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Changes in Sympathetic Nervous System Activity are Associated with Changes in Sexual Wellbeing in Women with a History of Childhood Sexual Abuse

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Abstract

Introduction—Women with histories of childhood sexual abuse (CSA) have higher rates of sexual difficulties, as well as high sympathetic nervous system (SNS) response to sexual stimuli.

Aim—To examine whether treatment-related changes in autonomic balance, as indexed by heart rate variability (HRV), were associated with changes in sexual arousal and orgasm function.

Methods—In Study 1, we measured HRV while writing a sexual essay in 42 healthy, sexually functional women without any history of sexual trauma. These data, along with demographics, were used to develop HRV norms equations. In Study 2, 136 women with a history of CSA were randomized to one of three active expressive writing treatments that focused on their trauma, sexuality, or daily life (control condition). We recorded HRV while writing a sexual essay at pre-treatment, post-treatment, and 2 week, 1 month, and 6 month follow-ups; we also calculated the expected HRV for each participant based on the norms equations from Study 1.

Main Outcome Measures—Heart rate variability, Female Sexual Function Index (FSFI), Sexual Satisfaction Scale – Women (SSS-W)

Results—The difference between expected and observed HRV decreased over time, indicating that, post-treatment, CSA survivors displayed HRV closer to the expected HRV of a demographics-matched woman with no history of sexual trauma. Also, over time, participants whose HRV became less dysregulated showed the biggest gains in sexual arousal and orgasm function. These effects were consistent across condition.

Conclusions—Treatments that reduce autonomic imbalance may improve sexual wellbeing among CSA populations.

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Keywords

childhood sexual abuse; heart rate variability; sexual function; autonomic nervous system; expressive writing

Introduction

The role of the autonomic nervous system in trauma has been well documented. Threat activates the sympathetic (SNS) and parasympathetic (PNS) nervous systems, and high levels of threat exposure, particularly early in life, can significantly affect an individual's long-term ability to modulate the SNS and PNS response to subsequent stress[1]. In response to a normal stressor, the SNS instigates autonomic arousal responses (e.g., increased blood pressure, perspiration, faster breathing), which soon return to resting equilibrium after removal of the stressor. However, after a traumatic stressor, SNS response to trauma-related stimuli is often elevated[2].

Women with a history of childhood sexual abuse (CSA) evidence relatively high SNS activity[3], particularly in response to sexual cues[4]. This is important, as there is a curvilinear relationship between autonomic balance and vaginal arousal such that very high SNS (or low PNS) activity is associated with lower sexual arousal in women[5]. It is likely that the SNS dominance displayed by CSA survivors towards sexual cues leads to poorer sexual arousal, and by extension, poorer orgasm function. Indeed, one study in CSA populations has found that relatively high SNS arousal to sexual stimuli is related to low sexual arousal and orgasm function[6]. However, it is unknown if *changes* in autonomic balance to sexual stimuli are associated with concomitant changes in sexual arousal and orgasm function.

Given that CSA survivors, compared with women without abuse histories, are at higher risk for sexual dysfunction[7], examining mechanisms by which sexual wellbeing may be augmented in this sample is important. To this end, the present study explored whether treatment-related changes in autonomic arousal to sexual stimuli (writing a sexual essay) were associated with improvements in sexual wellbeing among adult women with a history of CSA. SNS activity was examined using heart rate variability (HRV), an objective and noninvasive marker of autonomic function. HRV is a measure of vagal tone, and reflects the degree of variability of beat-to-beat intervals across time. High levels of HRV (indicating low SNS activation and/or high PNS activation) are a sign of healthy cardiac function and enhanced physical[8] and mental health[9], whereas high sympathetic tone (reflected as reductions in HRV), makes the heart vulnerable to arrhythmia and sudden death[10].

Data for this study were taken from a randomized controlled trial[11] where CSA survivors were randomly assigned to one of three expressive writing treatments. The expressive writing paradigm, in which participants write continuously and anonymously about a pre-specified topic for 20 – 40 minutes, has been shown to reduce SNS activity to trauma reminders[12]. In concert with ameliorating physical health symptoms, expressive writing has also been shown to improve indices of mental health such as depression and posttraumatic stress symptoms[13]. Of particular importance to the present study, expressive writing has

been shown to be an effective treatment for sexual dysfunction in women with CSA histories[11].

Aims

Our aim was to test if changes in autonomic balance predicted treatment-related changes in sexual function in women with a history of childhood sexual abuse. We hypothesized that women with trauma histories would have significantly lower HRV (corresponding to higher SNS response) to sexual stimuli (writing a sexual essay) than what would be expected of healthy non-abused women. In Study 1, we developed norms equations to predict HRV to sexual stimuli expected of healthy, sexually functional women with no trauma history. In other words, the predictive equation would model a "mathematically matched" NSA participant who is exactly similar to the CSA participant in all respects except for abuse history. We predicted that, over time (i.e., pre- to post-treatment), CSA survivors' HRV to sexual stimuli would approach that of healthy never-abused women. We also predicted that as CSA women's HRV to sexual stimuli became less dysregulated (i.e., closer to that expected of a never-abused, sexually functional woman), their sexual arousal and orgasm function would improve. However, given the specificity of the mechanism (SNS activity) to genital arousal, we did not expect changes in HRV to predict a related, but non-genital, construct (sexual satisfaction).

All procedures were approved by the University of Texas at Austin Institutional Review Board from 2004 to 2013, and the trial was registered on Clinicaltrials.gov (identifier NCT01803802). All participants provided informed consent.

Methods: Study 1

Participants

We recruited women with no history of sexual trauma via advertisements in local newspapers and websites using advertisements that noted the sexual nature of the study. Participants were screened over the phone for the following criteria: age 18 or older, physically healthy (free from medical conditions known to impact cardiovascular or sexual function such as high blood pressure), free from sexual difficulties (sexual dysfunction or low sexual satisfaction), no history of sexual or physical abuse in childhood, no unwanted sexual experiences in adulthood, and no traumatic experiences in the three months prior to enrollment. Sexual functioning was further assessed at the experimental session via the Female Sexual Function Index (FSFI; see below). Of the 102 women who were enrolled, 31 reported no partnered sexual activity in the past month, 20 had FSFI scores that indicated sexual dysfunction, and 9 had errors in recording or reducing HRV data (see below). Analyses below thus were conducted on a sample of 42 healthy, sexually functional women with no history of sexual trauma. Although none of the participants reported current depression, 6 women reported a history of a mood disorder diagnosed in the past 5 years; thus, we included depression symptoms as a covariate below.

Main Outcome Measures

Female Sexual Functioning Index—Participants completed the FSFI[14, 15], which is a widely used, extensively validated self-report measure of sexual function that includes six factor-analytically derived subscales: sexual desire, arousal, lubrication, orgasm, pain, and satisfaction. A cutoff score of 26.55 has been validated to reflect clinically relevant sexual dysfunction[15]. Reliability in this sample was excellent (Total scale Chronbach's α = .91; subscales Chronbach's α ranged from .85 – .99).

Beck Depression Inventory—Participants also completed the BDI-II[16], a gold-standard measure of depression symptoms that has been validated in both clinical and non-clinical populations[17]. Scores below 20 indicate no more than mild depression symptoms. Reliability in this sample was excellent (Chronbach's α = .93).

Demographics—Participants provided information about their demographics including age and race, as well as any medication use and nicotine consumption the day of the experimental session.

Heart rate variability—Heart rate was assessed via a 3-lead electrocardiograph (ECG); the ECG signal was collected at 200 samples/sec using AcqKnowledge software (Biopac Systems, Goleta, CA). Electrodes were placed by the experimenter on Einthoven's triangle sites[18] prior to stimuli presentation. Participants then sat at a computer while their heart rate was recorded during two 20-minute segments in immediate succession: one in response to a neutral essay (writing about their previous day) and then during a sexual essay (writing about sex; see http://bit.ly/wKzXT8 for assessment prompts). The neutral essay prompt was derived from the control condition of prior expressive writing studies[19]. The sexual essay prompt was designed to elicit a naturalistic response to sexual thoughts and feelings[6]. Separate analyses have shown that the sexual essay prompt reliably evokes sexual thoughts and feelings[20], as well as moderate arousal[6].

Beat-to-beat (RR) intervals were collected from these recordings using a peak-finding function, and HRV indices were calculated using Kubios HRV Analysis software (Biosignal Analysis and Medical Imagine Group, University of Kuopio, Finland). We used the standard deviation of the RR interval (SDRR, often termed SDNN) as our index of HRV. This time-domain measure is the most commonly used clinical measure of HRV[21, 22] and robust to moderate length recordings (greater than 5 minutes but less than 24 hours[18]. We also tested similar models using a frequency domain measure (the ratio of low to high frequency power, or LF/HF). Our findings were similar across measures of HRV (no difference in which parameters were found statistically significant nor direction of effects) and thus we report only on SDRR.

Results: Study 1

The average age of Study 1 participants was 31.95 (*SD* = 10.41), and participants were predominantly White (64%), mostly or exclusively heterosexual (98%), in a relationship (90%), with at least some post-secondary education (98%). The average BDI-II score in our

healthy non-abused sample was 9.62 (*SD* = 8.87). The average SDRR to sexual essay writing among healthy, non-abused women was 47.76 msec (*SD* = 20.5 msec).

To create a norms equation, we conducted a linear regression with SDRR while writing the sexual essay as the dependent variable. Predictors included HR while writing the sexual essay, and known covariates of HRV: age in years[23], BDI-II scores[24], race (coded: white 1/ non-white 0)[25], number of cigarettes smoked that day[26], and use of cardioactive medications such as anxiolytics (coded: yes 1/ no 0)[27]. The model was significant ($F(6, 41) = 5.39$, $p = .001$), and predicted 49.5% of the variance in observed HRV. The predictive equation (used in Study 2 to calculate *HRVexp*, the HRV to sexual essay, expected of a healthy, sexually functional woman) was as follows:

HRVexp (msec) = 154.42 + HR(−.989) + race(−3.339) + age(−.791) + cigarettes(1.215) + meds(−20.69) + BDI-II(−.04).

For example, to predict HRV (while writing the sexual essay) for a woman who had a HR of 82, who is White, 42 years old, smoked three cigarettes that day, does not take cardioactive medications, and has a BDI-II score of 9, we would calculate the following: *HRVexp* = 154.42 + 82(−.989) + 1(−3.339) + 42(−.791) + 3(1.215) + 0(−20.69) + 9(−.04) = 40.04 msec.

Methods: Study 2

A detailed description of the clinical trial protocol, including entry criteria, study procedures, and the expressive writing treatment protocol (including treatment prompts), can be found in Meston et al.[11].

Participants

Women aged 18 years or older with a history of CSA and current sexual complaints were recruited from the community using flyers and online advertisements, again noting the sexual nature of the study. CSA was defined as “unwanted oral, anal, or vaginal intercourse, penetration of the vagina or anus using objects or fingers, or genital touching or fondling” that occurred before age 16 and no less than 2 years prior to enrollment. To ensure adequate assessment of sexual function, participants were required to be sexually active and to report sexual dysfunction, distress, or low sexual satisfaction during a screening semi-structured clinical interview. Women reporting a traumatic experience in the past 3 months were excluded; however, women with a lifetime history of adult sexual assault (*N* = 16) were included[1]. Current psychiatric medication use was permissible if participants had been stabilized on those medications for at least three months (and included in the present analyses if they indicated no change in medication use throughout participation). Participants with medical conditions potentially impacting autonomic function (e.g., high blood pressure) were included; as in Study 1, use of cardioactive medications was coded and included in calculations of norms equations.

[1]Adult assault history was considered as a covariate; however, its inclusion did not significantly impact the significance nor direction of findings, and thus below we report on results without controlling for history of adult sexual assault.

A total of 136 participants were enrolled and randomized to treatment; however, pre-treatment heart rate variability data were unavailable for 8 participants and thus these participants were dropped from the analyses presented below. Participants (N = 128) had an average age of 34.26 years (SD = 10.32) and were predominantly white (64%), exclusively or predominantly heterosexual (74%) and married or in a committed relationship (53%). Details regarding participant flow are available in Meston et al.[11]; a detailed analysis of attrition can be found in Harte, Hamilton, & Meston[28]. Treatment condition was not associated with dropping out of the study. Irrespective of treatment group, those who terminated treatment prematurely (N = 35, 28% of enrolled participants) were younger compared with completers[28]. Treatment groups did not significantly differ on any demographic or baseline characteristic. All available data from all participants, including treatment dropouts, was included in the present analyses.

Procedures

Following informed consent procedures, participants completed a comprehensive pre-treatment assessment consisting of clinical interviews, and self-report questionnaires assessing mental health and aspects of sexual function and satisfaction (see below). Participants also completed two 20-minute continuous recordings of HR similar to those completed in Study 1 (recording while writing about their day, and then about sex). After completing the pre-treatment assessment, participants were randomly assigned to an expressive writing treatment that consisted of five 30-minute sessions of prompt-guided writing. Randomization was assigned by matching participant numbers to a list of randomly ordered treatment conditions generated at the beginning of the study; participants were assigned their treatment randomization by a study therapist at the time of their first treatment session and thus research staff conducting assessment sessions were blinded to participant's randomization status. Treatment sessions were scheduled approximately once weekly. After the treatment phase, participants completed a post-treatment assessment, as well as 2-week, 1-month, and 6-month follow-up evaluations all identical in procedure to the pre-treatment assessment.

The expressive writing treatment conditions were identical in format and only differed in regard to the writing prompts (see http://bit.ly/wKzXT8 for full text of all prompts). Participants received standard expressive writing prompts to write about either a stressful or traumatic experience (trauma-focused condition[19]), their beliefs about their personal sexuality (sexual-focused condition), or their daily life (control-condition). After the study was completed, linguistic analyses confirmed that participants wrote on-topic, in line with their treatment condition[29].

Main outcome measures

Heart rate variability—Heart rate was collected during assessment sessions only (not during expressive writing treatment sessions). Heart rate variability was calculated as described in the Methods for Study 1.

Sexual functioning and satisfaction—At each assessment session, participants completed the FSFI; for Study 2, we considered the lubrication and orgasm subscales.

Participants also completed the Sexual Satisfaction Scale for Women (SSS-W[30]). The SSS-W has excellent reliability and has been shown to distinguish women with and without sexual dysfunction[30]. The SSS-W measures overall contentment, communication and compatibility with a sexual partner, as well as personal and relational distress regarding sexual problems. For Study 2, we considered the total SSS-W score. Reliability of the FSFI and SSS-W in this sample were acceptable (Chronbach α = .94, and .74, respectively).

Results: Study 2

As predicted, prior to treatment, HRV to sexual essay writing in women with a history of childhood sexual abuse was lower than that observed in healthy nonabused women (see Table 1). At pre-treatment, 76% of participants demonstrated HRV to sexual essay writing that was 1 *SD* lower than the HRV observed in the healthy group (i.e., 76% of participants demonstrated higher SNS/lower PNS activity to sexual essay writing than healthy nonabused women).

To ideographically index the degree of autonomic imbalance, each participant's HRV (obtained while writing the sexual essay) during each assessment was compared with the HRV expected of a demographics-matched sexually functional woman without an abuse history. We first calculated *HRVexp* from the norms equations derived in Study 1. We then calculated *HRVdiff*, by subtracting observed HRV of each participant from her *HRVexp*. High positive values of this parameter reflected hyperactive SNS response and/or hypoactive PNS response; however, as values approached zero they reflected autonomic activity close to that typical of a woman without a CSA history. Indeed, at pre-treatment, *HRVdiff* values were on average positive (average = .002, *SD* = .014), indicating that, relative to demographics-matched non-abused women, women with CSA histories had lower HRV when writing a sexual essay.

We first examined if *HRVdiff* changed with treatment – that is, if participants HRV during sexual essay writing became closer to that expected of non-abused women. We conducted a mixed effect general linear model, with assessment session as the repeated measures variable (pre-treatment, post-treatment, 2-week follow-up, 1-month follow-up, 6-month follow-up), treatment condition (sexual-focused, trauma-focused, or control) as a fixed effect, and random intercept by subject (controlling for individual differences in baseline HRV). Mixed effects GLM are robust to missing data, allowing us to incorporate data from non-completers[31].

There was a significant effect of assessment session ($F(4, 70.20) = 2.97$, $p = .03$). Specific contrasts revealed that there was a decrease in *HRVdiff* from pre- to post-tx that approached significance (Mean difference = −. 002, $p = .15$), and a significant decrease between the pre-tx and 6-month follow-up (Mean difference = −.005, p = .02; see Figure 1). That is, following treatment, participant's HRV to writing a sexual essay became closer to that expected of a healthy, sexually functional woman, and this change was sustained (and even increased) over the long-term follow-up.

We then examined whether change in HRV during the sexual essay predicted change in lubrication and orgasm function, and sexual satisfaction, as a function of treatment condition. We again used a mixed GLM, which allowed for the examination of repeated measures effects with covariates that also changed at each assessment (i.e., whether HRV at each assessment predicted sexual function, both of which changed from pre- to post-treatment).

There was a significant interaction between assessment session and *HRVdiff* in predicting improvements in lubrication function ($F(4,283.20) = 2.50$, $p = .04$). Over time, women whose *HRVdiff* decreased (i.e., became more "normal") showed the improvements in lubrication function, while women whose *HRVdiff* increased (i.e., became more dysregulated) showed deterioration in lubrication function (see Figure 2). Similarly, there was a significant interaction between assessment session and *HRVdiff* in predicting orgasm function ($F(4,275.23) = 4.10$, $p = .003$). As with lubrication function, women whose *HRVdiff* decreased showed the greatest improvements in orgasm function (see Figure 3). In both models, the interaction between *HRVdiff* and treatment condition was non-significant, indicating the effect of HRV did not differ across conditions.

Finally, to test if the effect of change in HRV was specific to sexual arousal, we conducted the same mixed effect model as above, predicting sexual satisfaction. While there was a significant effect of assessment session on sexual satisfaction ($F(4,167.03) = 4.96$, $p = .001$), there was no significant interaction with *HRVdiff*. In other words, although sexual satisfaction improved across participants, this effect did not appear to be related to changes in HRV.

Conclusions

Although the relationship between autonomic activity and female sexual response has been demonstrated across multiple studies using a variety of manipulations[5, 32–34], the present study was among the first to prospectively show that *changes* in autonomic activity in response to psychological treatment are associated with *changes* in sexual function. Our findings suggest that treatment-related changes in sexual cue-induced autonomic activity are relatively longstanding (i.e., beyond a single experimental session) and are associated with clinically relevant targets (i.e., sexual function). Specifically, as women's autonomic balance during sexual stimuli (writing a sexual essay) became less dysregulated (i.e., closer to that expected of a healthy, never-abused woman), they reported enhanced sexual arousal and orgasm function. Our findings support the hypothesis that, in addition to the impact on cognitive and emotional components of sexual wellbeing, psychological treatments may impact sexual function via changes in autonomic response to sexual cues. These findings also suggest that the deleterious effects of CSA on sexual function may be attenuated (or potentially eliminated) through treatments that target autonomic balance. Of note, the effect of HRV specific to sexual arousal and orgasm, which supports the hypothesis that improving autonomic dysregulation during sexual stimuli may improve genital arousal in CSA populations.

These findings have several important clinical and research implications. Findings underscore the importance of an ideographic approach to the treatment of sexual dysfunction. For example, medications that reduce sympathetic tone (e.g., antidepressants), and consequently produce sexual arousal and orgasm side effects in women *without* trauma histories, may actually improve sexual arousal in CSA survivors who have autonomic dysregulation. Assessment of the patient's baseline response to sexual stimuli (very high SNS arousal or anxiety vs. normative, moderate arousal) may be a paramount factor in predicting treatment response and in enhancing treatment matching. For example, it is possible that biofeedback – in which patients are given real-time information about their HRV[35] – may improve treatment outcomes of sexual arousal problems among CSA survivors. Similarly, other means of moderating autonomic activity (e.g., via exercise or meditation) could also promote improvements in sexual function among CSA survivors.

Interestingly, there were no significant differences in change in HRV between the three writing conditions. It is possible that the assessment sessions may have had an effect on autonomic response during sexual essay writing, which eliminated any differences between the expressive writing treatments. The continued change in HRV post-treatment, with greatest treatment benefits not detected until 1 or even 6 months post-treatment (Figs. 2–3), further supports this interpretation. Previous studies have found that psychological distress and PTSD symptoms following sexual assault similarly respond to repeated assessments[36].

In particular, writing about sex and one's own sexuality could be a form of exposure treatment for women with a history of CSA. One prominent theory of therapeutic mechanisms of expressive writing holds that writing about traumatic or stressful topics may be a form of self-guided prolonged exposure[37]. Prolonged exposure entails individuals continuously engaging in an anxiety-provoking thought or memory until their physiological arousal habituates (i.e., subsides;[38]. For participants who had strong anxiety in response to sexual cues (which would elicit an SNS response, both during laboratory assessments and throughout their daily sexual lives), writing in depth about their thoughts and feelings about sexuality may have led to habituation and thus to improved sexual function. The timing of change seen in HRV and trauma symptoms (presented elsewhere[11]) further supports the interpretation that expressive writing had an exposure-like effect. It is also possible that by focusing women's attention to sex in a non-threatening, empowering environment (such as a treatment study for survivors of abuse), expressive writing may have promoted positive emotions such as sexual interest or warmth. Several studies have demonstrated that positive emotions are protective against chronic SNS hyperactivity[39]. Regardless of the mechanism by which HRV is impacted, however, our findings suggest that changes in autonomic function are associated with changes in sexual arousal.

A number of study limitations warrant mention. Most importantly, in construction of our norms equations in Study 1, we selected a group of healthy, non-abused women without sexual difficulties. We did so to characterize the autonomic response of individuals that represented the "end goal" of psychological treatment for CSA survivors. However, this means that our sample in Study 2 differed in two ways – namely, the presence of sexual difficulties as well as abuse histories. We expect that the results presented here would be similar for psychological treatments of sexual dysfunction in women without a history of

CSA to the extent that these patients have sympathetic hyper-reactivity to sexual cues at pre-treatment. The high proportion of sexual dysfunction among women presenting for treatment of conditions associated with autonomic imbalance (e.g., hypertension[40]) suggests there are likely many women who could benefit from such treatments in both CSA and non-CSA populations. However, we expect that, given the impact of CSA on the development of the autonomic nervous system, the population of women who have sympathetic hyper-arousal to sexual cues will include a high proportion of CSA survivors. This is an empirically testable hypothesis, which warrants further study.

While HRV is widely accepted as an index of autonomic activity, some consider the interpretation of HRV as reflecting SNS activity controversial[8]. Generally, the actions of the SNS and PNS are oppositional and inversely correlated and thus, HRV can be said to represent SNS activity[41]. However, complex interactions between the SNS and PNS make it difficult to determine if a lower HRV represents solely increased SNS response[42]. To conclusively determine the role of SNS activity on sexual wellbeing, one would need to use pharmacologic blockade of the SNS, measures of norepinephrine in blood, or a “pure” psychophysiological measure of SNS response such as skin conductance. It is important to note, however, that each of these methods has shown strong correlations with HRV[43–46]. Similarly, the actions of the autonomic nervous system are correlated across various sites in the body, but not universal: cardiovascular autonomic activity (as indexed by HRV) may not perfectly reflect vaginal autonomic activity. However, insofar as vaginal arousal is dependent on vaginal blood flow, there is a strong association between HRV and autonomic processes relevant for vaginal arousal[5].

Another limitation of the present study is that concurrent measurement of HRV and sexual wellbeing prohibited mediation analyses, and thus we cannot conclude that changes in HRV *caused* changes in sexual wellbeing, only that they were strongly associated with one another. Finally, it is possible that our findings were driven by attrition, such that women who remained in treatment tended to have longitudinal decreases in autonomic dysregulation, whereas those who displayed chronically low HRV dropped out. As we could not collect post-treatment data on women who dropped out, this remains unknown.

In conclusion, the present study was among the first to show that expressive writing treatments can improve autonomic balance in sexual response in women with a history of childhood sexual abuse. Moreover, changes in autonomic response to sexual stimuli (writing a sexual essay) were associated with treatment-related changes in sexual function, specifically, genital arousal and orgasm.

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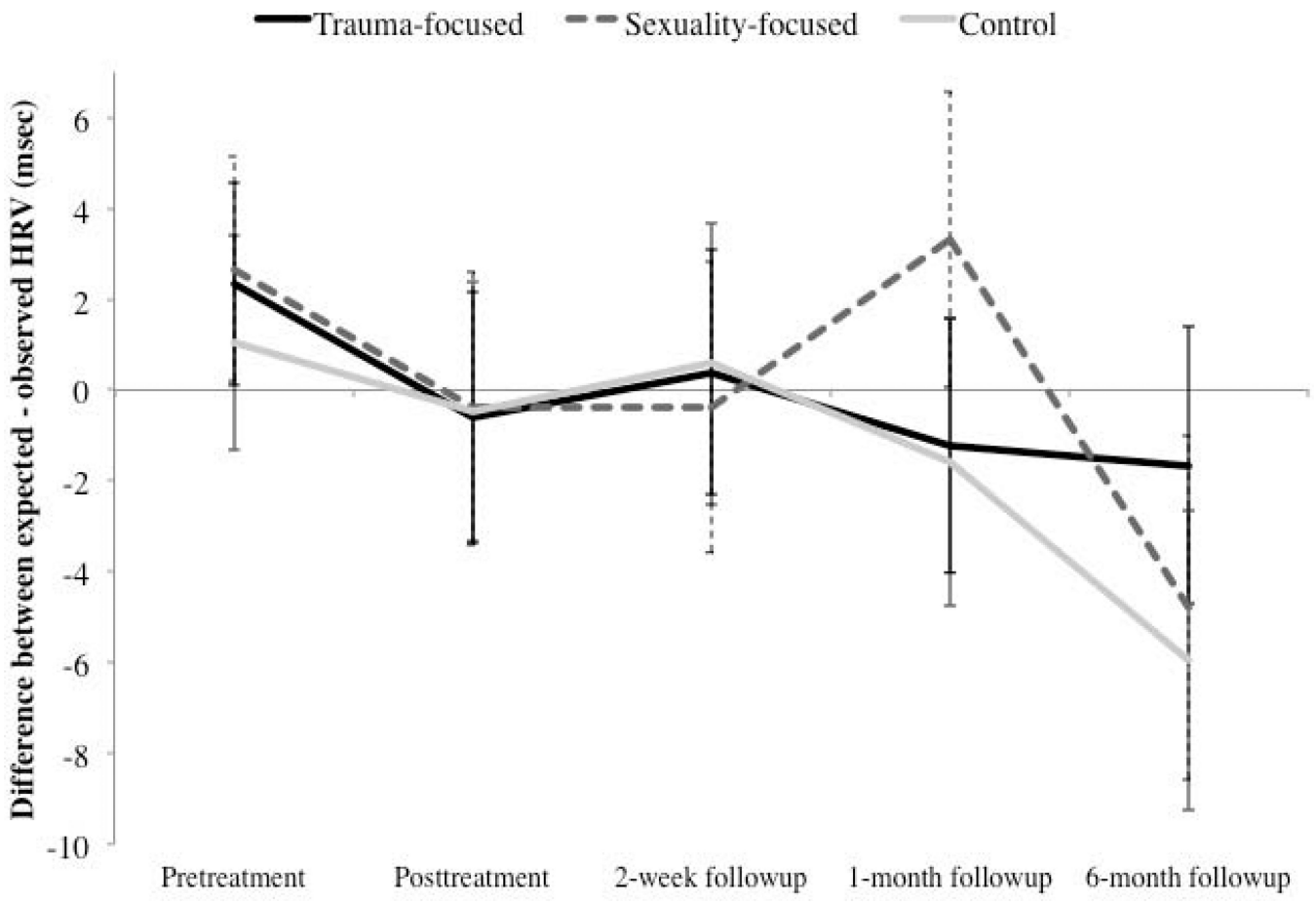

Fig 1.

Difference between expected HRV during sexual essay writing (as calculated from norms equations derived from a sample of healthy, sexually function, never abused women) and actual HRV observed while writing the sexual essay. HRV became significantly less dysregulated over time; treatment condition did not moderate these effects. Error bars represent standard errors of the means

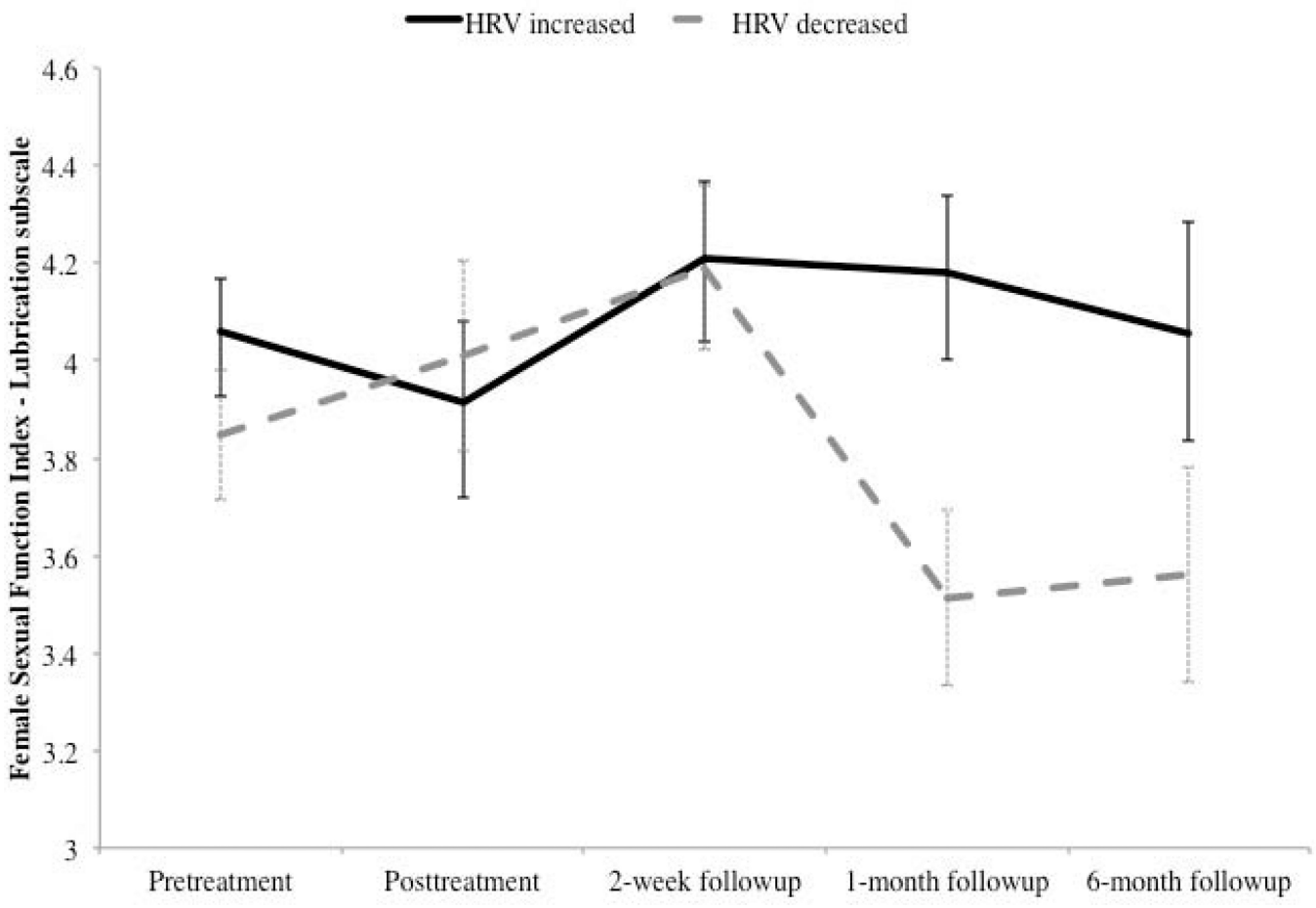

Fig 2.

Interaction between time and change in HRV, as predictors of lubrication function. There were no significant differences between treatment conditions. Error bars represent standard errors of the means

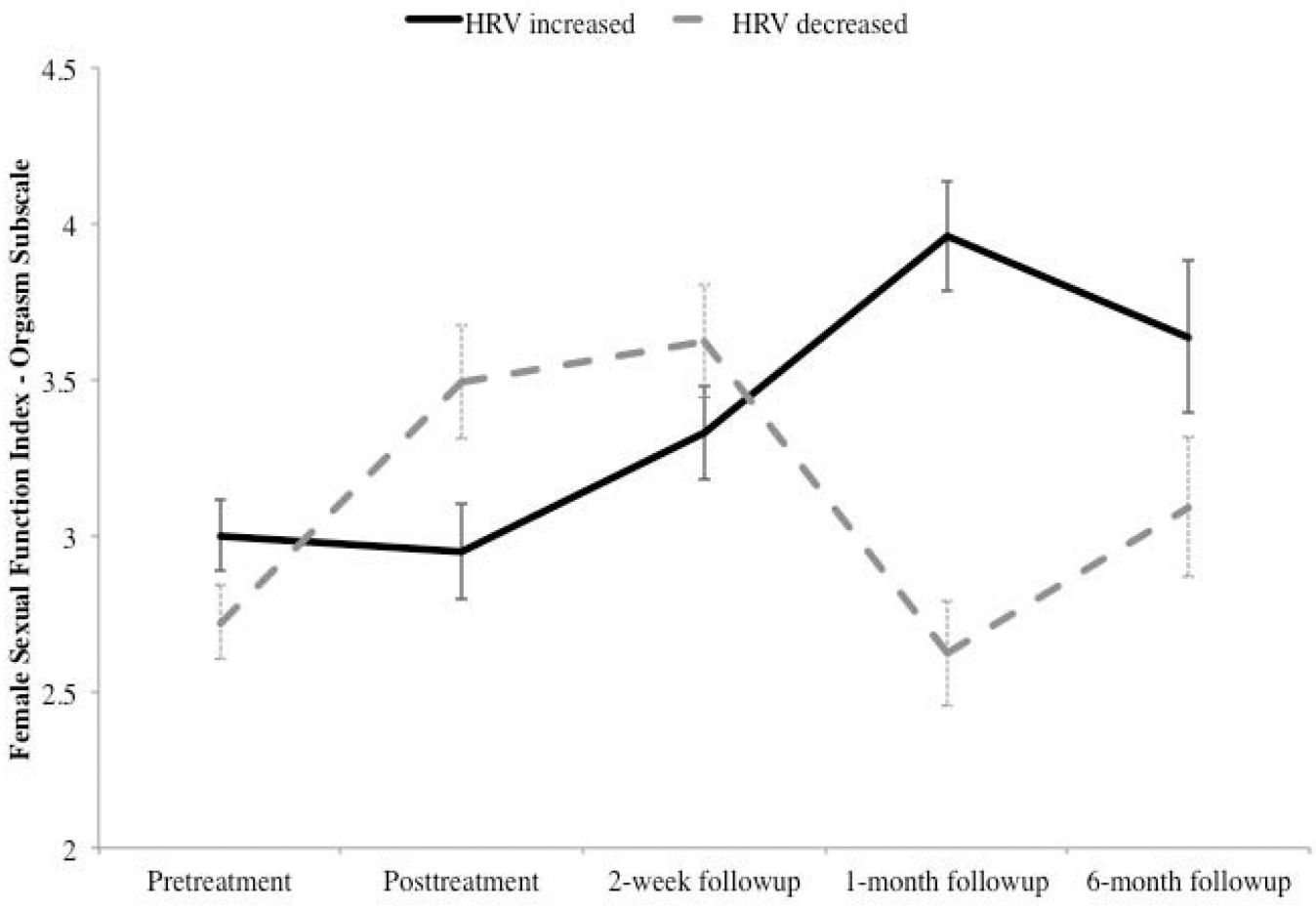

Fig 3.

Interaction between time and change in HRV, as predictors of orgasm function. There were no significant differences between treatment conditions. Error bars represent standard errors of the means

Table 1

Study 2: Heart rate variability (RRSD, in milliseconds) in women with a history of childhood sexual abuse, across assessment sessions as a function of experimental condition.

	Experimental Condition						Total	
	Trauma-focused writing		Sexual-focused writing		Control writing			
	M	***SD***	**M**	***SD***	**M**	***SD***	**M**	***SD***
Pre-treatment	41.24	*20.43*	34.52	*15.45*	44.56	*19.36*	40.37	*19.00*
Post-treatment	44.81	*18.54*	42.59	*22.60*	43.46	*15.54*	43.69	*18.77*
2-week follow-up	40.15	*18.96*	42.50	*14.85*	39.41	*15.71*	40.63	*16.70*
1-month follow-up	41.90	*18.22*	40.19	*14.91*	43.69	*16.26*	41.95	*16.51*
6-month follow-up	46.35	*23.71*	43.51	*15.87*	46.44	*22.23*	45.65	*21.06*

Note: Differences between conditions were not significant at any time point.