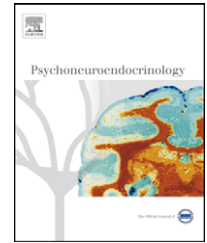




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The influence of attachment on perceived stress and cortisol response to acute stress in women sexually abused in childhood or adolescence

Blaise Pierrehumbert^{a,*}, Raffaella Torrisi^{a,1}, Nathalie Glatz^{a,1},
Nevena Dimitrova^{b,2}, Markus Heinrichs^{c,3}, Olivier Halfon^{d,4}

^aLausanne University, Department of Child and Adolescent Psychiatry, SUPEA, 25a rue du Bugnon, CH-1011 Lausanne, Switzerland

^bLausanne University, Psychology Institute, Anthropole, 1015 Lausanne Dorigny, Switzerland

^cUniversity of Zurich, Department of Psychology, Clinical Psychology and Psychobiology, Binzmuehlestrasse 14 / Box 8, CH-8050 Zurich, Switzerland

^dLausanne University, Department of Child and Adolescent Psychiatry, SUPEA, 23a rue du Bugnon, CH-1005 Lausanne, Switzerland

Received 10 July 2008; received in revised form 16 January 2009; accepted 16 January 2009

KEYWORDS

Unresolved attachment;
Child sexual abuse;
Stress reactions;
Saliva cortisol;
Trier social stress testing;
Adult Attachment
Interview

Summary The long-term implications of sexual abuse in childhood or adolescence (CSA) have been relatively well documented regarding attachment (disorganized attachment in childhood, unresolved trauma in adulthood), stress reactions (altered patterns of stress reactivity under experimental conditions), and psychopathology. Attachment has been shown to mediate the implications of CSA, namely on psychopathology. The implication of attachment on stress responses of abused persons has not been documented. Twenty-seven 20–46 years old women who had experienced episodes of CSA, and 17 controls have been interviewed using the Adult Attachment Interview. Sixty-three percent of abused women presented an unresolved trauma (12% for the controls). Thirty-six women (14 controls and 22 abused) came again to the laboratory for a session involving an experimental stress challenge (TSST). Subjects provided repeated

Abbreviations: AAI, Adult Attachment Interview; ACTH, Adreno CorticoTropic Hormone; AUC, Area Under the Curve; BPD, Borderline Personality Disorder; CSA, Childhood or adolescence Sexual Abuse; DES, Dissociative Experiences Scale; Ds, Dismissing classification at the Adult Attachment Interview; DSM-IV, Diagnostic and Statistical Manual for the mental disorders, version IV; E, Preoccupied classification at the Adult Attachment Interview; ETI, Early Trauma Inventory; F, Autonomous/secure classification at the Adult Attachment Interview; GAF, Global Assessment of Functioning scale; HPA, Hypothalamic–Pituitary–Adrenal axis; ICC, Intra-Class Correlation coefficient; IWM, Internal Working Models of attachment; MINI, Mini International Neuropsychiatric Interview; PTSD, Posttraumatic Stress Disorder; SES, Socio-Economic Status; SNF, Swiss National science Foundation; SSP, Strange Situation Procedure; STI, Severity of Trauma Index; TSST, Trier Social Stress Test; U, Unresolved classification at the Adult Attachment Interview; VAS, Visual Analogue Scale.

* Corresponding author. Tel.: +41 21 314 74 84; fax: +41 21 314 74 81.

E-mail addresses: blaise.pierrehumbert@chuv.ch (B. Pierrehumbert), raffaella.torrisi@chuv.ch (R. Torrisi), nathalielglatz@hotmail.com (N. Glatz), Nevena.Dimitrova@unil.ch (N. Dimitrova), m.heinrichs@psychologie.uzh.ch (M. Heinrichs), olivier.halfon@chuv.ch (O. Halfon).

¹ Tel.: +41 21 314 74 93; fax: +41 21 314 74 81.

² Tel.: +41 21 692 32 60.

³ Tel.: +41 44 635 7363; fax: +41 44 635 7159.

⁴ Tel.: +41 21 314 19 60.

appreciations of perceived stress on visual analogue scales and saliva samples were collected to assay cortisol levels. Whereas abused women with unresolved trauma showed the highest levels of perceived stress, they simultaneously presented the most suppressed cortisol reactions (there were significant post hoc differences between “unresolved abused” and controls on the increase of perceived stress and on cortisol recovery after the acute stress). It is suggested that important stressful experiences (such as CSA), especially when they have not been psychologically assimilated, may cause a disconnection, during subsequent mildly stressful circumstances, between the perception of stress and natural defensive body reactions.

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Unresolved mourning concerning episodes of abuse in childhood or adolescence represents a well-known condition in the adult clinic, with various implications on mental health, including posttraumatic stress disorder (PTSD), depression, and dissociation. The consequences of sexual abuse, experienced in childhood or adolescence (CSA), have been documented; for instance, the psychobiological reactions to stress of CSA victims have been explored, providing essential hints concerning the clinical implications of past abuse, and about factors mediating these consequences. The present study explored perceived stress, as well as psychobiological reactions of adults victims of CSA, when confronted to a psychosocial experimental stress (the Trier Social Stress Test, TSST). The non-resolution/resolution of trauma was explored in the subjects' narratives concerning their childhood, using the Adult Attachment Interview (AAI). It was expected that CSA victims would express altered stress reactions in adulthood, and that the psychological resolution of trauma would alleviate the long-term consequences of CSA on stress reactivity. Responding to such hypothesis might help to better understand the clinical implications of CSA.

1. Background

The rate of women who have experienced sexual abuse in childhood and/or adolescence (CSA) can be approximated to one in seven women, or 16% (Molnar et al., 2001). Girls are at higher risk (around 2.5–3 times) than boys (Finkelhor, 1993; Fergusson et al., 1996; Sobsey et al., 1997).

Most studies on the risk factors of CSA point to the family environment and family dysfunction as important influential variables (Finkelhor, 1993; Mullen et al., 1993; Briere and Elliot, 1994; Fergusson et al., 1996; Sobsey et al., 1997; Rind et al., 1998; Nelson et al., 2002).

No single syndrome can be specified regarding the psychosocial and psychopathological long-term outcomes of CSA (Finkelhor, 1990). Whereas some studies found no relationship between CSA and long-term outcomes in adulthood (Rind and Tromovitch, 1997; Rind et al., 1998), others reported rates of negative psychosocial or psychopathological outcomes in adulthood ranging between 6 and 45% (Browne and Finkelhor, 1986; Finkelhor et al., 1990; Wyatt et al., 1999).

Several authors insisted on individual differences in the risk of developing psychosocial problems after an experience of CSA, independently of its severity (e.g. Finkelhor and Berlinger, 1995; Barker-Collo and Read, 2003; Fassler et al., 2005). Namely, the quality of the family environment (e.g. Fassler et al., 2005) and of the victim's attachment

experiences (e.g. Shapiro and Levendovsky, 1999; Barker-Collo and Read, 2003) have been described as important moderating, or mediating factors on psychosocial and psychopathological consequences of CSA.

Bowlby (1969/1982) described attachment behaviors as resulting from an evolutionary biobehavioral system which provides a survival advantage by keeping young children close to their care providers in times of threat and danger. The experience of the caregivers' sensitivity and responsiveness to distress signals appears to be a key mechanism in the structuring of the subjects' construction of secure “Internal Working Models” (IWM) of the self and others in relationships (Bowlby, 1973/1980). These models develop throughout childhood and are assumed to influence social behaviors into adulthood, namely in adult relationships with peers (Bowlby, 1980; Weiss, 1982; Ainsworth, 1989). IWM have been described in terms of implicit rules to process attachment-related information.

The foremost operational approach of adolescents' and adults' IWM of attachment relies on the Adult Attachment Interview (AAI: Main et al., 1985; George et al., 1985). AAI interviews are categorized in one of three main adult attachment classifications. Adults receiving the “Autonomous” category tend to value attachment relationships, to describe their attachment experiences coherently (whether positive or negative), to consider these experiences as important for their emotional development, and show a significant capacity to reflect on their own thoughts. Adults categorized as “Dismissing” tend to minimize the importance of attachment in their lives; they may unconsciously idealize their childhood experiences. “Preoccupied” adults tend to maximize the importance of attachment; as adults, they are still engrossed and preoccupied with their past experiences and have difficulties to describe them coherently. All three categories correspond to organized “control strategies” (Kobak et al., 1993; Main, 1995) of information processing concerning emotions, especially in attachment-related experiences.

Under certain circumstances, the construction of organized strategies can be challenged. The experience of an extreme fear, and the lack of power in front of distress are thought to affect the attachment system (Main and Solomon, 1986; Kobak et al., 2004). Early in life, when an attachment figure represents both a haven of safety and a source of fear, the child is confused as to whether he/she should approach or avoid that caregiver when distressed (Lyons-Ruth and Jacobvitz, 1999). Maltreated children, for instance, often exhibit disorganized/disoriented attachment behaviors (Carlson et al., 1989; Van IJzendoorn et al., 1999). Because these children experience “fright without solution” (Main, 1995),

they are prone to feel particularly helpless and to exhibit overwhelming levels of anxiety when faced with problematic situations (Solomon et al., 1995). An experience of sexual abuse during childhood and/or adolescence may provoke a disorganization of the individual's confidence in others and impair his/her sense of self and trust of others (Briere and Elliot, 1994); this may further affect the construction of organized internal working models of self and of others in relationships.

In the AAI, disorganization corresponds to a fourth category, "unresolved trauma", which describes the intermittent collapse of organized strategies of information processing when emotions are concerned, resulting from traumatic experiences or losses. Whereas insecurity (dismissing and preoccupied categories, as opposed to the autonomous classification) is typified by incoherence at the level of language (Main et al., 2008), disorganization is evidenced through lapses in the monitoring of reasoning or discourse, indicative of unresolved loss or trauma (Main and Goldwyn, 1985/1997; Main and Hesse, 1990).

The manifestations of lapses in the monitoring of reasoning or discourse, which characterize unresolved trauma in the AAI, certainly overlap with symptoms of posttraumatic stress disorder (PTSD: DSM-IV, American Psychiatric Association, 1994) and of dissociative experiences following trauma. Some researchers have evidenced links between lapses in the monitoring of discourse and trauma-related symptoms. Stovall-McClough et al. (2008) for instance, in a sample of treatment seeking women with histories of abuse, found an association between the unresolved categorization and abuse-related PTSD diagnosis. Hesse and Van IJzendoorn (1999) found, in a non-clinical sample, a correlation between AAI scores of lapses in the monitoring of reasoning and symptoms of psychological absorption (Tellegen Absorption Scale). However, other researchers failed to find such relationships (e.g. Turton et al., 2004). Overall, there is only a limited empirical support to a relationship between the Unresolved classification, PTSD and dissociation (Stovall-McClough et al., 2008).

Adult disorganized or unresolved attachment has been related to maltreatment, and to physical abuse or neglect in childhood (Van IJzendoorn and Bakermans-Kranenburg, 1996; Stovall-McClough and Cloitre, 2006; Neufeld Bailey et al., 2007; Moran et al., 2008). Concerning CSA, several studies confirmed the association between unresolved attachment and a history of sexual abuse (Stalker and Davies, 1995; Riggs and Jacobvitz, 2002; Neufeld Bailey et al., 2007). Reciprocally, Alexander (1992) suggested that an alteration of the attachment context (which is likely to happen in abusing families) reduces the capacity to monitor self and others' emotions, the function of protection, and increases the vulnerability of children to intra- and extrafamilial abuse. Alexander (1992) also suggested that attachment quality might determine the long-term effects of CSA: these effects could depend on whether or not the victim maintained (or achieved) secure attachment IWM.

The notion that attachment can represent a mediating factor regarding the psychosocial and emotional consequences of CSA found empirical support: Neufeld Bailey et al. (2007) evidenced a mediating effect of unresolved abuse trauma on later relationship problems (but not on psychiatric symptoms), and Stovall-McClough and Cloitre

(2006) showed that unresolved childhood abuse predicts the likelihood to develop a PTSD in adulthood.

In the context of an alternative theoretical tradition of attachment research, which is mainly based on questionnaires addressed to adults, Muller et al. (2000) found insecure attachment to mediate the effect of physical abuse on PTSD; Twaite and Rodriguez-Srednicki (2004) found that insecure individuals with an experience of a CSA and/or of physical abuse were particularly vulnerable to developing PTSD after the shock of viewing images of September 11th; Roche et al. (1999) found that attachment mediates the link between CSA and later psychological adjustment, and Shapiro and Levendovsky (1999) found attachment to mediate the effect of CSA on psychological distress.

IWMs certainly influence the way stress is perceived and dealt with. It has been suggested (Kobak and Sceery, 1988; Kobak et al., 1993; Mikulincer and Florian, 2004) that a secure attachment is associated with smooth regulation of negative affects and constructive coping strategies, and represents an internal resource, or a resilience factor, able to lower anxiety related to stressful events. An insecure attachment (moreover an unresolved attachment), conversely, would provoke an unfruitful and excessive focus on malignant emotions, or turning away from feelings of distress, leading to inadequate emotion regulation (Moran et al., 2008).

When an individual is confronted to a stressful situation, one of the most salient reactions is the activation of the hypothalamic-pituitary-adrenal axis (HPA). This results, namely, in glucocorticoids (cortisol) release in the blood stream and other body fluids. This neuronal and hormonal response to a stressor is adaptive regarding energetic resources (Axelrod and Reisine, 1984), immunosuppression (Schaffner, 1985), and recovery from injuries (Chrousos and Gold, 1992). However, such a response may be inappropriate in some situations and even cause neurobiological alterations (Anand, 1993; Plotsky and Meaney, 1993; Bremner et al., 1995; Meaney et al., 1996; McEwen, 2000; Sapolsky, 2000; Mirescu et al., 2004), associated with cognitive disabilities (McEwen and Sapolsky, 1995), and with emotional troubles or psychiatric illnesses (McEwen, 2000). The effect of a prolonged exposure to glucocorticoids on brain structures, especially when occurring early in life, may result in persistent HPA dysregulation and altered stress reactivity to even mild stressors later in life (Graham et al., 1999; Stam et al., 2000; Taylor et al., 2000; Mirescu et al., 2004). HPA dysregulation, in individuals exposed to adverse events early in life, may represent in turn a factor of vulnerability to psychopathology in adulthood (Heim and Nemeroff, 1999, 2001; Heim et al., 2008).

Several studies associated basal hypercortisolism to psychopathology, such as depression and PTSD (e.g. Sapolsky, 2000; Kasckow et al., 2001). While the exposure to an acute stress has been often associated with an increased HPA axis activity, resulting in higher levels of cortisol secretion, suppressive responses have been observed in patients with PTSD (Yehuda, 1997) and in some other categories of chronically stressed individuals (Heim et al., 2000a; Ehler et al., 2001). Actually, the direction of the relationship between PTSD and cortisol concentrations (basal as well as reactive) depends on various factors, such as the subject's age (hypercortisolism in children, hypocortisolism in adults:

Pervanidou et al., 2007), or specific types – or even subtypes – of psychiatric disorders.

Concerning child abuse, Heim et al. (2000b) proposed to adults who had been exposed to stressful circumstances in their childhood, a laboratory psychosocial stress protocol (the Trier Social Stress Test, TSST; Kirschbaum et al., 1993). They found that women with childhood abuse (sexual or physical) and with current depression presented increased HPA responses to the acute stress protocol (higher ACTH and cortisol levels) as compared to women with childhood abuse and no depression, or to women without childhood abuse but with depression. Heim et al. (2008) reconfirmed these results on men with an history of physical and/or sexual abuse.

2. Objectives

A network of relationships has been documented between child abuse (namely CSA), cortisol response to an acute stress (HPA), attachment, and psychopathology; more specifically, associations have been shown between CSA and HPA (e.g. Heim and Nemeroff, 1999), attachment and HPA (e.g. Quirin et al., 2008), psychopathology and HPA (e.g. Soravia et al., 2006), CSA and attachment (e.g. Neufeld Bailey et al., 2007), CSA and psychopathology (e.g. Barker-Collo and Read, 2003); moreover, several interactions have been evidenced between these factors, such as cross-effects between CSA and pathology on HPA (e.g. Heim and Nemeroff, 2001), or between CSA and attachment on psychopathology (e.g. Twaite and Rodriguez-Srednicki, 2004). The question of a possible interference of attachment in the association between CSA and HPA has not been addressed yet.

We expected abused women (i.e. with CSA) to present more psychopathological troubles, to be more often categorized as Unresolved at the AAI (e.g. Stovall-McClough and Cloitre, 2006), and to show more altered cortisol stress reactions than controls (e.g. Heim and Nemeroff, 2001). Because disorganization of attachment-related information represents a frequent consequence of an exposure to abusive adults in infancy and in adulthood (e.g. Lyons-Ruth and Jacobvitz, 1999; Neufeld Bailey et al., 2007), we wanted to consider separately abused persons with organized attachment strategies and abused persons with disorganized attachment strategies (i.e. Secure, Dismissing or Preoccupied classifications versus Unresolved classification).

In an effort to disentangle the effects of these factors (abuse, attachment, psychopathology) on stress reactions, we postulated that attachment would affect HPA reactivity in CSA victims, and that this effect cannot be reduced to psychopathology.

Extrapolating from infant studies about disorganized attachment (Hertsgaard et al., 1995), we expected abused women with the Unresolved classification to show more severely altered HPA reactions than other abused women (and control subjects). Concerning the perceived stress, we expected CSA subjects with the Unresolved classification to present stronger responses (e.g. Solomon et al., 1995). Heinrichs et al. (2003) found converging data between HPA activation and self-report of anxiety in the TSST. However, knowing that subjects with the Unresolved classification are characterized by lapses of conscious monitoring, we expected these persons to present incon-

sistencies between subjectively perceived stress and endocrine responses.

3. Method

3.1. Participants

Two groups of adult female subjects were included in the study: a clinical group (women with an experience of CSA) and a control group. In order to recruit the clinical group, several centers, which provide anonymous assistance to adult victims of sexual abuse, were contacted; they systematically distributed brochures to their clients, describing the study and proposing to contact the research unit; participation was voluntary and anonymous. Otherwise, the centers did not intervene in the recruitment procedure. Most of the participants were newcomers to these centers. We included only female participants. Because women are over-represented among sexually abused persons, and since we used endocrine measures sensitive to gender, we preferred to avoid complicating the research design by including sex as a variable. The inclusion criteria were to be over 18 years old (civil majority) and to report at least one episode of CSA (such as provocative touching, having been forced to touch another person's intimate parts, having been touched in intimate parts, having experienced attempted or completed genital rape) during childhood and/or adolescence (up to the age of 18 years); the latest abusing episode should have happened more than 2 years before enrollment.

Exclusion criteria were: eating disorders, substance abuse, use of psychotropic drugs, pregnancy, not speaking French, and the presence, evaluated by a senior psychiatrist at the preliminary inclusion interview, of significant psychopathological symptoms which would make participation in the study potentially hazardous for the subject. Smoking was found to be relatively widespread (around one smoker out of four subjects, for the abused as well as for the controls), and since excluding abused smokers would have been problematic because of subjects shortage, we kept smokers (balanced in the abused and the control groups), and we asked them to reduce consumption to a maximum of 10 cigarettes/day during the week of the testing session (TSST). None of these subjects reported difficulties or stress due to reducing tobacco consumption (in which case we would have considered stopping the procedure to avoid interference with the results). According to Kirschbaum et al. (1999), salivary cortisol responses to the TSST can decrease in the menstrual and follicular phases (and meet the level of response of women with oral contraceptives). For that reason, the session with the TSST was postponed when necessary, in order to test women in their luteal phase; additionally, we recommended women with oral contraceptives to stop taking pills during the entire cycle in which the TSST took place. Only one subject was postmenopausal; she was receiving a hormone replacement therapy (progesterone); we kept this subject included; we will report about her specific data in the results section. Thirty-seven clinical subjects attended the first interview; two of them presented some exclusion criteria (one for important psychopathology, and the other for language reasons), five showed a lack of interest after the first interview (i.e. before entering the study), and three subjects

dropped out after the second interview. Twenty-seven women were finally included as clinical subjects with a CSA (in childhood and/or adolescence). Only three subjects reported CSA episodes, which ceased less than 5 years prior to the interview—and none had an ongoing history of abuse.

Seventeen women were recruited as control subjects (i.e. with no experience of CSA) by announcements in shopping or sport centers. Exclusion criteria were the same as for the clinical group. The two groups were matched for age and SES. These participants explicitly contacted the unit to be enrolled as control subjects in a study concerning CSA; we expected several of them to report some experience of abuse. In fact, six of the control participants reported some experience of abuse, such as “exposed to inappropriate comments about sex”, or “spied on in bathroom”. We maintained these subjects in the control group as representative of the general population, however the inter-group analysis will take into account the presence of abused controls.

The left columns and upper part of Table 1 provide demographic data and characteristics of abuse for the two groups (controls and abused). Overall, age ranged between 20 and 46 years (mean = 33.02 years old, S.D. = 7.12). The majority of participants were French-speaking Swiss citizens, with a middle-to-upper socio-economic status.

3.2. Measures

3.2.1. Abuse

The Early Trauma Inventory (ETI; Bremner et al., 2000, 2007a) is a structured interview concerning traumatic experiences in childhood and/or adolescence. This instrument provides an evaluation of the frequency, duration and perception of traumatic experiences. Each item refers to a specific kind of experience; concerning CSA for example, questions refer to the age at which CSA began, ended, the frequency of events and identity of the abuser (intra-

versus extrafamilial). An index of severity of CSA is computed, by multiplying the frequency (by year) of each CSA event by the number of years of duration, and then summing across the 15 items into a Childhood Sexual Trauma Severity Index (or Severity of Trauma Index, STI). Interrater reliability of the STI index was computed, using an intra-class correlation coefficient (ICC), on the 15 items relating to CSA experiences. As the authors of the ETI, we found a very high level of agreement between the raters (ICC = 0.99; $n = 48$ comparisons).

3.2.2. Psychiatric screening

Diagnostic interview. The Mini International Neuropsychiatric Interview (MINI; Weiller et al., 1994) was proposed as a screening instrument (this structured interview does not intend to produce a full diagnosis; it is designed to evaluate, in a standardized way, the likelihood of psychiatric disorders of axis I (DSM-IV). Twenty-three disorders are screened by the MINI (among which depression, mania, phobia, anxiety, obsessive-compulsive, psychotic, dependence, eating disorders, and PTSD). The interview requires about 20 min. Depression (presence or not of a current major depressive episode, and of a past major depressive episode), and PTSD (presence or not of current posttraumatic stress disorder) will be considered here, given the relationship reported in the literature between these diagnosis and HPA measures.

Dissociative experiences. The Dissociative Experiences Scale (DES; Bernstein and Putnam, 1986; Carlson et al., 1993) is a self-report measure of the frequency of dissociative experiences in the subject’s daily life, recorded on 28 scale lines (scores 0 “never” to 100 “always”). Dissociative experiences include: disturbances in memory, identity, awareness, and cognition (e.g. “Some people find that sometimes they are listening to someone talk and they suddenly realize that they did not hear part or all of what was said”).

Global Assessment of Functioning. The Global Assessment of Functioning scale (GAF) of the DSM-IV provides an estimate

Table 1 Demographic data, characteristics of abuse, and clinical dimensions, by groups: means (standard deviations in parenthesis) for age, socio-economic status (SES), age at child abuse onset, chronicity of abuse episodes, index of severity of abuse (STI), index of experiences of dissociation (DES), and index of global functioning (GAF); frequencies (percentages in parenthesis) of intra- and extrafamilial abuse, of depression (current and past), and of posttraumatic stress disorder (PTSD), using a diagnostic interview (MINI).

	Control $n = 17$	Total abused $n = 27$	Abused organized $n = 10$	Abused Unresolved $n = 17$
Age (years)	32.46 (8.87)	33.38 (6.01)	32.70 (3.94)	33.81 (7.10)
SES index (1–4)	2.81 (0.66)	2.51 (0.69)	2.37 (0.54)	2.57 (0.81)
Intrafamilial abuse	0 ^{ab} (0%)	11 ^a (41%)	5 ^b (50%)	6 (35%)
Extrafamilial abuse	6 (35%)	16 (59%)	5 (50%)	11 (65%)
Onset abuse (years)	12.00 (5.76)	8.33 (4.17)	8.70 (4.81)	8.11 (3.89)
Chronicity abuse (years)	1.16 ^{ab} (1.16)	7.74 ^a (6.42)	7.20 (8.06)	8.06 ^b (5.48)
Severity abuse (STI)	5.71 ^{abc} (8.53)	67.92 ^a (72.48)	77.70 ^b (86.24)	62.18 ^c (65.25)
Physical abuse (ETI)	14.47(17.17)	25.63 (32.33)	21.40 (19.53)	28.12 (38.13)
Depression current (MINI)	2 (12%)	13 (48%)	5 (50%)	8 (47%)
Depression past (MINI)	1 (6%)	7 (26%)	3 (30%)	4 (23%)
PTSD (MINI)	2 (12%)	8 (30%)	4 (40%)	4 (23%)
Dissociation (DES)	7.09 ^{ab} (7.24)	19.01 ^a (14.72)	14.62 (15.64)	21.84 ^b (13.93)
Global functioning (GAF)	81.09 ^{ab} (5.46)	58.02 ^a (15.69)	66.85 ^c (11.00)	52.82 ^{bc} (15.96)

Indexes ^a, ^b, ^c indicate a significant difference between the two groups with the same index (chi-squares or post hoc Tukeys, $p < 0.05$).

of the individual's current overall psychological functioning. After the whole procedure of interviews (see below), the psychiatrist and the psychologist who conducted the interviews used all the available information to attribute a GAF score, estimated on a continuous scale ranging from 1 (severely altered psychological functioning, i.e. mental illness) to 100 (superior functioning, i.e. mental health). The index reflects an overall evaluation of the individual's current psychological, social and professional functioning. In order to calculate inter-rater reliability, three experienced clinicians reviewed all the available written information concerning the subjects and provided GAF coefficients; all the cases have been reviewed. The level of agreement between coders ($n = 44$ cases) was $ICC = 0.96$.

3.2.3. Attachment

The Adult Attachment Interview (AAI; [George et al., 1985](#)) is a semi-structured interview which addresses the subject's attachment experiences during childhood, and the effects that these experiences are thought to have on current relationships, through a number of open-ended questions. The coding procedure focuses on the subject's ability to describe, discuss, and evaluate attachment experiences while simultaneously maintaining a coherent and cooperative discourse, rather than on the actual content of the subject's life history. The authors of the AAI identified four categories (see introduction): Autonomous/secure (F), Dismissing (Ds), Preoccupied (E), and Unresolved (U) with respect to experiences of loss or abuse. The three first categories are considered as "organized" since a singular strategy is manifested in the discourse task (i.e. providing a positive expression of childhood experiences while avoiding discussing particular events for the Dismissing; maximizing attention to attachment-related experiences at the expense of appropriate conversational collaboration for the Preoccupied; [Hesse, 1999](#); [Main, 1995](#)). The U ("disorganized") classification is reflected in striking lapses in the monitoring of reasoning or of discourse: the autobiographical narrative may involve local disorganizations surrounding discussions of potentially traumatic events such as loss or abuse. For example, the person may briefly indicate a belief that a lost friend or relative is simultaneously dead and alive; the person may fall silent in the middle of a sentence discussing loss or trauma, and complete the sentence after a moment (or never complete it); the person may shift to an odd, childish, poetic, or eulogizing phrasing or speech; the discourse may be intruded by visual-sensory images or by other information regarding traumatic experiences involving attachment figures, which interfere with the narrative flow. Such lapses suggest that "the speaker enters a state of mind in which he or she no longer appears appropriately conscious of the interview situation" ([Lyons-Ruth and Jacobvitz, 1999](#), p. 528). The interviews were tape-recorded. Transcripts were analyzed by two certified reliable coders (R. Miljkovitch and F. Becker-Stoll) who were trained by Mary Main and Erik Hesse.

3.2.4. Stress

The Trier Social Stress Test (TSST; [Kirschbaum et al., 1993](#)) consists of a public speaking task and mental arithmetic performed in front of an audience. This standardized procedure was developed so that to induce a moderate psychosocial stress under laboratory conditions. A first part of the

experiment is a 5 min role playing task in which the subject is submitted to a job interview in front of two unknown "experts" (one male and one female, who are intentionally reserved towards the subject); the subject has to enumerate his/her qualification and personal suitability for a job; this is followed by 5 min of mental arithmetic performed out loud. Previous studies have indicated that the TSST induces significant perceived stress as well as physiological stress responses, in healthy subjects and in patients (e.g. [Heim et al., 2000b](#); [Heinrichs et al., 2003](#); for a review, see [Dickerson and Kemeny, 2004](#)).

Perceived stress. In order to evaluate the perceived stressfulness of the situation, a visual analogue scale (VAS; [Folstein and Luria, 1973](#); [Kirschbaum et al., 1999](#)) was proposed at repeated time intervals (i.e. before, during and after the stressing protocol). The scale of perceived stressfulness consists of a 100-mm horizontal line accompanying the question: "How much do you feel stressed?"; the left end of the line is labeled "not at all" (0) and the right end "extremely" (100). Participants were instructed to place a mark on the line, indicating how they felt at that moment.

Physiological response. Among the different hormones which can be measured as indicators of the HPA activation, saliva cortisol has been used most often. It is considered a reliable and valid measure, reflecting the concentration of "free" (unbound to plasma protein) fraction of cortisol present in the blood stream, with a time lag (after exposure to an acute stressing event) of about fifteen minutes ([Goodyer, 2006](#)). Saliva samples were collected at repeated time intervals (i.e. before, and after the stressing protocol). The level of saliva cortisol forms a diurnal pattern, with a high level following awakening, and a progressive decrease during the day. Several studies indicated a number of moderating factors on cortisol levels following awakening (e.g. low levels have been reported in adults with a history of loss experienced in childhood; [Meinlschmidt and Heim, 2005](#), or who had been exposed to adverse conditions such as maternal postnatal depression; [Halligan et al., 2004](#)). Besides the diurnal rhythm, levels of cortisol show a consequential reactivity to a number of acute events (a rapid rise followed by a return to the baseline forty minutes after the event's termination). Many studies (e.g. [Heim and Nemeroff, 1999](#); [Heim et al., 2000b](#)) showed that the intensity of the cortisol response (i.e. the delta between the baseline and the maxima following an acute stressing event) is influenced by an early exposure to traumatic events. The intensity of the cortisol response can be estimated using the delta index; an additional procedure is to compute the "area under the curve" (AUC). Its purpose is to obtain a simple and single measure, without sacrificing the information contained in multiple measurements ([Pruessner et al., 2003](#)). Computing the area under the curve takes into account not only the hormonal increase, but also the timing of the response; in other words, it integrates the speed of increase and of decrease of the endocrine response. That information summarizes the "total hormonal output", whereas the delta only expresses the raw increase value.

3.2.5. Socio-economic status

The socio-economic status was coded according to four levels, taking into account both education and professional status (e.g. level 1 corresponds to no training and/or a

position of employee, level 2 and 3 to specialized training and/or a specialized position, and level 4 to high level education and/or private practice in a profession); education and professional status were coded separately; scores were then averaged.

3.3. Procedure

Participants came to the laboratory four times. The preliminary interview led by a psychologist and a psychiatrist was proposed in order to verify that the subject fulfilled the inclusion criteria, to evaluate potential exclusion criteria, and to check whether it was appropriate or not (from a psychiatric point of view) to include the subject in the study. During this preliminary interview, subjects were informed about the purpose and the procedure of the study and they were required to provide a written consent. In the second session, the ETI, MINI, DES, and AAI were proposed. The TSST was proposed in the third session. The fourth was a "debriefing" session with the psychologist and the psychiatrist. Participation was remunerated.

Considering the circadian drift of cortisol levels, all TSST sessions took place at 2 p.m.; subjects were instructed not to eat and drink at least 1 h before the study took place. Participants remained 2 h in the laboratory. A catheter was inserted by a nurse at the arrival in the lab, in order to collect supplementary indicators (oxytocin, ACTH), which have not been analyzed for the present report. The TSST itself (10 min) took place between 47 and 57 min after arrival in the laboratory. The perceived stressfulness of the situation was repeatedly assessed, using the VAS, at 0, 35, 40, 44 min (i.e. before participants entered the TSST examination room), 55 min (i.e. inside of the examination room), 60 min (i.e. after leaving the examination room), and 65 min. Saliva samples were collected for the measurement of the stress hormone at 15, 44, 60, 65 min (i.e. before the stress procedure), 75, 85, 100, and 115 min (i.e. after the stress procedure).

Saliva was collected using sampling devices being chewed for about 60 s (Salivettes; Sarstedt, Rommelsdorf, Germany). Devices were stored at -20°C until sent for biochemical analysis (Dresden LabService GmbH, Dresden, Germany). The free cortisol concentration in saliva was analyzed using a time-resolved immunoassay with fluorescence detection (Dressendörfer et al., 1992).

The Ethics committee for clinical research at the Lausanne University Medical School approved the procedure.

4. Results

4.1. Abuse

All subjects included in the abused group reported several positive responses on the STI items, some expressing an experience of relatively moderate abuse (e.g. provocative touching) and others an experience of more severe abuse (e.g. genital rape). The STI scores derived from the ETI ranged between 0 and 22 for the control group (mean = 5.71, S.D. = 8.53) and between 4 and 618 (mean = 67.92, S.D. = 72.48) for the clinical group. The small overlap is due to the 6 control subjects who reported some moderate

experience of CSA. The scores of the clinical group do not differ more than half a standard deviation from the STI scores reported by Heim et al. (2000b): mean scores, for subjects respectively without and with major depression were: 131.71 and 70.84. Eleven subjects of the clinical group reported intrafamilial abuse on the ETI (none among the control group); 20 subjects of the clinical group reported child abuse (i.e. 11 years old or younger) and seven reported adolescent abuse. Twelve subjects of the clinical group reported abusing situations, which lasted more than 6 years (chronic abuse). Incidentally, we computed ETI scores for physical abuse; the clinical group's mean (25.63) was far below the scores reported by Heim et al. (2000b) (respectively 199.36 and 173.84). In our sample, subjects were recruited as sexually abused, whereas in Heim et al.'s, physical abuse was a criteria for enrollment.

4.2. Psychiatric screening

The bottom part of Table 1 shows that 13 subjects of the clinical group (two of the control group) were described by the MINI as having a current major depressive episode, seven a past major depressive episode (one for the control group), and eight a PTSD (two for the control group); none of these group differences was significant. The clinical group obtained scores of dissociative experiences (DES) significantly higher than those of the control group. Van IJzendoorn and Schuengel (1996) reported DES scores of abused victims (5 studies) between 27.06 and 29.17, which is higher than in our sample (mean = 19.01); these studies however generally considered patients with multiple pathologies. The GAF scores also differed significantly; thirteen subjects of the clinical group (none of the control group) received scores equal or lower than 60 points on the GAF (i.e. moderate or more serious symptoms, and difficulties in social, or occupational functioning).

4.3. Attachment

We found an over-representation of the Unresolved classification of AAls in the abused group: 17/27 of the subjects (63%), against 2/17 (12%) in the control group. The between groups difference regarding the U classification is significant (*Pearson chi-square* = 4.98, $p = 0.03$).

The right part of Table 1 presents the demographic data, the characteristics of abuse and the main results of the psychiatric screening for abused subjects with organized strategies (F, Ds and E), and with the Unresolved classification (U). Interestingly, there were no significant differences between the two groups of abused subjects (organized versus Unresolved), on the demographic data, the characteristics of abuse, or on the psychiatric screening, except for the GAF scores, which were significantly lower for the Unresolved subjects.

4.4. Perceived stress

Of the 44 subjects who were included and were interviewed with the AAI, three dropped out before completing the TSST and there were three more missing data concerning the report of perceived stress, due to a delayed introduction

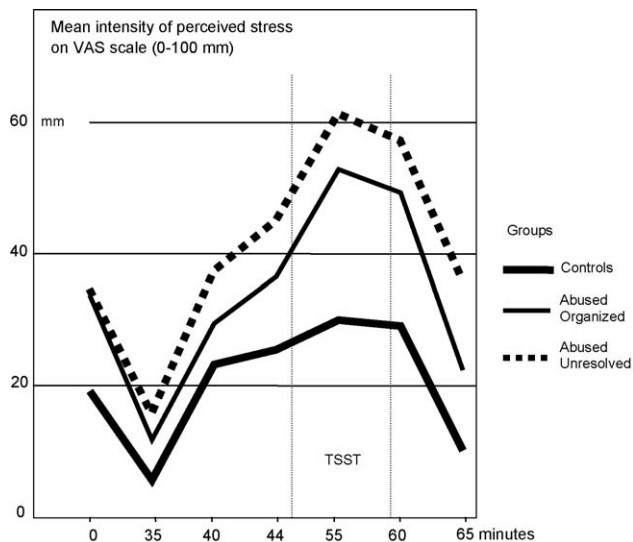


Figure 1 Perceived stress (mean VAS scale, range 0–100 mm, for controls ($n = 14$), abused with organized strategies at the AAI ($n = 9$), and abused Unresolved ($n = 13$).

of the VAS into the procedure. There was a clear response to the TSST for the whole group of participants, expressed by a peak of perceived stress during – or just after – the TSST, at points 5 and 6 (55–60 min); see Fig. 1. We then reduced the data as a three-point curve in order to ease statistical analysis: we considered a baseline (point 2, at 35 min), a peak response (points 5 and 6, at 55–60 min), and a recession (point 7, at 65 min).

Since our objective was to envisage the effect of attachment disorganization on stress responses of abused victims, we compared control subjects, abused subjects with organized strategies respectively with the U classification. Since we could not compose a full group of control subjects with the U classification (there were only two of them), we excluded these subjects from the subsequent analysis. Therefore, $n = 36$ subjects were kept for the intergroup analysis on VAS measures of perceived stress: 14 controls (all with organized strategies), 9 abused with organized strategies, and 13 abused categorized Unresolved.

Visual examination of Fig. 1 suggests that abused subjects expressed a more intense stress during the TSST, as compared to control subjects. Interestingly, abused subjects with the Unresolved classification presented the highest responses; abused subjects with organized strategies showing inter-

mediate values. Analysis of variance for repeated measures (3 points) showed a significant group effect ($F(2, 34) = 4.55$; $p = 0.02$). We then compared the three groups (post hoc) on three variables: baseline, delta (peak minus baseline), and recovery (peak minus recession). Table 2 presents the statistics; post hoc tests showed a significant difference between controls and abused Unresolved on the perceived stress response (delta). Interestingly, there were no significant differences regarding the baseline.

4.5. Salivary cortisol

Four subjects had missing salivary cortisol data, due to dried or to lost assay salivettes. Analysis were performed on $n = 35$ subjects (the two controls with Unresolved AAI classification being excluded): $n = 13$ controls, $n = 9$ abused with organized strategies, and $n = 13$ abused categorized as Unresolved. There was a clear physiological response to stress, delayed of about 20 min following the stress exposure (and also delayed regarding perceived stress), due to the physiological process of salivary cortisol.

Fig. 2 presents the curves of the three groups. Visual examination suggests that abused subjects with the Unresolved category had lower endocrine responses to the TSST, as compared to control subjects, and abused subjects with organized strategies.

For the statistical analysis, we reduced the data as a three-point curve: baseline (lowest point 2 or 3, at 44–60 min), peak response (points 4 and 5, at 65–75 min), and recession (points 7 and 8, at 100–115 min). The analysis of variance for repeated measures (3 points) showed no significant group effect ($F(2, 32) = 1.29$; $p = 0.29$). We further compared the three groups on four variables: baseline, delta (peak minus baseline), recovery (peak minus recession), and the area under the curve. Computing the area can take into account either the area “with respect to the ground” or the area “with respect to increase” (Pruessner et al., 2003). Given the fact that we did not find any group difference regarding the baseline, we used the second formula. Table 3 presents the statistics. Post hoc tests revealed a significant difference between controls and abused Unresolved, regarding the recovery after the TSST (Tukey post hoc test $p = 0.05$); concerning the area under the curve, the difference between the same groups expressed a statistical tendency (Tukey post hoc test $p = 0.06$).

Since previous studies showed an association between psychopathology and cortisol responses in individuals exposed to an acute stress (e.g. Yehuda, 1997; Heim

Table 2 Mean scores (standard deviations in parenthesis) on VAS scale of perceived stress (range: 0–100 mm) by group (control, abused with organized strategies at the AAI, and abused Unresolved), before the TSST (baseline), increase (delta) and subsequent decrease (recovery).

	Control $n = 14$		Abused organized $n = 9$		Abused Unresolved $n = 13$		Statistics	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	$F(2, 34)$	p
Baseline	8.00	(10.94)	11.11	(10.83)	15.23	(12.03)	1.37	0.26
Delta	23.25 ^a	(17.04)	34.77	(28.50)	45.07 ^a	(22.42)	3.25	0.05
Recovery	21.39	(18.45)	25.88	(23.27)	24.88	(17.12)	0.18	0.83

Index ^a indicates a significant difference between the two groups with the same index (post hoc Tukey, $p < 0.05$).

Table 3 Means (standard deviations in parenthesis) of concentration of salivary cortisol (in nmol/l), by group (control, abused with organized strategies at the AAI, and abused Unresolved), before the TSST (baseline), increase (delta), subsequent decrease (recovery), and area under the curve.

	Control <i>n</i> = 13		Abused organized <i>n</i> = 9		Abused Unresolved <i>n</i> = 13		Statistics	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	<i>F</i> (2, 32)	<i>p</i>
Baseline	6.20	(4.47)	5.87	(2.91)	5.05	(2.00)	0.40	0.67
Delta	5.75	(6.87)	4.43	(5.55)	1.66	(1.32)	2.14	0.13
Recovery	5.85 ^a	(4.95)	3.89	(3.07)	2.40 ^a	(2.11)	2.95	0.06
Area	203.51 ^(a)	(194.03)	144.17	(133.83)	73.35 ^(a)	(60.30)	2.76	0.07

Index ^a indicates a significant difference between the two groups with the same index (post hoc Tukey, $p < 0.05$); index ^(a): post hoc (Tukey), $p < 0.10$.

et al., 2000b), we conducted a regression analysis to examine the possible contribution of psychopathology in the association between cortisol responses and the Unresolved classification. The scores of dissociation and global functioning were entered in a regression equation along with the variables of past depression, current depression, PTSD, unresolved attachment, and group, in order to predict the area under the curve of cortisol values (stepwise method). Only the variable Unresolved remained in the model ($Beta = 0.35$; $t = 2.14$, $p = 0.04$). We repeated the procedure after excluding the six control subjects with some experience of CSA. The analysis produced similar results (Unresolved only remained in the model; $Beta = 0.38$; $t = 2.15$, $p = 0.04$). We further entered in the regression the variables characterizing abuse (onset age, severity, chronicity of sexual abuse, and the score for physical abuse), and finally tobacco consumption. None of these variables predicted the cortisol response (regarding tobacco, the mean delta cortisol was 4.09 (5.25) for the non-smokers, and 3.11 (5.72) for the smokers, p n.s.).

We examined the data concerning the subject receiving a postmenopausal hormone replacement therapy; this subject had been included in the group of abused women with the Unresolved classification. All her values were conservative,

i.e. they deviated from the mean of the abused Unresolved group in the direction of the other two groups.

We did not find any correlation across subjects between the variables of perceived stress and of physiological responses: correlations coefficients between VAS scores and salivary cortisol concentrations were, for the baseline $r = -.03$, for the delta $r = -.19$, and for the recovery $r = -.00$ ($n = 35$).

5. Discussion

We evaluated the perceived stress as well as the endocrine responses to an experimental psychosocial stress session (TSST) of 44 women, a part of them having been exposed to sexual abuse in their childhood and/or adolescence. Overall, the average scores of the whole group of participants showed a coherent pattern of activation and deactivation of both kinds of indicators. The visual examination of the data showed a trend (not statistically significant) of abused women to present a higher perceived stress, and at the same time lower endocrine reactions to the procedure, as compared to control subjects. When we looked more specifically at the group of abused women receiving the Unresolved classification (U, or unresolved trauma) at the Adult Attachment Interview (i.e. women showing striking lapses in the monitoring of discourse, speech or reasoning when evoking traumatic experiences during the AAI), we found significant differences: whereas the group of abused subjects with the Unresolved classification expressed the highest perceived stress, they also showed the most suppressed endocrine reactions, when compared to control subjects (and at a lesser extent to abused women with organized strategies F, Ds, and E).

5.1. Abuse and unresolved attachment

We found a high prevalence of Unresolved attachment in abused subjects (63%). Several studies had evidenced such an association (e.g. Riggs and Jacobvitz, 2002; Neufeld Bailey et al., 2007; Stovall-McClough et al., 2008); this last study found 43% of Unresolved categorization in sexually abused women. As mentioned, a transcript is classified as U if the subject becomes disoriented when discussing either losses or traumatic experiences; in fact, the coder provides two specific scores, one of unresolved loss and one of unresolved trauma. Considering these scores, some authors (e.g. Riggs

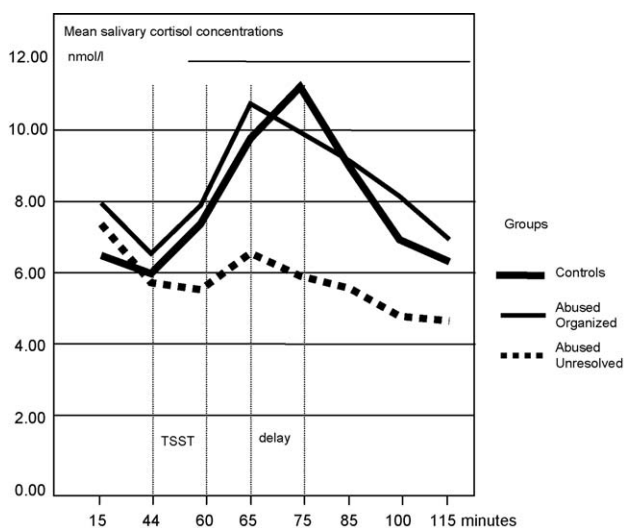


Figure 2 Salivary cortisol (mean concentrations expressed in nmol/l, for controls ($n = 13$), abused with organized strategies at the AAI ($n = 9$), and abused Unresolved ($n = 13$).

and Jacobvitz, 2002) differentiated between Unresolved subjects with respect to loss, and Unresolved subjects with respect to trauma. They found an association between sexual abuse and unresolved loss, suggesting that a traumatic experience, such as an abuse, may affect the integration of other traumatic experiences. We did not find such an association however, in our sample of abused participants. Fifteen out of the seventeen abused participants who were classified as Unresolved obtained higher scores at the scale “non-resolution with respect to trauma” than at the scale “non-resolution with respect to loss”; only one subject had a higher score of unresolved loss, and one had equivalent scores. Interestingly, the two control participants classified as U obtained higher scores of unresolved loss than of unresolved trauma. We may question whether the difference between these studies may be due to the recruitment procedures. Riggs and Jacobvitz’s participants had been recruited as part of an at-risk sample (i.e. adolescent mothers), whereas our participants have been explicitly recruited as sexually abused, which may lead to an emphasis on these events during the AAI autobiographical narrative.

5.2. Abuse and responses to stress

Visual examination of the scores of perceived stress suggests that participants who had been exposed to stressful events (sexual abuse) in their childhood and/or adolescence experienced a particularly elevated stress during the laboratory psychosocial stress protocol. This is consistent with the literature, which indicates increased anxiety disorders in victims of childhood sexual abuse (e.g. Barker-Collo and Read, 2003). The stress was especially high for CSA participants with the AAI Unresolved classification (there was a statistically significant difference with the control group).

The examination of the levels of salivary cortisol suggests that participants who had been exposed to stressful events (i.e. sexual abuse) in their childhood and/or adolescence had suppressed endocrine reactions to the laboratory psychosocial stress. Animal and human studies showed that individuals exposed to stressing events, especially when these events took place early in their lives, present persistent endocrine dysregulations and altered stress reactivity to even mild stressors (e.g. Penza et al., 2003; Bevans et al., 2005). Carpenter et al. (2007) found adult subjects (males and females) with a history of childhood maltreatment (CSA, emotional neglect or physical abuse), and without psychopathology, to have lower cortisol reactions at the TSST, as opposed to control subjects. Concerning women with CSA, dysregulated HPA reactions to a psychosocial stressor have been evidenced (Heim et al., 2000b). We found more specifically suppressed cortisol reactions in CSA participants with Unresolved attachment (which was found to be significant with regression analysis). A meta-analysis conducted by Meewisse et al. (2007) on five studies showed lower basal cortisol in women with PTSD due to CSA and/or physical abuse, in comparison to healthy controls.

The coding of Unresolved attachment is somehow entangled with that of PTSD or of dissociative experiences: the lapses in the monitoring of speech or reasoning have been attributed (Main et al., 2008) to the arousal (and interference) of partially dissociated fear in connection with the experience of traumatic experiences “in statements that

appear to violate our usual understanding of physical causality or time–space relations” (p. 61). These lapses may indicate an important emotional absorption involving a “compartmentalized, or even partially dissociated/segregated states of mind” (p. 61). Dissociative processes and posttraumatic reactions have been suggested as the mechanisms underlying the Unresolved speech (Stovall-McClough et al., 2008). Liotti (2004) proposed a “unitary perspective” regarding trauma, dissociation, and attachment disorganization: childhood traumatic events may lead to trauma-related disorders (such as dissociation and PTSD) through the mediation of the internal working model of disorganized attachment. The literature, however, provides only limited empirical support regarding an association between the Unresolved category and clinical symptoms of PTSD or of dissociation (e.g. Stovall-McClough et al., 2008). We found, in our sample of CSA victims, a clear relationship between the Unresolved classification and the Global Assessment of Functioning; however there were no significant relationships with PTSD, dissociative experiences, and depression.

Unresolved attachment, certainly, does not reduce to dissociation or to PTSD. However, since hypocortisolism has been associated with PTSD in individuals having been exposed to stressful events (e.g. Yehuda, 1997, 2001; Bremner et al., 2007b), and to dissociation (Simeon et al., 2007), one should question whether the effects of trauma on later stress reactions (i.e. suppressed cortisol responses of the subjects who were classified U) are linked to disorganized attachment in itself, or to trauma-related disorders such as PTSD, depression, or dissociation. The regression analysis conducted in our sample ruled out the contribution of psychopathology in the relationship between cortisol responses and the Unresolved classification. The presence of an association between hypocortisolism and unresolved trauma, independently of PTSD and of dissociation had not been reported yet.

Low cortisol concentrations during stressing situations (i.e. the TSST) have been associated with a negative emotionality (mood, anxiety), in non-psychiatric (Het and Wolf, 2007), and in psychiatric subjects (Soravia et al., 2006). In their review of studies using stress-eliciting protocols, Dickerson and Kemeny (2004) mentioned that the subjective evaluation of a specific event (for instance, its uncontrollability) affects the magnitude of the response. However, perceived stress in itself is generally reported to be unrelated to cortisol responses. In our study, we did not find any correlation between perceived and physiological responses. Endocrine responses, such as salivary cortisol, broadly used as indicators of stress, definitely differ from the perception of stress. Interestingly, when comparing the three sub-samples of participants (controls, abused organized, and abused Unresolved), we found the last group to present, significantly, the highest scores of perceived stress and, at the same time, the lowest levels of endocrine responses.

5.3. The role of attachment on stress responses

Cortisol has been described as critically involved in the body homeostasis and allostasis, and as essential for the survival when the individual has to mobilize metabolic resources following a stressing event (Goodyer, 2006). Abused subjects with an unresolved trauma showed, as a group, a substantial

perceived stress and low cortisol responses, as if their body failed to activate normally adaptive defensive processes (the HPA activation), when confronted to a mild psychosocial stress. Hypocortisolism of Unresolved subjects associated with a high perceived stress might reflect a discrepancy between subjective and physical responses to threat. Consistently, *Main and Hesse's (1990)* defined unresolved attachment as a collapse of organized strategies of information processing with, as a consequence, a segregation and non-integration of experiences.

In a sample of adult inpatients, most of them women with CSA, *Riggs et al. (2007)* found an association between the Unresolved classification and borderline personality disorder (BPD). According to *Holmes (2003)*, interpersonal relationships in BPD can be seen in terms of an approach–avoidance dilemma, similarly to disorganized attachment (in infancy for example, the approach–avoidance dilemma refers to the fact that a traumatizing caregiver can be simultaneously a source of threat and a secure base). This may suggest a possible understanding of the discrepancy between the perception of stress and endocrine responses to stress of Unresolved subjects with CSA (even if we did not consider the BPD diagnosis in our study): while the subject is consciously experiencing an acute stress, he/she defensively tries to keep the stress system deactivated, because of the failure of his/her attachment system to regulate emotions.

Additional parallels may be drawn with other disruptive aspects in CSA victims with the Unresolved classification. That classification has been defined through lapses in the monitoring of thought processes, and this is coherent with the notion of a difficulty to integrate stressing events, emotionally and cognitively, in other words with a failure to monitor physiological states, and to coordinate physical experience with subjective states. This faulty monitoring may possibly originate from the frequent pressure on CSA victims to deny the pain of experience. Whatever the explanation, such a discrepancy may finally affect behaviors. In a study on an intervention program aimed at improving the quality of adolescent mothers interactions with their children, *Moran et al. (2008)* found that subjects with the Unresolved classification associated with childhood experiences of loss or abuse failed to respond positively to the program, whereas other adolescent mothers responded positively. The authors speculated on cognitive and emotional processes affected by early trauma, which may render interventions ineffective. We may further suggest that a desynchronization between subjective and physical responses to stress in adults with the Unresolved classification, associated with a failure to monitor and regulate one's emotions, may persistently endanger the capacity to respond to others' emotions, hence to affect parental sensitivity. These results may be of interest for the comprehension of the psychological processing of traumatic experiences and its implications.

The paradigmatic experimental settings used by attachment researchers is the AAI for adults, and, for infants, the Strange Situation Procedure (SSP: *Ainsworth et al., 1978*), typically proposed at 12 months of age. Both kinds of settings have been designed so to arouse the attachment system, and, potentially, to activate the HPA axis. During the AAI with adults, *Scheidt et al. (2000)* found, in a clinical sample, an elevated cortisol response, specifically among dismissing

subjects (disorganization had not been coded in that study). In infancy, during the SSP, *Spangler and Grossman (1993)* found children with an insecure attachment (likely to have experienced an insensitive and unresponsive caregiver) to present higher saliva cortisol responses, as compared to secure children. The increased HPA reactivity of insecure children has also been evidenced in other settings in early childhood (e.g. in non-parental child care settings: *Ahnert et al., 2004*; *Vermeer and van IJzendoorn, 2006*; *Dettling et al., 1999*). Among insecure children, those with a disorganized/disoriented attachment have been shown to present the highest cortisol reactivity (*Spangler and Grossman, 1993*; *Hertsgaard et al., 1995*), however not all studies could replicate this result (*Spangler and Schieche, 1998*). These data generally support the notion of a protective effect of secure attachment strategies, regarding the child's reaction to stressful events (*Nachmias et al., 1996*).

So why disorganized/Unresolved adults present suppressed HPA reactions while disorganized/disoriented infants present more elevated responses, as compared to secure individuals? According to *Spangler and Grossman (1993)*, disorganized infants lack a behavioral coping strategy. The normal functioning of the attachment system is that proximity helps regulating emotions; when no strategy is available to gain proximity (because of the approach–avoidance dilemma, the caregiver representing simultaneously a haven of safety and a source of threat) the HPA axis remains highly activated.

A chronic exposure to stress (even a single abusing experience may cause a chronic stress, especially in presence of abusing caregivers, and/or when the event remains psychologically unresolved) may finally cause a desensitization of the endocrine system: hypocortisolism may be described as an exhaustion of the stress response system in traumatized individuals. The deficiency of the HPA response then corresponds either to a reduced adrenocortical secretion, a reduced adrenocortical reactivity or an enhanced negative feedback inhibition of the HPA axis (*Heim et al., 2000a*; *Bevans et al., 2005*).

The difference, regarding stress responses, between abused subjects with and without the Unresolved classification, is then coherent with the notion of attachment as a mediating factor in the long-term consequences of stress exposure, as described in several studies (e.g. *Finkelhor, 1990*; *Muller et al., 2000*; *Twaite and Rodriguez-Srednicki, 2004*).

We acknowledge the numerous limitations of the present study. First of all, the restricted sample size limits the generalization of the results. Then, there are likely recruitment bias. The recruitment procedure implied that the participants contacted the team – and identified themselves – either as victims, or as controls; this may cause two kinds of problems: in the clinical group, allegation of abuse remained uncontrolled, and in the control group, several subjects reported some experience of abuse. Moreover, clinical subjects came from a victim association, which means that they already made an explicit step to seek help, and we did not control for the effect of counseling or of therapy. There was a lack of rigorous control of compliance regarding oral contraceptives, smoking and ingestion of drugs. Additionally, an important limitation is that we did not explore deeply enough (with an interview) the posttraumatic symptoms of

the subjects, which would have been necessary to better disentangle the respective contributions of PTSD and of unresolved trauma, regarding hypocortisolism. Also, we did not examine other possible confounding factors such as personality, schizotypy, or neuroanatomical damages, and we certainly did not explore deeply enough other kinds of trauma. Finally, it would have been important to explore the subjects' borderline symptoms and to consider the possible moderating influence of psychological treatments.

Role of the funding source

Funding for the study was provided by from the Swiss National Science Foundation (SNF) No. 3200B0-100676/1 awarded to B. Pierrehumbert. The SNF had no further role in the study design, in the collection, analysis and interpretation of data, in the writing of the report, and in the decision to submit the paper for publication.

Conflict of interest

None of the authors have any conflicts of interest.

Acknowledgements

Swiss National Science Foundation (SNF) No. 3200B0-100676/1. Association "Faire le Pas", Lausanne.

We thank the psychologists and psychiatrists who conducted the interviews, ran the experiments, or provided support for the study: Clelia Argenziano, Catherine Badertscher, Maria Bayoi, Olivier Chouchena, Emmanuelle Cohin, Elisabetta Constantino, Giusi Daniele, Céline Dessarzin, Nevena Dimitrova, Daniela Equestre, Carol Gachet, Nathalie Glatz, Olivier Halfon, Markus Heinrichs, Dominique Laufer, Sonia Lucia, Raphaële Miljkovitch, Robert Muller, Isabelle Reverte, Gaëtan Rivier, Raffaella Torrisi, Mariame Traoré, Mélanie Wüst, Laure Ziegler.

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