Startle reactivity and PTSD symptoms in a community sample of women

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Abstract

Exaggerated startle and PTSD symptoms have been investigated primarily in relation to acute or Type I stressors. The present study examined PTSD symptoms and startle eyeblink response in relation to chronic or Type II stressors. Type II stressors were operationally defined as high levels of childhood corporal punishment and high levels of current partner aggression. This study recruited a sample of 52 women from a metropolitan community and administered several questionnaires assessing experience of corporal punishment in childhood, current intimate partner aggression and level of PTSD symptoms. Following questionnaires, women were presented with eight auditory startle probes (white noise). Results showed that both childhood corporal punishment and intimate partner aggression were associated with women's PTSD symptom scores. However, only PTSD symptom scores were associated with reduced startle. Results are discussed in light of Type I and Type II stressors, and recent suggestions in the PTSD literature that a subgroup of individuals may experience physiological suppression rather than heightened physiological reactivity. © 2001 Elsevier Science Ireland Ltd. All rights reserved.

Keywords: PTSD symptoms; Startle; Chronic stressor

1. Introduction

An important focus of psychophysiological investigations into post-traumatic stress disorder (PTSD) has been the study of increased arousal and physiological reactivity in persons suffering from this condition (see ver Ellen and van Kammen, 1990; Shalev and Rogel, 1993, for reviews). Increased reactivity to both trauma-related cues and unconditioned stimuli (e.g. sudden or loud noises) has been the subject of numerous investigations over the last decade and a half. Elevated...
physiological arousal elicited by audiovisual and imaginal reminders of the original trauma have been found in studies of combat veterans (Blanchard et al., 1986; Pitman et al., 1987, 1990) and traumatized civilians, both male and female (Shalev et al., 1992, 1993). In addition, studies with PTSD-afflicted individuals have demonstrated that they also exhibit increased sympathetic responses, such as increased heart rate and skin conductance responses, to simple, strong stimuli such as loud tones (Paige et al., 1990; Shalev et al., 1992, 1997; Orr et al., 1995, 1997).

Recently, psychophysiological studies of PTSD have begun to focus more closely on the physiological hyperreactivity of patients to unconditioned stimuli, such as the exaggerated startle response to sudden or loud noises. Exaggerated startle responsivity is a criterion for diagnosis of PTSD as listed in the Diagnostic and Statistical Manual of Mental Disorders, 4th ed. (American Psychiatric Association, 1994). The startle eyeblink response, a robust and reliable component of the startle reflex (see reviews by Filion et al., 1998; Dawson et al., 1999), is a particularly useful instrument in the investigation of increased physiological reactivity in PTSD. Some studies employing electromyographic (EMG) measurement of the startle eyeblink response have shown that persons suffering from PTSD symptoms exhibit physiological hyperreactivity to such unconditioned stimuli as novel loud tones or loud bursts of white noise (Butler et al., 1990).

However, other investigations of startle responsivity in PTSD-afflicted samples have produced equivocal results, with some studies finding evidence of hyperreactivity and others failing to detect differences in startle between PTSD and control samples. Morgan and colleagues (1995, 1996) found greater startle responsivity in both Gulf War and Vietnam veterans with PTSD when compared to, in the first study, civilians and veterans without PTSD, and in the second study, ‘healthy controls’. The Gulf War veteran study presented the startle stimuli in a neutral setting, whereas the study with Vietnam veterans included the threat of aversive shock stimuli. Notably, though, a subsequent study using the same Vietnam veteran cohort without threat of shock in the paradigm (Grillon et al., 1996) failed to obtain results supporting the hypothesis of exaggerated baseline startle in PTSD patients. In addition, other investigations of the startle response in men and women afflicted with PTSD that have presented startle stimuli in neutral settings without the threat of shock have failed to find differences between PTSD and normal groups in startle habituation (Ross et al., 1989) and startle amplitude (Shalev et al., 1992; Morgan et al., 1997). Indeed, one study actually reported smaller baseline startle responses (although less pre-pulse inhibition of startle) in children with PTSD (Ornitz and Pynoos, 1989).

In the discussion of trauma, it may be important to distinguish between aversive situations which occur only once or are clearly delimited in time and where the individual perceives or experiences some level of control and can adopt active coping responses, and aversive situations of long or apparently unlimited duration in which the individual feels helpless and lacking adequate coping responses. In writing of childhood traumas, Terr (1991) distinguished between sudden, acute stressors (Type I trauma) and chronic stressors (Type II trauma). According to Terr (1991), an acute stressor is a single external blow characterized by intense surprise, whereas chronic stressors are marked by ‘prolonged and sickening anticipation’ (p. 11). Unlike an acute stressor such as combat, Type II or chronic stressors are characterized by repeated victimization over a long period of time (months or even years), where the situation is frequently perceived to be utterly aversive and inescapable, and where the individual can do little or nothing to effect an outcome other than victimization. Given the distinction between types of stressors, we suggest that traumatic stress during combat is usually an acute experience, rendering this a Type I stressor. Moreover, the scripted coping responses and agency possessed by soldiers (in the form of orders and weapons) are less characteristic of a Type II stressor.

In the discussion of trauma, psychophysiological studies of startle in individuals suffering from PTSD have, heretofore, focused largely on individuals exposed to an acute or Type I stressor
(e.g. combat, rape). Investigations into PTSD and startle in individuals exposed to chronic or Type II stressors have yet to be undertaken. Terr (1991) notes that the two types of trauma are characterized by distinct psychological sequelae. The question of whether PTSD associated with Type II stressors is also characterized by distinct physiological sequelae, including distinct startle response patterns, remains to be addressed.

The animal literature provides indirect evidence that Type I and II stressors may be characterized by distinct physiological profiles. Research with rats has shown that the type of stressor plays a critical role in determining the type of physiological and/or behavioral responses. For example, Mormede et al. (1990) observed that male rats displayed different neuroendocrine changes to different types of social stress. Furthermore, Williams and Scott (1989) determined that, under certain circumstances, conspecific stressors (i.e. the presence of alpha male odors for rats previously defeated by alpha males) increase freezing behavior in rats, but predatory stressors (i.e. cat odors for rats) do not. In light of the fact that rats are social animals, the presence of alpha males may have been an inescapable and aversive experience for the rats in this study. Thus, the conspecific stressor can be understood as a chronic or Type II stressor, whereas the predatory stressor appears to represent an acute or Type I stressor. Although animal models of Type I and Type II stressors have yet to be explicitly studied, evidence within the animal literature implicitly supports the notion that Type I and Type II stressors may be characterized by distinct physiological and behavioral profiles.

In addition to type of stressor influencing physiological and behavioral responses, age of exposure to traumatic stressors may likewise distinguish physiological reactions such as startle responses. Findings of hyporesponsiveness to traumatic stressors have, to our knowledge, only been detected in children (Ornitz and Pynoos, 1989; Carrey et al., 1995). Ornitz and Pynoos (1989) found reduced startle in children exposed to sniper fire. Moreover, whereas PTSD in adults exposed to acute stressors has been linked to autonomic hyperarousal, autonomic hypoarousal has been observed in abused children in the form of lower electrodermal response to emotional and visual stimuli (Carrey et al., 1995). Although neither PTSD symptomatology nor startle were assessed in this latter study, the Type II stressor of growing up in a hostile home environment appears to have resulted in physiological inhibition rather than sensitization in these children. Thus, it may be that an individual’s age of exposure to a stressor, as well as type of stressor, affects physiological responding.

Given the findings of Ornitz and Pynoos (1989), and of Carrey et al. (1995) of hyporesponsiveness in traumatized children, we might expect adults who experienced frequent corporal punishment as children to display similar hyporesponsive startle reactions. However, other researchers have determined that adults exposed to Type I stressors, who were also exposed to high levels of childhood corporal punishment, appear more vulnerable to developing PTSD (Donovan et al., 1996; King et al., 1996). Keeping in mind startle studies by Morgan and colleagues, which generally found heightened startle in adult PTSD patients, we might conversely expect hyperresponsive startle reactivity. This study was designed to test these opposing predictions by examining the influence of Type II stressors and PTSD related to child and adulthood Type II stressors, on startle reactivity.

The present investigation assesses startle in a group of women with PTSD symptoms associated with chronic, non-catastrophic (Type II) stressors, defined in this study as childhood corporal punishment and intimate partner aggression. A non-help-seeking sample of women were recruited and evaluated for the level of corporal punishment in childhood, level of current partner aggression and PTSD symptoms. We hypothesized that exposure to Type II stressors would be associated with PTSD symptoms. Moreover, consistent with past startle reactivity studies of PTSD patients (Butler et al., 1990), we hypothesized that women suffering from more severe PTSD symptoms would display larger startle responses than women suffering from less severe or no PTSD symptoms. We also speculated that women who had aggressive partners and/or who were fre-
requently struck as children would display different patterns of startle eyeblink reactivity than women without these experiences. However, given findings in children (Ornitz and Pynoos, 1989; Carrey et al., 1995), and in light of the conflicting PTSD literature on adults, it was difficult to predict whether facilitation or inhibition of startle eyeblink reactivity might occur as a function of childhood experiences.

2. Methods

2.1. Subjects

Fifty-two women from the Los Angeles Metropolitan community were recruited as part of a larger study investigating communication patterns between couples and their effects on children. Notices were placed in parental magazines and church bulletins, and there was a wide distribution of flyers to YMCAs, public and private schools, recreation and community centers, police activity leagues, parks and libraries (Medina et al., 2000). The advertisement read:

‘Seeking mothers and children. The family studies project at the University of Southern California seeks volunteers for a study on the effects of couple’s communication styles on mothers and children. Must be native English speakers. Children must be 8–13 years old. Mother/child pairs to be paid $30 for approximately 2 h of their time.’

Eligibility criteria for the study included: (a) Having at least one biological child between the ages of 8 and 13; (b) having lived with a spouse or partner of the opposite sex within the last 6 months; (c) being a native English speaker; and (d) having no hearing difficulties.

Data related to cognitive performance and emotional responsivity of these mothers and children will be reported elsewhere (Medina et al. 2000, manuscript in preparation). This investigation examined the startle eyeblink reactivity of the mothers. Due to equipment difficulties, blink data could not be scored for six participants, leaving a sample of 46 women whose data are discussed here. The final sample of women consisted of 22 African-Americans (47.8%), 11 Caucasians (23.9%), 7 Hispanics (15.2%), and 6 women who identified themselves as ‘Other’ (13.0%). The median family income was US$55 000, with the minimum at US$7 000 and a maximum of US$800 000. The mean length of current relationship was 10.93 years, with the minimum being 9 months and the maximum being 29.5 years. The mean length of current relationship for women in the ‘high partner aggression’ group was 8.06 years, again with the minimum length being 9 months and the maximum being 29.5 years. Seventeen women (37%) from the total sample reported having been separated from their partner at least once.

2.2. Procedures

Upon arrival, subjects were asked to sign a consent form giving an explanatory overview of the testing session. The experimenter presented the subject with a brief introduction followed by the attachment of electrodes for the recording of skin conductance and startle eyeblink, and the attachment of a photoelectric plethysmograph on the right index finger for the recording of blood pulse volume and heart rate. During the first phase of the experiment, the subjects’ skin conductance reactivity, blood pulse volume and heart rate were recorded while they listened to three conversations between a man and a woman, varying in degree of verbal and physical conflict between the couple, that was developed by Margolin and colleagues (1992). The effects of the conversations on autonomic responses are reported by Medina et al. (manuscript in preparation).

After the subject had listened to all three conversations, the experimenter entered the room and verbally administered the Los Angeles Symptom Checklist (LASC; Foy, 1993), a questionnaire regarding the final vignette, and a brief questionnaire which contained questions regarding demographic information and traumatic childhood experiences. While the participant followed along on her own copies, all directions and questions
were read aloud by the experimenter to control for reading level differences that may have existed between subjects.

Upon completion of these questionnaires, subjects were told that they would be presented with a series of short static bursts over their headphones. Subjects were told that they need not respond in any way, just sit quietly and listen. A total of eight startle stimuli were presented at random intervals of 28–33 s apart. The startle eyeblink magnitudes elicited by these stimuli served as the primary dependent variable in this study. After this startle phase of the experiment, electrodes were removed and the participant was led into another room where other questionnaires were administered, including one which inquired about current partner aggression.

2.3. Instruments

2.3.1. Childhood corporal punishment

Women were asked ‘How often did your parents hit or slap you?’ Women responded by indicating a number between 0 and 6. This number corresponded to the following frequency: 0 = never; 1 = once; 2 = 2–5 times; 3 = 5–10 times; 4 = 10–20 times; 5 = 20–50 times; 6 = more than 50 times. Scores ranged from 0 (never) to 6 (more than 50 times) (mean = 2.93, S.D. = 1.84, median = 3), with 39 of the total 46 women (84.78%) indicating they had been hit at least once as a child.

2.3.2. Partner aggression

Partner aggression conflict was assessed using the Domestic Conflict Index (DCI) (Margolin et al., 1990). This 51-item inventory of intimate partner conflict behaviors assesses the incidence and frequency of physical, emotional and verbal aggression, and anger between partners. The DCI contains all eight physical aggression items and all six verbal symbolic aggression items from the Conflict Tactics Scale (Straus, 1979), but has been supplemented with additional items concerning physical abuse, emotional abuse and general anger.

Each woman was presented with the list twice, first reporting on her partner’s behavior and then reporting on her own. For each behavior, she rated: (a) whether the behavior had ever occurred in the relationship with the partner; and (b) whether it had ever occurred in front of the child. To report frequency in the previous year, the woman endorsed one of six categories, representing: ‘not at all’ (0); ‘once’ (1); ‘2–5 times a year’ (2); ‘6–12 times per year’ (3); ‘2–4 times per month’ (4) and ‘more than once per week’ (5). A previous study that involved 136 married women found the test–retest reliability for husband’s total aggression over a 2-week interval was 90 based on wives’ reports (Margolin, et al., 1990).

A partner aggression score was created for this study by summing the frequency in the past year of each woman’s experience of physical, emotional and/or verbal aggression by her partner. Scores ranged from 0 to 77 (mean = 14.96; S.D. = 18.70). Of the total participants, 8% did not experience any aggression by their partners in the last year.

2.3.3. Post-traumatic stress disorder symptoms

PTSD symptoms were assessed with the Los Angeles symptom checklist (LASC; Foy, 1993). The LASC is a 43-item scale that has been used to measure PTSD and associated features in a number of different trauma groups including Vietnam veterans (Carroll et al., 1985), survivors of childhood sexual abuse (Rowan et al., 1994) and battered women (Astin et al., 1993). A subset of 17 items target the PTSD symptom categories of ‘re-experiencing’, ‘avoidance and numbing’ and ‘hyperarousal.’ Each item is a word or phrase delineating a PTSD symptom or other attribute of distress, which is accompanied by a 5-point Likert-type rating scale. The respondent is asked to indicate the extent to which the item is a problem for her by providing a rating from 0 (no problem) to 4 (extreme problem). For this study, the 17 PTSD subscale items were summed for each subject, resulting in a continuous score for PTSD symptom severity. PTSD symptom scores ranged from 0 to 40 (mean = 12.72, S.D. = 9.43, median = 10.00), with 44 of the total 46 women (95.65%) reporting at least one PTSD symptom as being a slight problem.

For a categorical diagnosis of PTSD, the re-
spondent must endorse at least one item on the PTSD subscale assessing re-experiencing of the trauma, three items indexing avoidance and numbing, and two items reflecting increased arousal (King et al., 1995). Of the 46 participants, seven qualified as PTSD-positive and two qualified as PTSD-partial (meeting any two of the above three criteria). None of the women endorsed having sustained any severe or major illnesses or injuries in the past year or having sought therapy in the past year. Although this does not preclude an isolated Type I stressor that may have contributed to high levels of PTSD symptoms, it does suggest that the likelihood of such a stressor, in the absence of injury, illness or therapy seeking, is low.

2.4. Experimental stimuli

The startle stimulus consisted of a 104-dB (A) white noise that was 40 ms in duration. The white noise was generated by a Grason-Stadler 901B noise generator and was gated at a near instantaneous rise/fall time. The eight stimuli were presented binaurally through headphones (TDH-49P). Auditory stimulus intensities were calibrated on a realistic sound level meter (cat. no. 33-2055) using a Quest Electronics Earphone Coupler (model EC-9A) appropriate for the supra-aural cushions. A 486 computer with a METROBYTE DAS-16 A/D board and a custom program written in C controlled the onsets of and intervals between stimuli.

2.5. Recording and scoring of dependent variables

Startle eyeblink amplitude was measured as electromyographic activity (EMG) from two miniature electrodes (4 mm in diameter) placed over the orbicularis oculi muscle of the left eye, one electrode centered below the pupil and the other approximately 10 mm lateral to the first. The EMG signal was fed to a Grass 7P3 wide band pre-amplifier/integrator and a 7DA-driver amplifier. The EMG signal was digitized at a rate of 2000 Hz for 200 ms before to 300 ms following the presentation of each startle-eliciting stimulus. The startle eyeblink was then scored off-line with a custom algorithm. In this algorithm, the amplitude of each EMG response is scored in microvolts (μV) as the difference between the mean rectified EMG activity in the 200 ms preceding the onset of the startle probe, and the mean EMG activity in the 10 ms following the peak of the response to the startle probe. The peak of the response is defined as the highest, average microvolt reading calculated across three EMG samples (because raw EMG was collected at 2000 Hz, the average was calculated across 1.5 ms).

2.6. Statistical approach

Firstly, Pearson correlations were generated to confirm that subjects’ PTSD symptom scores were related to the Type II stressors of interest in this study, namely childhood corporal punishment and intimate partner aggression. Pearson correlations were also used to explore associations between the blink average and each of the risk variables. Next, a simultaneous regression was conducted to determine the relative contribution of childhood and adult Type II stressors to subjects’ PTSD symptom scores. In addition, although extent of childhood corporal punishment, partner aggression and PTSD symptomatology are all continuous constructs, previous investigators have employed the upper quartile to represent risk status when dichotomizing distributions of risk variables (Klein and Forehand, 2000). Thus, this investigation adopted a categorical approach in order to compare extreme levels of the independent variables. Childhood corporal punishment, partner aggression and PTSD symptomatology were grouped into the lowest, two middle and the highest quartiles of each distribution, and the lowest and highest quartiles were then compared with respect to the dependent variables. In other words, to examine the influence of the independent variables on startle response, groups representing the lowest and highest quartiles of each independent variable distribution were compared. Descriptions of group composition are included in the results.

Startle eyeblink magnitude scores were averaged across blocks of two trials, producing four trial blocks. Also, in order to evaluate the possi-
bility that any group differences in startle eyeblink magnitude might be due to group differences in baseline muscle tension of the orbicularis oculi, mean baseline EMG activity (μV) was calculated for the 200 ms precedling each startle probe onset for each trial block. Finally, because the response to the startle stimulus on the first trial block may be dominated by the novel characteristics of the stimulus rather than by group differences in general startle reactivity, an average of startle responses was calculated across the three subsequent trial blocks, excluding the first. Thus, in addition to employing repeated measure analyses of variance to examine blink response across groups and all trial blocks, extreme groups also were compared for differences on this modified average of overall blink response, which excluded the first trial block.

3. Results

3.1. Type II stressors and PTSD

Table 1 reveals associations between Type II stressors and PTSD. Specifically, links can be seen between childhood corporal punishment and PTSD symptoms, as well as between partner’s aggression and PTSD symptoms. Table 1 also presents correlations among the modified blink average and risk variables, revealing that only PTSD symptoms are significantly associated with startle eyeblink magnitude. Moreover, this association between startle eyeblink magnitude and PTSD symptoms is a negative one, such that as PTSD symptom scores increase, startle eyeblink magnitude scores decrease. To investigate the relative contributions of childhood corporal punishment and current partner aggression to PTSD, a simultaneous multiple regression analysis was conducted to determine whether these variables contribute uniquely to PTSD symptoms. Childhood and adult stressors accounted for 37% of the PTSD symptom variance (adj \( R^2 = 0.37 \), d.f. = 2,43, \( P < 0.001 \), with both betas significant at the \( P < 0.05 \) level \( \beta_{\text{Childhood corporal punishment}} = 0.30; \beta_{\text{Partner aggression}} = 0.45 \). Thus, for this community sample, both childhood and adult Type II stressors contribute uniquely to PTSD symptoms.

3.2. Baseline EMG and startle eyeblink response

Comparisons of groups representing the highest and lowest quartiles of each risk variable were performed with respect to both baseline EMG levels and startle eyeblink magnitude scores. The lowest quartile of the childhood corporal punishment distribution comprised women who never experienced corporal punishment during childhood \( (n = 11) \). The highest quartile of the distribution included women who reported being hit at least 20 times during childhood \( (n = 10) \). A group (lowest vs. highest quartiles for childhood corporal punishment) \( \times \) trial block (1–4) repeated

<table>
<thead>
<tr>
<th></th>
<th>Childhood corporal punishment</th>
<th>Partner aggression</th>
<th>PTSD symptom scores</th>
<th>Modified blink average</th>
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<tbody>
<tr>
<td>Childhood corporal punishment</td>
<td>−</td>
<td>0.40(^b)</td>
<td>−</td>
<td>−</td>
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<tr>
<td>Partner aggression</td>
<td>0.40(^b)</td>
<td>−</td>
<td>0.57(^b)</td>
<td>−</td>
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<tr>
<td>PTSD symptom scores</td>
<td>0.48(^b)</td>
<td>−0.16</td>
<td>−0.32(^c)</td>
<td>−</td>
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<tr>
<td>Modified blink average</td>
<td>−0.10</td>
<td>−0.16</td>
<td>−</td>
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\(^a\)Two-tailed correlations.  
\(^b\)Correlation is significant at the 0.01 level.  
\(^c\)Correlation is significant at the 0.05 level.
measures analysis of variance (ANOVA)\(^1\) was conducted for both baseline EMG and eyeblink magnitude scores. No significant effects, neither main nor interaction effects, were detected.

For the partner aggression distribution, the lowest quartile included women whose partners were reported to have an aggression score of 2 or lower \((n = 10)\), whereas the highest quartile comprised women whose partners were reported to have an aggression score of 19 or higher \((n = 12)\). Again, a group × trial block repeated measures ANOVA for baseline EMG and eyeblink magnitude revealed no significant findings for either main or interaction effects.

The lowest quartile of the PTSD symptom score distribution included women with symptom scores of 6 or lower \((n = 12)\), and the highest quartile contained women with symptom scores of 20 or higher \((n = 11)\). The seven women who met criteria for a categorical diagnosis of PTSD and the two women whom the LASC identified as ‘PTSD-partial’ were included in the highest quartile group. That is, in addition to their symptom profile matching a ‘PTSD-positive’ or a ‘PTSD-partial’ diagnosis, these women also scored in the highest quartile of the PTSD symptom score distribution. A group × trial block ANOVA for baseline EMG revealed only a significant main effect for trial block \((F_{3,63} = 6.41, P < 0.05, \varepsilon = 0.45)\), showing that baseline EMG declined over trial blocks. The low and high quartile PTSD groups did not significantly differ with respect to baseline EMG, nor was an interaction effect detected.

A similar ANOVA conducted to examine startle eyeblink magnitude revealed main effects for both trial block and group. That is, results indicated that startle blink magnitude diminished over blocks \((F_{3,63} = 4.55, P < 0.05, \varepsilon = 0.84)\), and that the high PTSD symptom group displayed significantly smaller startle eyblinks than the low PTSD symptom group \((F_{1,21} = 6.77, P < 0.05)\). Fig. 1 depicts the eyeblink magnitude scores for both high and low quartile PTSD symptom groups over the four trial blocks.

In order to determine whether differential sensitization or suppression from the first to the second trial blocks occurred between the groups, a group (high vs. low quartiles for PTSD symptom scores) × trial blocks \((1–2)\) repeated measures ANOVA was performed on eyeblink magnitude scores. A main effect for group was observed indicating that the startle eyeblink magnitude scores of the high and low quartile PTSD symptom groups significantly differed across both trial blocks \((F_{1,21} = 5.81, P < 0.05)\). In addition, a marginal interaction effect was detected \((F_{1,21} = 2.67, P < 0.12)\), despite very low observed power \((\text{observed power} = 0.35)\), showing that the two groups differed almost significantly in the direction of their eyeblink magnitude response change from trial block 1 to trial block 2. Whereas eyeblink magnitude scores of the low quartile PTSD symptom group increased slightly from trial block 1 \((\text{mean} = 29.23, \text{S.D.} = 23.97)\) to trial block 2 \((\text{mean} = 32.00, \text{S.D.} = 28.65)\), the eyeblink magnitude scores of the high quartile PTSD symptom group decreased substantially from trial block 1 \((\text{mean} = 13.02, \text{S.D.} = 16.18)\) to trial block 2 \((\text{mean} = 7.55, \text{S.D.} = 8.39)\).

3.3. Modified blink average and risk variables

As indicated earlier, a modified blink average was computed which omitted the first trial block. This was done to circumvent problems raised by the possibility that response to the first trial block may have been dominated by novel characteristics of the stimulus, rather than group differences in startle reactivity. A one-way ANOVA (high vs. low quartiles of PTSD symptom scores) indicated that the modified blink average of the high quartile group \((\text{mean} = 6.13, \text{S.D.} = 6.16)\) was significantly less than that of the low quartile group \([\text{mean} = 26.53, \text{S.D.} = 23.78, F(1,21) = 7.60, P < 0.05]\).

4. Discussion

The aim of this investigation was to highlight potential links between Type II stressors, PTSD symptoms and startle eyeblink reactivity. Results revealed that Type II stressors experienced both

\(^1\)Huynh-Feldt probabilities were used for the repeated measures effects.
in child and adulthood contribute uniquely to women’s PTSD symptom scores. Contrary to expectation, results also suggested that PTSD symptom scores associated with Type II stressors were negatively related to startle eyeblink magnitude. That is, higher PTSD symptom scores were related to smaller eyeblink responses.

No direct links were detected between Type II stressors and startle eyeblink reactivity. That Type II stressors did not change startle magnitude is perhaps not surprising in light of earlier findings where traumatized individuals suffering from PTSD differ from traumatized individuals not afflicted with the disorder. For example, previous studies of individuals exposed to Type I (acute) traumas have shown that physiological changes are most frequently detected in individuals who have developed PTSD (Grillon et al., 1996; Orr et al., 1997).

PTSD is often understood in terms of a diathesis–stress model, wherein genetic or acquired individual differences lead to differences in emotional reactivity and information-processing biases with respect to stressors (Rasmusson and Charney, 1997; Thrasher and Dalgleish, 1999). This model has been based primarily on research involving individuals exposed to Type I or acute stressors. The present investigation extends our understanding of PTSD and the generalizability of the diathesis–stress model by showing that high levels of PTSD symptoms are found in some, but not all, individuals exposed to chronic or Type II stressors. It is only when these chronic stressors, like acute stressors, are associated with high

Fig. 1. Average startle blink magnitude across trial blocks for PTSD groups.
PTSD symptom scores that abnormalities in startle reactivity manifest themselves. In this study, women with the highest, compared with the lowest, PTSD scores demonstrated lower startle eyeblink magnitude.

Researchers have noted that stimuli with moderate to strong intensities generally elicit initial sensitization of the startle response in animals and in humans, followed by habituation (Groves and Thompson, 1970; Davis et al., 1982). Results of this study indicate, however, that whereas women with the lowest PTSD symptom scores seem to display sensitization from trial block 1 to trial block 2, women with the highest PTSD symptom scores display an abrupt diminution in startle response from trial block 1 to 2. This pattern of response is consistent with the findings of Carrey et al. (1995) regarding downward regulation in children exposed to Type II stressors.

The lower magnitude startle responses in the high PTSD group are especially striking given the moderately stressful context in which the eyeblink data were collected. Prior investigations have found that the recall of trauma-related thoughts or imagery is linked to heightened physiological reactivity (Shalev et al., 1993), and Grillon et al. (1996) have speculated that ‘...the degree to which the experimental test conditions are perceived as stressful or reminiscent of prior trauma may lead to a state of heightened startle during testing’ (p. 170). In this study, smaller startle eyeblink responses were elicited in women from the high PTSD group following both an audio-taped presentation of aggressive marital conflict and a questionnaire concerning their partner's aggressive conflict behaviors. Findings of this investigation thus suggest that PTSD arising from Type II stressors experienced in either childhood or adulthood may be related to suppression rather than sensitization of physiological reactivity.

One theory consistent with this possibility is that of augmentation vs. reduction of environment perception. Petrie (1967) argued for a neurological basis for individual differences in methods of perceiving the environment. Three types of persons were defined: the augmenter, who tends to subjectively increase what is perceived, the reducer, who tends to diminish what is perceived, and the moderate, who does neither. Whereas the augmenter amplifies incoming stimulation, the reducer immediately begins to limit his/her intake of it. Petrie further stated that although these conditions may be genetically determined to some extent, it was also likely they could be greatly altered by environmental conditions. In fact, she suggested that one biological function that these traits may serve is as an adaptation for survival.

This theory provides one possible explanation for the results of this study, wherein women with high PTSD scores not only show the absence of exaggerated startle, but exhibit diminished startle. An investigation relevant to both Petrie’s theory of reducers and findings from the present study, is Griffin and colleagues (1997) study of peritraumatic dissociation in rape survivors. These researchers observed suppression of autonomic physiological responses for rape survivors classified into a high dissociation group. A person who dissociates in response to a stressor appears to fit Petrie’s description of ‘reducers’. Perhaps Type II stressors, which are chronic and perceived to be inescapable, more frequently elicit coping responses of dissociation, and thus PTSD arising from Type II stressors is more likely to be related to suppression of physiological reactivity. The present findings, in conjunction with conflicting results from previous studies investigating startle reactivity, highlight the possibility that psychophysiological differences may exist among different subgroups of traumatized individuals.

An important feature of the present study was the use of a non-treatment-seeking sample. Previous investigations into startle and PTSD have relied primarily on treatment-seeking samples exposed to Type I stressors. With the exception of Orr and colleagues (1997) and Ornitz and Pynoos (1989), studies of startle and PTSD generally have employed treatment-seeking civilian hospital patients (Shalev et al., 1992, 1993), Vietnam and Gulf War combat veterans at a Veterans Administration hospital (Grillon et al., 1996; Morgan et al., 1995, 1996), or victims of sexual assault participating in an outpatient women’s trauma program (Morgan et al., 1997).

The prevailing use of treatment-seeking sam-
ples in past studies of PTSD has been criticized as being ‘seldom representative of the target population’ (Solomon, 1993, p. 53), with the use of such samples placing ‘severe limitations on the generalizability of findings to larger populations (e.g. the population of all patients with PTSD)’ (Carlson, 1996, p. 109). Interestingly, Orr et al. (1997) did not find PTSD vs. non-PTSD group differences in startle responding to loud tones in a non-treatment seeking sample. Orr and his colleagues (Orr et al., 1995, 1997) have suggested that exaggerated startle eyeblink responses observed in other PTSD subjects may be due to an accompanying state of anxiety. As Orr et al. (1997) pointed out, treatment-seeking samples of convenience are more likely to include more severe cases of PTSD than are the non-treatment-seeking samples that they (and also we) studied. Alternatively, a treatment-seeking, PTSD-affected sample may be simply less effective in suppressing physiological responses than a similar non-treatment-seeking sample. Whatever the source of difference between treatment-seeking and non-treatment-seeking PTSD samples, the observations of Orr and colleagues and the findings of this study suggest that the physiological profile of PTSD is more variable and complex than previously thought. This possibility bears further investigation.

Another important feature to consider in understanding the link between reduced startle reactivity and PTSD symptom scores is the exposure to the stressor. That is, whereas previous studies of PTSD and startle eyeblink have investigated individuals in the weeks, months and years following a particular traumatic stressor, this study investigates PTSD symptoms and startle eyeblink within a population still exposed to one of the Type II stressors. Moreover, in those cases where high PTSD symptom scores may be more related to childhood exposure to corporal punishment, exposure to this Type II stressor is presumed to have encompassed years instead of the shorter durations of exposure to stressors in many previous studies.

A primary limitation of the present study is related to the small sample size. Although effects were detected despite relatively low statistical power, replication of these results is clearly warranted. Nonetheless, these findings encourage further investigation of types of stressors associated with PTSD symptoms and additional inquiry into the startle eyeblink response of persons afflicted with PTSD stemming from Type II stressors.

Previous studies examining the presence of PTSD symptoms and physiological reactivity have focused on PTSD associated with acute stressors and have relied on institutionalized or treatment-seeking samples from hospitals or other social service agencies. These samples may represent only one type of PTSD and also may reflect only the most extreme presentation of that type. By assessing the linkages between Type II or chronic stressors, PTSD symptoms, and the startle eyeblink response in a community sample, our study broadens understanding of the physiological effects of both less severe levels of PTSD and the influence of type of stressor associated with PTSD on physiological reactivity.

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