Characteristics of Response to Experimental Pain in Sexually Abused Women

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Objectives: Women with a history of sexual abuse (SA) commonly report greater pain symptoms. It is still unclear whether enhanced pain susceptibility is the result of altered pain processing and response. Therefore, this pilot study aimed to explore pain sensitivity to experimentally induced pain and associated psychology in women with a history of severe SA.

Methods: Twenty-one survivors of severe, long-lasting SA and 21 control women underwent experimentally induced heat pain and completed psychological questionnaires. Pain measures included heat pain thresholds, pain intensity ratings, and pain tolerance in response to contact heat, painful stimulation delivered to the volar forearm. Questionnaires included somatization (Brief Symptom Inventory), personality traits including harm avoidance, novelty seeking, and reward dependence (Cloninger tridimensional personality questionnaire), and levels of dissociation (Dissociative Experiences Scale).

Results: SA women had elevated heat pain thresholds (45.7 ± 2.2°C vs. 43.9 ± 3.1°C; $P = 0.042$) and higher pain intensity ratings (on a 0 to 100 scale: 80.0 ± 26.6 vs. 51.2 ± 27.7; $P = 0.001$). In addition, they had lower tolerability to painful tonic stimulation, greater somatization, and larger harm avoidance scores. Regression analyses showed that higher pain intensity ratings in SA women associated with greater tendency for harm avoidance but not with levels of dissociation.

Discussion: Women with a history of severe SA seem to have a paradoxical pattern of experimental pain response, characterized by both higher pain thresholds and increased pain intensity ratings. This pattern is associated with the personality trait of harm avoidance. Models that might account for these findings are discussed.

Key Words: sexual abuse, experimental pain, harm avoidance, somatization, pain perception

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Sexual abuse (SA), especially during childhood, often occurs within families and crosses all socioeconomic strata.[1] SA affects about 10% to 25% of women to a certain degree at some point in their lives. However, this may be a conservative estimate, as abuse is typically underreported.[2] Early exposure to SA may lead to severe negative consequences, such as suicide, and increased tendency for somatization[3–5] and a higher incidence of psychological[6–8] and medical disorders.[9] Furthermore, a history of childhood physical or SA is commonly reported among chronic pain populations and has been associated with poorer adjustment to pain and increased pain symptoms.[10,11] These victims show greater incidence of chronic pain disorders such as pelvic pain, headache, gastrointestinal symptoms, and musculoskeletal pain[12–17] and personality disorders.[13] The possible relationships between SA, psychological problems, and pain are supported by the greater incidence and severity of depression, anxiety, and somatization among women with chronic pain disorders.[9,18]

Despite the growing body of research indicating greater pain morbidity among SA women, the specific mechanisms in which such a trauma leads to chronic pain syndromes, and whether there is altered pain perception among these women, have not been elucidated. This may be because of earlier studies' limitations in recruiting and investigating the most appropriate population. This is the first study to investigate women with a severe and well-defined history of SA who are undertaking specialized treatment at a clinical center. Furthermore, most existing studies have concentrated on pain perception among SA women primarily from a psychological perspective and by self-reporting of clinical pain symptoms.[4,6] Therefore, we designed our study to incorporate experimentally induced pain techniques to provide further understanding of the mechanisms of pain perception in SA women. Previously, Fillingim and Edwards[19] have evaluated pain perception using thermal and ischemic pain stimulation on college students. They found an association between history of SA, based on a self-report questionnaire, and decreased sensitivity in response to experimental pain. Other studies that have focused on the response to experimental pain among patients with chronic pain with a self-reported history of SA showed mixed results of either similar or attenuated pain compared with pain patients with no reported SA.[20,21] These findings, and the greater incidence of chronic pain disorders in SA women, emphasize the need to clarify whether these women show an enhanced or attenuated pain response.

This preliminary study was conducted to obtain a more comprehensive understanding of pain perception in SA women by focusing on relevant personality and psychological traits and their responses to experimentally induced pain. SA women have a higher incidence of dissociative disorders and borderline personality disorder (BPD). These disorders may in turn alter their pain processing and response.[11,22,23] A greater response to experimentally induced pain is positively correlated with

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harm-avoidance (HA) scores in healthy participants.[24] Moreover, there is a high incidence of SA among women with pelvic pain,[12] and a greater sensitivity to experimentally induced pain is associated with HA in women with vulvar pain.[25] HA, novelty seeking (NS), and reward dependence (RD) are considered to be heritable traits with a neurobiological basis, as posited by the Cloninger Tridimensional Personality Questionnaire (TPQ). Specific central monoaminergic pathways mediate aspects of each of these 3 dimensions and are related to individual variations in the pattern of response to specific types of stimuli.[26,27] Therefore, to understand further the relations between personality and psychological traits and pain response, we investigated responses to experimentally induced pain, personality questionnaires, and somatic symptom self-reports in a clinical population of women who were severely affected by early-onset, long-lasting SA.

MATERIALS AND METHODS

Patient Population

The sample consisted of women survivors of SA who were participating in a 2-year intensive outpatient treatment program. The program was delivered by the staff at a multidisciplinary clinical center specializing in the treatment of the consequences of SA. Treatment modes included individual and group therapy and occupational rehabilitation. Women in this center were exposed to long periods of severe SA mainly during childhood, and suffered from difficulties in daily functioning and in maintaining interpersonal or intimate relationships.

The inclusion criteria for participation in this study were (1) participation of at least 3 months in the treatment program and (2) being emotionally stable enough over the past month to be enrolled in the study, which included receiving painful stimuli and completing various psychological questionnaires, without risking emotional exacerbation. The final decision with regard to inclusion eligibility was determined for each participant by her primary therapist in consultation with the center's director. To maintain strict participant confidentiality, staff members of the research team were blind to any patient identification data.

This is the first study investigating women with severe and clinically well-defined spectrum of SA history. The strict inclusion criteria and the sensitive nature of the investigated population prohibited the examination of a control group at the same setting. Therefore, we used comparable experimental pain and personality trait data taken from healthy women matched by age, education, and ethnicity that were assessed at the Neurophysiology Laboratory of the Rambam Medical Center. This data obtained from controls was collected a few months earlier using the same equipment, methodology, and protocol as that used in the study group and located not far from the clinical center where the SA women are treated.

Assessment of Experimental Pain

All pain tests were delivered by a single experimenter. Quantitative sensory testing was performed with a Thermal Sensory Analyzer (TSA-2001, Medoc, Ramat Yishai, Israel), using a $30 \times 30\,mm^2$ contact thermode. All stimuli were applied to the volar part of the right forearm.

Heat Pain Threshold

Heat pain threshold (HPT) was defined according to the method of limits.[28] Each woman was asked to define the point at which a nonpainful warm sensation changed into a perceived painful heat sensation. All women were exposed to 3 stimuli by elevating the temperature from 32°C at a rate of 1°C/s with an interstimulus interval of 5 s between each stimulus. An average of 3 stimuli was calculated to determine the pain threshold.

Scoring of Pain Intensity

Magnitude estimation of perceived pain was assessed for both phasic and tonic stimuli. The phasic stimulus was delivered at 47°C for 1 s and the tonic stimulus was given for 60 s at an intensity of 46.5°C. Immediately after the phasic stimulus, the participants reported the level of perceived pain intensity using a numeric pain scale ranging from 0 representing "no pain" to 100 representing "the worst pain imaginable." The assessment of tonic pain scores was obtained in real time (at 5, 20, 35, and 50 s) by a Computerized Visual Analog Scale (COVAS, Medoc, Israel), which consisted of an easily moveable horizontal lever on a 100 mm range with an anchor at each end. The mean of the 4 scores was calculated to determine the tonic pain score.

Participants were told that they could terminate the painful stimulation by removing the thermode in any case they felt the pain to be intolerable. When a participant choose to remove the thermode prior to completion of the trial, she was considered as "low-tolerance" for tonic pain and her mean tonic pain score was calculated using the pain scores reported until this point.

Tridimensional Personality Questionnaire

The TPQ is a 100-item true/false self-report inventory.[27] This instrument was designed to measure the 3 primary personality factors which are considered to be involved in the mediation of particular types of stimuli: (1) HA—associated with serotonin and is characterized by the tendency to respond intensely to previously established signals of aversive stimuli and to learn to passively avoid punishment (34 items); (2) NS—associated with dopamine and is described as the tendency to respond with strong excitement to novel stimuli, leading to the pursuit of reward and escape from punishment (34 items); and (3), RD—associated with noradrenaline and is defined as the tendency to respond intensely to reward signals and to maintain behavior previously related to reward or relief from punishment (30 items). The total score for each dimension was calculated. The reliability of the Hebrew version of the TPQ has been demonstrated by[29] with Cronbach α (0.89 for HA, 0.90 for NS, and 0.85 for RD).

Dissociative Experiences Scale—Hebrew Version

The Dissociative Experiences Scale (DES) was developed in the United States[30,31] and is used to measure the frequency of 28 dissociative experiences that are considered important aspects of the dissociation construct. The instrument was shown to be a valid and reliable screening instrument.[32,33] The Hebrew translation of the DES (H-DES) was shown to have high reliability and validity.[34] The instruments' total score test-retest reliability coefficient was 0.87 ($P < 0.0001$; $N = 141$). Split-half reliability coefficient (calculated using the Spearman-Brown formula) was 0.86 ($P < 0.0001$; $N = 584$). Cronbach α coefficient for the H-DES was 0.91. Convergent validity was calculated by

comparing scores of the H-DES with scores of the Phillips Dissociation Scale (PDS), a 20-item instrument derived from the The Minnesota Multiphasic Personality Inventory 2 (MMPI-2). There is no item overlap between the H-DES and the PDS. A Spearman correlation between the H-DES and the PDS scores for 284 patients was found $r = 0.59$ ($P < 0.001$). Divergent validity was calculated by comparing the scores of the H-DES and the male/female scale of the MMPI-2. As expected, there was no correlation between dissociative experiences and scores on a scale measuring masculinity/femininity ($r = -0.03$; $P < 0.28$).[34] A cutoff score of 30 has been determined to mark potential dissociative psychopathology.[31] However, Waller and Ross[35] have determined that scores on the DES may cause researchers to overestimate the percentage of their sample that has a dissociative disorder. They suggested that pathologic dissociation is a class variable and the "dissociative type" is a member of the Dissociative Taxon (DES-T). The cutoff score for the DES-T (set at 20) was, therefore, also calculated in this study.

Assessment of Somatization Level

The level of somatization was assessed using the short version of the Brief Symptom Inventory[36] that represents one factor in the Symptom Check List-90.[37] This multidimensional screening instrument is a 13-item self-report questionnaire on psychological distress and multiple aspects of psychopathology. It is often included in the evaluation of patients with pain,[38] and has also been found to be appropriate for the Israeli population.[39] The questionnaire rates the frequency of complaints or symptoms in different areas of the body, including chest pain, headache, low back pain, vomiting, dizziness, flushes, or numbness.

Statistical Analyses

To assess the intercorrelations among experimental pain measures (pain thresholds and magnitude estimation of pain scoring), each individual TPQ trait (ie, HA, NS, and RD), somatization, and dissociation levels, Pearson correlations were conducted. Group differences for experimental pain and characteristics of personality traits were tested using *t* tests. Linear regression analysis was also performed to explore the relative contribution of TPQ traits and somatization in the prediction of experimental pain ratings. A logistic regression model was set to define the variables that characterize the study group versus the control group. Data were analyzed using the Statistical Package for the Social Sciences (version 17.0). Descriptive statistics are reported as mean ± SD, and the significance was set at $P < 0.05$.

RESULTS

The study sample consisted of 42 women, 21 were SA patients and 21 controls. Mean age of the entire sample was 30.04 ± 11.4 (median age of the SA was 26.0 y old and 29.0 y in the control group). The mean number of years of formal education for the entire sample was 14.5 ± 2.1 years (13.9 ± 2.6 y for the SA women vs. 15.1 ± 2.3 y for the controls). All participants from both groups were Caucasian ethnicity. Age and education levels were not correlated with any of the experimental pain measures nor with TPQ personality traits or somatization levels. In the study group, SA onset and duration and the duration of treatment in the rehabilitation center were not associated with age or education. Demographical data and characteristics of SA history and dissociation levels of the SA women are presented in Table 1. Data show that SA women were younger than 10 years of age when their abuse started and that they experienced long-term abuse.

Dissociation and Pain

Twelve women (57.1%) showed a dissociative psychopathology (DES-T score above the cutoff score of 20). The level of dissociation in both measures of DES and DES-T was not correlated with any of the experimental pain scores or with the personality traits defined by the TPQ. A trend for positive correlation was found between the somatization scores and DES and DES-T ($r = 0.417$, $P < 0.053$; $r = 0.413$, $P = 0.061$, respectively).

Characteristics of TPQ Personality Traits and Somatization

Each subscale of the TPQ, that is, HA, NS, and RD, was analyzed. Figure 1 depicts the TPQ scores of both groups. SA women, compared with controls, showed higher levels of HA (17.5 ± 7.6 vs. 12.9 ± 6.5; $t = 2.056$; $P = 0.047$). No significant differences were noted for NS and RD. In addition, SA women were found to have higher somatization scores (20.8 ± 8.4 vs. 12.3 ± 8.9; $t = 2.471$; $P = 0.021$).

Characteristics of Experimental Pain Perception

In the SA group, 7 women (33%) were characterized as having low tolerance to pain, as they did not complete the tonic pain assessment due to feeling unbearable pain. They terminated the tonic pain test after the first or second pain report, about 10 to 25 s from the beginning of the stimulation (thus, their tonic pain scores were calculated as the mean of these pain reports). Conversely, none of the women in the control group terminated the tonic pain assessment early. The low-tolerance women scored the phasic stimulus and the first tonic stimulation as 100 on the 0 to 100 Numerical Pain Scale. However, no difference between the low-tolerance patients and the other patients was noted with regard to HPT (44.9 ± 2.3°C vs. 46.1 ± 2.1°C; $P = 0.521$). Comparison between the SA and control groups indicates a tendency for higher pain ratings

TABLE 1. Demographics and Characteristics of Exposure to Sexual Abuse and Dissociation Levels Among the SA Women

	SA Group
Age of SA onset (y)	9.52 ± 6.7
Duration of SA (y)	4.6 ± 6.4
Time of rehabilitation treatment (mo)*	25.5 ± 18.2
Dissociation (DES) level	27.9 ± 1.5
DES-T level	24 ± 1.5
Marital status:	
Single	9 (43%)
Married	5 (24%)
Divorced	7 (33%)
Work status	
Employed	13 (62%)
Unemployed	8 (38%)

Data are expressed as mean ± standard deviation or percentage.

*Seven women were treated by other community caregivers services before joining to the program at the Multidisciplinary Treatment Center for Victims of Sexual Abuse.

DES indicates Dissociative Experiences Scale; DES-T, Dissociative Experiences Scale-Taxon; SA, sexual abuse.

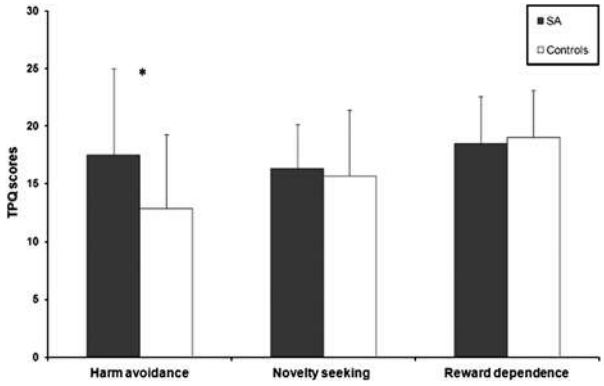

FIGURE 1. Characteristics of Tridimensional Personality Questionnaire, personality traits in sexual abuse, and control groups.

among the SA group 73.8 ± 28.3 versus 60.4 ± 19.4, but these differences did not reach significance ($P = 0.085$). Owing to the difficulty in adequately calculating the tonic pain ratings among the low-tolerance women, further analyses for the tonic pain measure will not be presented.

Higher pain thresholds were found in the SA group compared with controls (45.7 ± 2.2°C vs. 43.9 ± 3.1°C; $t = 2.071$; $P = 0.042$). In contrast, SA women reported significantly higher pain scores in response to the phasic 47°C noxious stimuli (80.0 ± 26.6 vs. 51.2 ± 27.7; $t = 3.645$; $P = 0.001$, respectively). No correlations were found in the study group between the age of SA onset, SA duration, or duration of rehabilitation treatment and any of the experimental pain measures (pain threshold and pain scores).

Associations Between Experimental Pain and Personality Variables

Higher pain scores were correlated with higher HA levels only in the study group ($r = 0.500$; $P = 0.035$). No such associations were found in the controls ($r = 0.060$; $P = 0.796$). Conversely, a negative correlation between NS levels and pain scores was found in the controls ($r = -0.603$; $P = 0.030$) but not in the study group ($r = -0.205$; $P = 0.414$). In both groups positive correlations were found between scores of HA and somatization ($r = 0.674$, $P = 0.008$ and $r = 0.530$, $P = 0.029$, respectively). HPT were not correlated with somatization or any of the TPQ measures.

Logistic regression analysis was performed to define which variables characterize the SA women. This model ($P = 0.003$) showed that higher pain thresholds and higher HA scores are associated with a history of SA (Table 2). Finally, linear regression analysis was performed to better define which of the study variables was associated with higher phasic pain scores. The results of this model ($R^2 = 0.479$; $P < 0.001$) indicated that a history of SA and higher HA scores are associated with enhanced pain perception, but no significant role was found for somatization scores.

Antidepressant Use

As a possible confounder, data were collected on usage of antidepressants. Eleven SA women had used antidepressant medications on a regular basis. Compared with SA women who had not used antidepressant medications, these women were characterized by an early age of exposure to SA (6.0 ± 5.5 y vs. 13.1 ± 1.1 y; $t = 2.26$; $P = 0.021$) and longer duration of exposure to SA (7.9 ± 7.6 y vs. 1.3 ± 1.8 y; $t = 2.67$; $P = 0.015$). No differences with regard to other experimental pain and personality-assessed variables were noted between SA women with and without antidepressant medications.

DISCUSSION

Despite a growing awareness for the association between a history of SA and a greater incidence of pain symptoms, it is not yet well understood whether the higher pain morbidity is a consequence of altered pain modulation and/or processing mechanisms, or whether it could be attributed to other variables such as personality and psychological factors. Thus, the focus of this study was to investigate the relations between a response to experimentally induced pain and specific personality and behavioral variables among SA victims. The main findings of this study were that SA women were characterized by (1) elevated pain thresholds and higher pain intensity ratings in response to a noxious phasic stimulation, (2) greater incidence of lower tolerability to painful tonic stimulation, (3) greater somatization and HA scores, and finally (4) higher phasic pain ratings were found to be associated with a greater tendency for HA but not with dissociation scores.

The pain measures highlight contradicting facets of pain response to experimentally induced noxious stimulation. On the one hand, a higher temperature was required to elicit pain sensation, but in contrast, when a noxious stimulation was delivered, it was perceived as more painful and less tolerable. Furthermore, Fillingim and Edwards[19] found no such contradiction; a history of childhood abuse was associated with decreased sensitivity to experimentally induced pain. In addition, increased pain symptoms and poorer self-reported health and greater negative affect were reported in these women. Our findings are in accordance with previous studies that focus on pain among women with BPD, many of whom share traumatic events similar to SA victims. These studies showed an attenuated response to experimental pain stimulation.[40] For example, higher HPTs

TABLE 2. Logistic Regression Model to Define Variables That Characterized SA Women

						95.0% CI for OR	
Variable	**B**	**SE**	**Wald**	**P**	**OR**	**Lower**	**Upper**
Harm Avoidance (TPQ)	0.142	0.064	4.91	0.027	0.868	0.766	0.984
Pain threshold	0.448	0.193	5.38	0.020	0.639	0.437	0.933

B indicates estimate; CI, confidence interval; OR, odds ratio; P, probability; SE, standard error of the estimate; TPQ, tridimensional personality questionnaire; Wald, the scores of the test of significance.

and lower pain ratings have been reported in BPD, suggesting that the hypoalgesia can be attributed to altered intracortical processing similar to certain maladaptive states[41] and changes in the functional magnetic resonance imaging response to painful stimulation have been linked to attenuation of pain processing.[42]

Our findings raise the possibility that the exposure to SA may lead to brain alterations that stem from altered pain processing caused by the traumatic experience. For example, Bremner et al,[43] reported deficits in hippocampal function and structure in women with SA-related trauma. In addition, evidence obtained by magnetic resonance imaging of SA women showed reduced volume of specific brain regions, such as the hippocampus, corpus callosum, and frontal cortex, that were associated with the age at which SA occurred.[44] SA during early childhood was also found to be associated with reduced gray matter volume in the visual cortex of these women.[45] As mentioned earlier, greater incidence of pelvic pain disorders were found among SA women.[12] With regard to this, brain imaging studies in women with provoked vestibulodynia indicated increased activation and morphological alterations in brain areas associated with pain modulation.[46,47] Thus, these studies may indicate that being exposed to SA leads to brain changes which may affect the degree to which a sensory stimulus is perceived as painful.

The complexity of our findings raises the question of using the experimentally induced pain approach to investigate responses to clinical pain. It may be suggested that SA women use different coping mechanisms in these 2 different contexts of pain. It should be noted that pain threshold was negatively correlated with pain intensity in both SA and control groups, but these 2 psychophysical measures are distinct in that they require different tasks and represent separate facets of pain perception.[48] The distinguishable properties of these 2 pain measures may explain the higher pain intensity ratings despite higher pain thresholds.

In this study, the higher pain ratings in response to the noxious stimulus observed may be explained, for example, by the involvement of other cognitive mechanisms such as expectation, attentiveness, and emotional state, which may modify the aversiveness of pain.[49–51] It has been suggested that dissociative states, which affect conscious mental functioning, might serve as a defense mechanism protecting against the physiological and cognitive consequences of the aversiveness of pain.[52,53] In this study, dissociation was not associated with the response to experimental pain. This is supported by the findings of Horowitz and Telch,[54] who reported that dissociation did not lead to greater pain tolerance but led to significantly greater reports of pain.

Another possible explanation for the apparent discrepancy between the increased pain ratings and the elevated pain thresholds found in our study might have to do with the unique psychological consequences of long-lasting SA during childhood. Compared with other traumatic experiences, chronic SA is usually perpetrated by someone the child knows well, such as a parent or another close relative. SA children are often dependent upon the adult who abused them for nurturance and survival. It has been suggested that this dependence may serve as a strong incentive for the child to minimize the abuse, and sometimes to ignore or to forget it completely.[55–57] This is because acknowledging or becoming aware of the abuse carries with it the risk of alienating the abusive caregiver, who might withdraw his care or his love from the child or may risk breaking the vital attachment bond with the caretaking. Children who grow up under these circumstances may develop cognitive tendencies that allow them to act and feel as if the abuse never happened. To do that, many of them may need to redefine noxious abusive stimuli as benign. This process might result in elevated thresholds for identifying a heat stimulus as painful, even in the presence of an overall increased sensitivity to pain. Interestingly, traumatic childhood experiences in which the perpetrator was a close relative were more likely to result in chronic pain syndromes in adulthood than other types of trauma.[58]

Another interesting finding was that greater intensity pain ratings were associated with higher HA scores. The trait of HA is characterized by the tendency to respond intensely to aversive stimuli and to learn to avoid such stimuli. It has been suggested that HA corresponds to a higher level of serotonin transmission. Serotonin is considered to be a major neurotransmitter involved in pain inhibition mechanisms. Higher binding to serotonin receptors in the cerebral cortex has been shown to be associated with a higher tendency to avoid danger, as determined by the TPQ in healthy adults,[59,60] and in patients with pain with irritable bowel syndrome.[61] Given that part of the variability in pain perception is attributed to personality traits and coping mechanisms, it may be assumed that the tendency for HA is associated with maladaptive coping strategies. Granot[25] reported that higher pain intensity ratings in women with provoked vestibulodynia (considered often to be associated with a SA history) was mediated by higher HA scores. The exaggerated pain intensity ratings seen in this study among SA women, therefore, may be explained by linking alarming responses to possible hazardous situations that serve as a possible protective mechanism.

There is still a need to understand whether pain attenuation in SA women reflects a dysfunctional nociceptive system, or whether it might be due to psychological processing that alters the pain response. This lack of clarity partially stems from the fact that most former studies were based on nonclinical samples. This may be because of the participants in these previous studies often being defined as SA victims by self-report questionnaires, with little information as to the nature, onset, and duration of the SA, and the level of consultation with professionals who specialize in the treatment of SA. Therefore, we designed this study to investigate women with a severe and well-defined history of SA, by recruiting participants from an ongoing SA rehabilitation program. Our sample, therefore, might be considered to more truly represent the profile of women who are victims of severe exposure to long-lasting SA. Nevertheless, despite the advantages of these strict recruitment criteria, our results concur with those of Fillingim and Edwards[19] study in which we found a greater pain threshold in SA women. This implies that with regard to this pain measure, self-report questionnaires are analogous to using the more well-defined sample group. Therefore, such research also brings relevant valuable understanding to the pain characteristics in these women.

Several limitations in this study that may affect the generalization of our findings should be noted. First, due to our strict recruitment criteria and the care taken to avoid a situation where a woman would feel demoralized or her emotional state exacerbated by participating in such a study, the sample size was relatively small and did not

include the most severely affected patients within our study population. Second, the selection of the control group; although the same equipment and protocol of experimental pain were used, the control group was examined in a different setting which may have had some impact on the differences between groups. Third, although we applied heat stimuli, which is one of the most commonly used modalities in psychophysical pain research, it could be argued that the use of one modality of thermal pain and the application of partial psychophysical assessment that included only static pain measures may be limiting, as the inclusion of dynamic pain measures may better represent mechanisms of pain modulation.[48] The use of heat stimuli has been beneficial due to accurate thermal discrimination capabilities that are further enhanced in the noxious thermal range compared with the innocuous one,[62,63] and therefore, may be considered as a suitable pain modality to explore our study question. Despite these possible limitations, this preliminary study provides potentially valuable insight with regard to the psychological and behavioral consequences of exposure to SA on perceiving and processing of experimentally induced pain.

Future studies with a larger sample size may shed more light on other psychological associations of the altered pain sensitivity in SA women, including coping mechanisms. For example, SA women are more vulnerable to self-mutilative behavior (SMB) defined as the intentional act of tissue damage to shift emotional pain into physical pain.[20] Normally, it is expected that body injury will cause pain and evoke an aversive response and consequently to HA behavior. However, as SMB is often reported as occurring for psychological relief and is not experienced as pain, this behavior may support the claim of attenuated pain sensation among SA victims.[64–67] In our sample, preliminary analyses showed no differences in any of the experimental pain measures and TPQ and the somatization levels between SMB women and non-SMB women. Future investigations may explore whether SMB is linked to attenuated pain sensitivity or simply is an expression of coping with emotional stress independent of the functionality of the nociceptive system.

The possible clinical relevance of these exploratory findings concerns the altered pain response in SA women. As the pain response represents a self-protective mechanism, the altered pain profile of SA women may be considered for the assessment of their well-being and rehabilitation. The particular associated psychological effects, such as HA, may result in concerns about compliance and adherence of treatment interventions in these women. Further studies should include a wider battery of dynamic and static psychophysical tests that encompass varying pain modalities to show both whether there are altered pain characteristics and the nature of these changes in response to pain.

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