderation role of PTSS between captivity, attachment and pain, have not been investigated. Examination of these significant issues has both important theoretical and clinical contributions. The present study aimed to fill these knowledge gaps by exploring these issues among ex-POWs and controls.

Hypotheses

We hypothesized: A) ex-POWs, compared to controls, will experience higher pain threshold, levels of clinical pain and attachment insecurities and lower levels of SEA; B) PTSS will be associated with higher pain threshold, levels of clinical pain and attachment insecurities and lower levels of SEA; C) high attachment insecurities and low SEA will be associated with higher levels of clinical pain and lower pain threshold; D) PTSS will moderate between attachment insecurities and SEA, and the clinical level of pain and pain threshold; and E) PTSS will moderate the mediating role of attachment insecurities and SEA between captivity, clinical pain and pain threshold.

Method

Participants

The present study uses data from a longitudinal study on the psychological implications of war [29]. The sample included 104 Israeli combat veterans of the 1973 Yom Kippur War: 60 ex-POWs (mean age 57.5 ± 3 years) and 44 control combat veterans (58.8 ± 4 years).

According to Israel's Ministry of Defense, 240 combat soldiers were POWs during the Yom Kippur War. The ex-POW groups consisted of veterans who were captured and imprisoned in Egypt or Syria. The duration of captivity in Egypt was 6 weeks (44/60 of the present sample) and 9 months in Syria (16/60) from 1973 to 1974. In previous measures the ex-POW group included 164 participants in 1991, 144 in 2003, and 183 in 2008.

The control group included combat veterans from the same war, who were never held captive. Controls were selected on the basis of similarity to the ex-POWs in regard to military and personal variables such as age, combat exposure, and rank. In previous measures the control group included 185 participants in 1991, 143 in 2003, and 118 in 2008.

Overall 1–17.5% data were missing across the study variables. No differences were found between the 2 groups with regard to religion ($\chi^2(2) = 1.82$, n.s.), income ($t(92) = 1.58$, n.s.), age ($t(100) = -.28$, n.s.) and health before the war ($\chi^2(1) = .28$, n.s.). Twenty-six percent of participants were married during the war and 70% had completed high school.

Participants were obtained through the records of the Israeli Ministry of Defense. We sent letters of invitation to participate in the present study, followed by a phone call two weeks later. Those who agreed to participate in the study were scheduled for a single testing session. Each participant signed an informed consent after receiving a detailed explanation on the study's aims and procedures. The study was approved by the institutional review board of Tel-Aviv University.

Materials and procedure

Heat–pain threshold

Heat–pain threshold was used to evaluate the sensitivity of the pain system. The threshold was measured using a Peltier-based computerized thermal stimulator (TSA II, Medoc Ltd., Ramat Yishai, Israel), with a 3 × 3 cm contact probe. The probe of the stimulator was attached to the forearm with a Velcro strap. Subjects received four successive ramps of gradually increasing temperature, starting from a baseline of 35 °C, at a rate of 2 °C/s with an inter-stimulus interval of 30 s. During each ramp, subjects were asked to press a switch when a pain sensation was first perceived, thus defining heat–pain threshold. Pressing the switch resulted in an automatic recording of the threshold temperature and reset the probe temperature to baseline. Heat–pain threshold was computed by averaging the readings of four successive trials [30].

The McGill pain questionnaire

The McGill pain questionnaire (MPQ; [31]) provides a quantitative evaluation of the patient's clinical pain experience with a separate measure of sensory, affective and cognitive dimensions. We used two quantitative parameters from the MPQ: pain rating index (PRI) — the total sum of the values of words chosen out of a list of pain descriptors and number of words chosen (NWC) — the number of words chosen from the list.

SEA

SEA was investigated experimentally in the laboratory. First, participants were asked to provide the first names of secure figures using the 6-item WHOTO scale [32], i.e., people from whom they sought proximity (2 items), provided them with a safe haven (2 items), and provided them with a secure foundation for engaging in other activities (2 items). Second, they provided the first names of their parents, siblings, grandparents, close friends, and current and previous romantic partners. Third, we read them a list of 100 first names and asked them to indicate the names of people they knew (acquaintances). This built a list of names for each participant of security providers, other close persons not included in the WHOTO scale, and acquaintances. These names were used in the computerized tasks. No participant had difficulty naming security providers.

We used Stroop color-naming procedure [18] to examine the effect of secure representations in reducing the accessibility of trauma-related mental representations. This procedure has been used in previous studies [6]. The target words were either war-related (e.g., captivity, prison), negatively valenced (e.g., poverty, failure), or neutral (e.g., circle, dress). Words were printed in Hebrew and matched for the number of letters, syllables, and frequency of use. Different blocks of experimental trials were preceded by subliminal presentations of the name of a participant's attachment figure [32] or the name of an acquaintance. Following 30 practice trials, participants performed 144 experimental trials. Each experimental trial began with an *X* in the middle of the screen, which was replaced by a rapid (32-millisecond) subliminal presentation of one of 4 prime names (i.e., attachment figure, close friend, acquaintance, unknown) followed immediately by a masking stimulus (an *XXX* pattern) for 500 ms. Immediately following the prime, one of six possible words (2 captivity-related words, 2 negatively valenced words, 2 neutral words) was presented for 1000 ms in 1 of 4 colors. Each combination of name and color was presented three times with each of the two primes (12 trials for each word in each priming condition = 24 total trials for each word), for a total of 144 trials. None of the participants perceived the subliminal presentation of the names.

SEA was measured as the response time for color-identifying war-related words after attachment figure name-priming compared to the response time for the same words after other-priming (i.e., name of close friend, acquaintance or unknown). The lower the gap (i.e., the lower the response time after attachment figure name-priming while controlling for the response time after other-priming), the stronger the soothing effect.

Attachment anxiety and avoidance

Attachment anxiety and avoidance were assessed using the 36-items Experiences in Close Relationships questionnaire (ECR; [33]). Participants were asked to think about their close relationships, without focusing on a specific person, and rate the extent to which each item accurately described their feelings in such relationships using a 7-point scale ranging from 1 (not at all) to 7 (very much). Eighteen items measured attachment-related anxiety (e.g., I worry about being abandoned) and 18 items measured avoidance (e.g., I prefer not to show a partner how I feel deep down). The reliability and validity of the two subscales have been repeatedly demonstrated [e.g.,6]. In the present study, the inventory was found to have high internal consistency (Cronbach's $\alpha = 0.89, 0.91$ for attachment avoidance and attachment anxiety, respectively).

The PTSD Inventory

The PTSD Inventory [34] was used to measure combat-related PTSS. This instrument is based on the clusters of PTSS according to DSM-IV [35]. The questionnaire consists of 17 statements describing different expressions of the disorder following war experience. Respondents rate each statement according to the frequency of the experience during the last month, on a 4-point scale from 'never' to 'very often'. The total score for the scale was based on the total number of symptoms endorsed. In the present study, the inventory was found to have high internal consistency (Cronbach's $\alpha = 0.96$). The scale was also found to have high convergent validity when compared to diagnoses based on structured clinical interviews [36].

Results

Inter-correlations between the main study measures are presented in Table 1.

Hypothesis A. Captivity, attachment and pain.

To examine differences in pain and PTSS as a function of type of trauma (ex-POWs versus combat veterans), we conducted a series of t-tests for independent samples with type of trauma as factor, and pain

Table 1
Inter-correlations between the main study measures.

Measure	1	2	3	4	5	6	7
1. Pain threshold	1	.09	.11	−.06	.16	.07	.00
2. NWC		1	.95***	.42***	.18	.24*	.26*
3. PRI			1	.41***	.15	.23*	.25*
4. PTSS				1	.36***	.45***	−.15
5. Attachment anxiety					1	.33**	.01
6. Attachment avoidance						1	.02
7. SEA							1
M (SD)	45.10 (3.60)	8.24 (4.50)	18.09 (11.23)	6.92 (5.55)	3.02 (1.13)	4.10 (1.09)	999.91 (281.39)

Notes. 1. PTSS = posttraumatic stress symptoms; SEA = soothing effect of attachment. SEA was measured in milliseconds. Pearson correlations are computed as case-wise relationships. Coefficients for SEA and other variables represent partial correlations.

* = $p < .05$.
** = $p < .01$.
*** = $p < .001$.

measures (PRI, NWC and pain threshold) as well as PTSS as dependent variables. To examine differences in attachment as a function of type of trauma we conducted multivariate analysis of variance (MANOVA) with type of trauma as factor and the two dimensions of attachment insecurity measures (attachment avoidance, attachment anxiety) as the dependent variables. Lastly, we conducted analysis of covariance (ANCOVA) with type of trauma as factor, response time for war-related words after attachment figure name-priming as dependent variable and response time for war-related words after other-priming as covariates, in order to examine SEA (see Table 2). We controlled for Type I error with Bonferroni corrections.

Analysis of PRI and PTSS revealed significant effect for type of trauma. Ex-POWs reported higher pain ratings and more PTSS compared to combat veterans. Analysis of NWC and pain threshold did not reveal a significant effect for type of trauma. Analysis on trauma-SEA did not reveal significant effect for type of trauma.

MANOVA on attachment avoidance and attachment anxiety revealed significant effect for type of trauma, *Pillai's Trace* $F(4180) = 5.44$, $p < .001$, Partial $Eta^2 = .11$. Ex-POWs reported higher levels of attachment avoidance and attachment anxiety compared to combat veterans.

Hypothesis B. PTSS, attachment and pain.

In order to examine the relationship between PTSS on the one hand, and pain measures and attachment insecurities, on the other, we conducted two-tailed Pearson correlations. In order to examine the relationship between PTSS and SEA, we conducted partial correlations with PTSS as the independent variable, response time for war-related words after attachment figure name-priming as the dependent variable, and response time for war-related words after other-priming as covariates (see Table 1).

The analyses revealed significant positive correlations between PTSS and PRI as well as NWC. Meaning, the more the PTSS, the more pain descriptor words chosen and the higher the pain rating. Analyses revealed significant positive correlations between PTSS and attachment insecurities. The more the PTSS, the higher the attachment insecurities. The relationship between PTSS and pain threshold as well as SEA was non-significant.

Hypothesis C. Attachment and pain.

In order to examine the relationship between attachment insecurities and pain measures we conducted series of linear regressions with attachment insecurities as the independent variables and pain measures as dependent variables. In order to examine the relationship between SEA and pain measures we conducted a series of linear regressions with response time for war-related words after attachment figure name-priming as the independent variable, and pain measures as the dependent variables. Response time for war-related words after other-priming was used as covariate.

The relationships between attachment avoidance and attachment anxiety and PRI ($\beta = .20$, $p = .07$; $\beta = .09$, $p = .39$, respectively), as well as pain threshold ($\beta = .15$, $p = .14$; $\beta = .02$, $p = .83$, respectively) were non-significant. However, while the relationship between attachment anxiety and NWC was non-significant ($\beta = .12$, $p = .26$), the relationship between attachment avoidance and NWC was significant ($\beta = .21$, $p = .05$); higher attachment avoidance implied more pain descriptor words and a higher pain rating.

The relationship between SEA and pain threshold was non-significant ($\beta = .00$, $p = .99$). However, the relationships between SEA and PRI as well as NWC were significant ($\beta = .66$, $p = .02$; $\beta = .70$, $p = .02$, respectively). The higher the response time for war-related words after attachment figure name-priming (i.e., the lower the SEA), the more pain descriptor words chosen and a higher pain rating.

Hypothesis D. PTSS as moderator between attachment and pain.

To examine Hypothesis D, we performed a series of multiple regression analyses for attachment insecurities, SEA and the interactions with PTSS, predicting pain measures, and controlling for 2 study groups (ex-POWs vs. controls). All of our predictors were mean-centered prior to entering them into the regression analyses. Significant interactions were probed using the Hayes's [37] PROCESS (model 1) computational macro. Table 3 presents the regression coefficients.

The interaction between SEA and PTSS contributed significantly to the explained variance of pain threshold. Simple effect analyses revealed that among participants with low PTSS there was a significant effect of attachment soothing on the pain threshold ($\beta = -1.03$, $p = .02$) — the longer the response time for war-related words after attachment figure name-priming (i.e., lower SEA), the lower the pain threshold. However, among participants with high PTSS, the soothing effect on pain threshold was not significant ($\beta = .29$, $p = .38$). Other interactions between SEA and PTSS in predicting pain measures were non-significant.

The interaction between attachment avoidance and PTSS contributed significantly to the explained variance of NWC. Simple effect analyses

Table 2
Means, SDs, t tests/analyses of variance F results of pain and attachment measures among ex-POWs and controls.

	Ex-POWs	Controls	t(df)/F (df1, df2)	Cohen's d/η_p^2
	n = 60	n = 44		
	M (SD)	M (SD)		
Pain measures				
PRI	20.22 (10.66)	15.19 (11.49)	−2.08* (83)	.45
NWC	8.98 (4.07)	7.22 (4.91)	−1.80 (83)	.39
Pain threshold	45.30 (3.19)	44.83 (4.11)	−.65** (78.66)	.13
Attachment measures				
Attachment avoidance	4.47 (1.08)	3.60 (.87)	19.42*** (1101)	.16
Attachment anxiety	3.37 (1.08)	2.56 (1.03)	14.56*** (2101)	.13
SEA	942.43(292.90)	1000.50(264.47)	2.50 (1, 97)	.03
PTSS	9.74 (4.37)	2.61 (4.27)	−7.90*** (94)	1.65

Note. Ex-POWs = ex-prisoners of war; PRI = pain rating index; NWC = the number of words chosen to describe pain; PTSS = posttraumatic stress symptoms; SEA = soothing effect of attachment. SEA was measured in milliseconds.
* = $p < .05$.
** = $p < .01$.
*** = $p < .001$.

Table 3
Hierarchical multiple regression analyses predicting pain measures with group, attachment, PTSS, and the interaction between PTSS and attachment.

Predicting variables		Pain threshold	NWC	PRI
		β	β	β
Model 1	Group	.09	−.12	−.04
	Attachment anxiety	.17	.05	−.00
	Attachment avoidance	.00	.13	.12
	PTSS	−.19	.45**	.45**
	Attachment anxiety × PTSS	.05	.00	.05
	Attachment avoidance × PTSS	.06	−.27*	−.27*
Model 3	Group	−11	−.04	.03
	PTSS	.45	1.44**	1.48**
	SEA	−.40	.71*	.65*
	SEA × PTSS	2.654*	1.29***	1.30

Note: *Ns* ranged from 79 to 103. The table depicts a series of regression analyses. PRI = pain rating index; NWC = the number of words chosen to describe pain; PTSS = posttraumatic stress symptoms. SEA = soothing effect of attachment. SEA was measured in milliseconds.
* = $p < .05$
** = $p < .01$
*** = $p < .001$.

revealed that among participants with low PTSS there was a significant effect of attachment avoidance on NWC ($\beta = 2.30, p = .02$) — the lower the attachment avoidance, the fewer pain descriptor words. However, among participants with high PTSS, the effect of attachment avoidance on NWC was non-significant ($\beta = 1.07, p = .22$).

The interaction between attachment avoidance and PTSS contributed significantly to the explained variance of PRI. Simple effect analyses revealed that among participants with low PTSS there was a significant effect of attachment avoidance on PRI ($\beta = .43, p = .04$) — the lower the attachment avoidance, the lower the pain rating. However, among participants with high PTSS, the effect of attachment avoidance on PRI was non-significant ($\beta = -.21$, $p = .21$). Other interactions were non-significant.

Hypothesis E. The mediating role of attachment in the effect of captivity on pain — PTSS as a moderator.

We conducted a moderated mediation model using PROCESS (model 14) to investigate whether the level of PTSS moderated the mediation role of attachment within the relationship between type of trauma and pain measures. The correlation between type of trauma and SEA was non-significant ($r = .16$, n.s.). Hence, we did not include SEA in the analyses as a mediator. In addition, the correlations between type of trauma and pain threshold ($r = .06$, n.s.) as well as NWC were non-significant ($r = .19$, n.s.). Hence, we did not include pain threshold and NWC in the analyses as outcome measures.

The analysis included type of trauma as the predictor, attachment anxiety and attachment avoidance as the mediators, PRI as the outcome measure, and PTSS as moderator. The model revealed that only attachment avoidance mediated the relationship between type of trauma and PRI. Type of trauma had a significant main effect on attachment avoidance (the "a" path in mediation analysis), $b = .26$, $p < .05$. In addition, PTSS significantly moderated the link between attachment avoidance and PRI, $b = -.31$, $p < .05$. In other words, the path (the "b" path in mediation analysis) going from attachment avoidance (i.e., the mediator) to PRI (i.e., the outcome) was qualified by PTSS. As expected, a higher degree of attachment avoidance increased PRI among participants with low PTSS, but did not predict PRI among participants with high PTSS. In other words, being an ex-POW was associated with higher attachment avoidance, which in turn increased PRI among participants with low PTSS (Bootstrap confidence interval (CI) [.02, .30]). This indirect effect was non-significant among participants with high PTSS (Bootstrap confidence interval (CI) [−.18, .02]).

Discussion

The present study aimed to investigate the role of PTSS in the associations between war captivity, attachment and pain. As expected, ex-POWs reported higher levels of pain and attachment insecurities compared to controls. The present findings are consistent with previous studies [4,12], indicating the widespread and long-term ramifications of war captivity. It is suggested that physical torture and psychological abuse during captivity alter pain modulation and contribute to elevated pain [38]. At the same time, the abusive relationship with the captor may permeate the captive's personality, thereby harming basic personal resources, such as attachment [1].

Consistent with previous studies [e.g.,14] we found that PTSS were associated with higher levels of clinical pain. According to the mutual maintenance model, PTSS and pain are mutually maintained by psychological mechanisms, such as reminders of trauma and avoidant behaviours [13]. However, another possibility is that physical harm resulting from torture led to both PTSS and elevated pain. The present study did not control for physical harm and hence cannot rule out this alternative. Future studies should account for this while assessing the link between PTSS and pain.

Results regarding the associations between PTSS and attachment insecurities correspond with previous research [e.g.,18]. It might be that elevated insecure attachment increases the risk for PTSS. However, it is also possible that the negative interpersonal implications of PTSS predicted negative changes in attachment [10]. Due to the nature of the present study, the precise nature of the association between attachment and PTSS cannot be determined. However, it is suggested that the relationship between the two variables is mutual.

As expected, significant correlations between attachment avoidance and SEA, on the one hand, and clinical pain, on the other hand, were found. These results are consistent with previous studies linking attachment insecurities to pain [e.g.,20]. According to the attachment theory, attachment acts as a resource [8]. Hence, low levels of attachment avoidance and high levels of SEA might impact coping with pain, leading to decreased pain perceptions [20]. An alternative explanation, which arises from social pain theory [39], suggests that physical pain and social distress are based on a shared neurological system. Hence, high attachment avoidance or low SEA might lead to elevated physical pain [39]. Contrary to our hypotheses, we did not find associations between attachment anxiety and pain. This discrepancy between our findings and existing theory and empirical findings [20,21] is unexpected.

The main contribution of the present research relates to the moderating role of PTSS between attachment and pain. While attachment avoidance and SEA were related with pain among participants with low PTSS, these associations became non-significant among participants with high PTSS. Moreover, the relationship between captivity and pain ratings was mediated by attachment avoidance only among individuals with low PTSS. Our results imply that although attachment is an important personal resource, its positive impact on pain may not be strong enough among trauma survivors who suffer from elevated PTSS. One explanation for the present findings offers that attachment does have positive impact on pain among individuals with high PTSS. However, this effect is obscured by the pervasive negative implications of higher levels of PTSS on pain. An alternative explanation suggests that PTSS disrupt the attachment system to such an extent [2], that it becomes ineffective in reducing pain.

One may suggest that re-experiencing of the traumatic event, as manifested by high PTSS, exposes the traumatized individual to the limitations of close relationships as a source of safety. At these moments, the protective role of attachment figures (real or internalized) is undermined as the mental apparatus is flooded. The traumatized victim feels helpless and faces the failure of the attachment system to provide a sense of security. Over time, this might erode the attachment system's protective role against distress such as pain.

Several limitations may have affected our findings. First, the present study uses cross-sectional data, hence we cannot infer the direction of causality between attachment, pain and PTSS. Second, the present study uses a highly selective sample of ex-POWs and combat veterans. This emphasizes the necessity of caution in generalizing our results.

The present findings have important theoretical and clinical implications for the treatment of trauma survivors. Our results call attention to the possible role of PTSS in the association between attachment and pain. Ex-POWs who suffer from high levels of PTSS may be particularly vulnerable to pain, partially due to damaged attachment. The present results imply that although attachment can be an important resource for coping with pain, it can be severely disrupted by PTSS. It is important that clinical interventions will focus on the relief of PTSS before enhancing secure attachment.

The authors have no competing interests to report.

References

[1] J.L. Herman, Trauma and Recovery: The Aftermath of Violence, Basic Books, New York, 1992.
[2] M. Mikulincer, Z. Solomon, P. Shaver, T. Ein-Dor, Attachment-related consequences of war captivity and trajectories of posttraumatic stress disorder: a 17-year longitudinal study, J. Soc. Clin. Psychol. 33 (2014) 207–228.

[3] Y. Lahav, R. Rodin, Z. Solomon, Somatic complaints and attachment in former prisoners of war: a longitudinal study, Psychiatry: Interpersonal and Biological Processes, 2015 (in press).
[4] R. Defrin, K. Ginzburg, M. Mikulincer, Z. Solomon, The long term impact of tissue injury on pain processing and modulation: a study on ex-prisoners of war who underwent torture, Eur. J. Pain 18 (2013) 548–558.
[5] K. Prip, A.L. Persson, B.H. Sjölund, Pain when walking: individual sensory profiles in the foot soles of torture victims — a controlled study using quantitative sensory testing, BMC Int. Health Hum. Rights 12 (2012) 40.
[6] M. Mikulincer, P.R. Shaver, Attachment in Adulthood: Structure, Dynamics, and Change, Guilford, New York, 2007.
[7] K. Bartholomew, L.M. Horowitz, Attachment styles among young adults: a test of a four-category model, J. Pers. Soc. Psychol. 61 (1991) 226–244.
[8] J. Bowlby, Attachment and Loss: Volume 3. Loss, Sadness and Depression, Basic Books, New York, 1980.
[9] J.A. Crowell, D. Treboux, E. Waters, Stability of attachment representations: the transition to marriage, Dev. Psychol. 38 (4) (2002) 467 (2002).
[10] J. Davila, R. Cobb, Predicting change in self-reported and interviewer assessed adult attachment: tests of the individual difference and life stress models of attachment change, Personal. Soc. Psychol. Bull. 29 (2003) 859–870.
[11] M. Mikulincer, T. Ein-Dor, Z. Solomon, P.R. Shaver, Trajectories of attachment insecurities over a 17-year period: a latent growth curve analysis of the impact of war captivity and posttraumatic stress disorder, J. Soc. Clin. Psychol. 30 (2011) 960–984.
[12] Z. Solomon, R. Dekel, M. Mikulincer, Complex trauma of war captivity: a prospective study of attachment and posttraumatic stress disorder, Psychol. Med. 38 (2008) 1427–1434.
[13] T.J. Sharp, A.G. Harvey, Chronic pain and posttraumatic stress disorder: mutual maintenance? Clin. Psychol. Rev. 21 (2001) 857–877.
[14] A. Kraus, E. Geuze, C. Schmal, W. Greffrath, R. Treede, M. Bohus, E. Vermetten, Differentiation of pain ratings in combat-related posttraumatic stress disorder, Pain 143 (2009) 179–185.
[15] J.D. Otis, T.M. Keane, R.D. Kerns, An examination of the relationship between chronic pain and post-traumatic stress disorder, J. Rehabil. Res. Dev. 40 (2003) 397–406.
[16] R. Stam, PTSD and stress sensitisation: a tale of brain and body part 1: human studies, Neurosci. Biobehav. Rev. 31 (2007) 530–557.
[17] R. Defrin, K. Ginzburg, Z. Solomon, E. Polad, M. Bloch, M. Govezensky, S. Schreiber, Quantitative testing of pain perception in subjects with PTSD—implications for the mechanism of the coexistence between PTSD and chronic pain, Pain 138 (2) (2008) 450–459.
[18] M. Mikulincer, P.R. Shaver, N. Horesh, Attachment bases of emotion regulation and posttraumatic adjustment, in: D.K. Snyder, J.A. Simpson, J.N. Hughes (Eds.), Emotion Regulation in Couples and Families: Pathways to Dysfunction and Health, American Psychological Association, Washington 2006, pp. 77–99.
[19] G. Emilien, C. Penasse, G. Charles, D. Martin, L. Lasseaux, A. Waltregny, Posttraumatic stress disorder: hypotheses from clinical neuropsychology and psychopharmacology research, Int. J. Psychiatry Clin. Pract. 4 (2000) 3–18.
[20] P.J. Meredith, T. Ownsworth, J. Strong, A review of the evidence linking adult attachment theory and chronic pain: presenting a conceptual model, Clin. Psychol. Rev. 28 (2008) 407–429.
[21] T.E. Andersen, O. Brink, A. Elklit, PTSD symptoms mediate the effect of attachment on pain and somatisation after whiplash injury, Clin. Pract. Epidemiol. Ment. Health 9 (2013) 75–83.
[22] N.E. Andrews, P.J. Meredith, J. Strong, Adult attachment and reports of pain in experimentally-induced pain, Eur. J. Pain 15 (2011) 523–530.
[23] P.J. Meredith, J. Strong, A. Feeney, The relationship of adult attachment to emotion, catastrophizing, control, threshold and tolerance, in experimentally-induced pain, Pain 120 (2006) 44–52.
[24] J.M. Meredith, A review of the evidence regarding associations between attachment theory and experimentally induced pain, Curr. Pain Headache Rep. 17 (2013) 326.
[25] C.F. Sambo, M. Howard, M. Kopelman, S. Williams, A. Fotopoulou, Knowing you care: effects of perceived empathy and attachment style on pain perception, Pain 151 (2010) 687–693.
[26] C.L. Wilson, M.A. Ruben, A pain in her arm: attachment, social support, and the tourniquet task, Pers. Relat. 18 (2011) 241–265.
[27] N.I. Eisenberger, S.L. Master, T.K. Inagaki, S.E. Taylor, D. Shirinyan, M.D. Lieberman, B.D. Naliboff, Attachment figures activate safety signal-related neural region and reduce pain experience, PNAS 108 (28) (2011) 11721–11726.
[28] A.C. Rowe, K.B. Carnelley, J. Harwood, D. Micklerwright, L. Russouw, C.L. Rennie, C. Liossi, The effect of attachment orientation priming on pain sensitivity in pain-free individuals, J. Soc. Pers. Relat. 29 (2012) 488–507.
[29] Z. Solomon, D. Horesh, T. Ein-Dor, A. Ohry, Predictors of PTSD trajectories following captivity: a 35-year longitudinal study, Psychiatry Res. 199 (3) (2012) 188–194.
[30] G. Zeilig, S. Enosh, D. Rubin-Asher, B. Lehr, R. Defrin, The nature and course of sensory changes following spinal cord injury: predictive properties and implications on the mechanism of central pain, Brain 135 (2012) 418–430.
[31] R. Melzack, The McGill pain questionnaire: major properties and scoring methods, Pain 1 (1975) 1277–1299.
[32] R.C. Fraley, K.E. Davis, Attachment formation and transfer in young adults' close friendships and romantic relationships, Pers. Relat. 4 (1997) 131–144.
[33] K.A. Brennan, C.L. Clark, P.R. Shaver, Self-report measurement of adult romantic attachment: an integrative overview, in: J.A. Simpson, W.S. Rholes (Eds.), Attachment Theory and Close Relationships), Guilford Press, New York 1998, pp. 46–76.
[34] Z. Solomon, R. Benbenishty, Y. Neria, M. Abramowitz, K. Ginzburg, A. Ohry, Assessment of PTSD: validation of the revised PTSD Inventory, Isr. J. Psychiatry Relat. Sci. 30 (1993) 110–115.
[35] American Psychiatric Association, Diagnostic and Statistical Manual of Mental Disorders, 4th ed. American Psychiatric Association, Washington DC, 1994.
[36] Z. Solomon, D. Horesh, Changes in diagnostic criteria of PTSD: implications from two prospective longitudinal studies, Am. J. Orthopsychiatry 77 (2007) 182–188.
[37] A.F. Hayes, Introduction to Mediation, Moderation, and Conditional Process Analysis: A Regression-based Approach, Guilford Press, New York, 2013.
[38] A.J. Carinci, P. Mehta, P.J. Christo, Chronic pain in torture victims, Curr. Pain Headache Rep. 14 (2010) 73–79.
[39] G. MacDonald, M.R. Leary, Why does social exclusion hurt? The relationship between social and physical pain, Psychol. Bull. 131 (2) (2005) 202–223.