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Adult attachment and social support interact to reduce psychological but not cortisol responses to stress

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Abstract

Objective: Adult attachment has been suggested to mediate the effect of social support on stress protection. The purpose of this study was to investigate the effects of adult attachment and social support on psychological and endocrine responses to psychosocial stress. **Methods:** Sixty-three healthy men who were married or cohabiting were randomly assigned to receive either instructed social support from their partner or no social support before being exposed to a standardized psychosocial stressor (Trier Social Stress Test). Attachment was determined using the Experiences in Close Relationships—Revised questionnaire. State anxiety, mood, and salivary cortisol levels were repeatedly assessed before and after stress. **Results:** Secure attachment was associated with stronger decreases in state anxiety levels following stress exposure. More importantly, the combination of social support and secure attachment exhibited the lowest anxiety levels after stress (interaction effect). Social support alone reduced cortisol responses to stress, whereas secure attachment did not influence cortisol concentrations. **Conclusion:** This first study on the interaction of adult attachment and social support in terms of psychological and endocrine stress responses concurs with previous studies suggesting an important protective role of attachment for psychological stress responsiveness. However, attachment did not directly moderate cortisol responses to acute stress.

Keywords: Adult attachment; Social support; Psychosocial stress; Anxiety; Cortisol

Introduction

Close social relationships have been shown to reduce stress levels and to promote subjective well-being and health in humans [1,2]. In particular, being married or cohabiting with a significant other was negatively associated with morbidity and mortality in epidemiological studies [3,4]. However, not all individuals seem to benefit from the social support offered in a close relationship [5]. Attachment theory might provide a theoretical explanation for these individual differences in seeking social support and the benefit gained from it. The founder of attachment theory, John Bowlby [6,7], conceptualized attachment as a child's motivation to seek proximity to the mother in periods of stress. During repeated interactions with a supportive and sensitive caregiver, it was suggested that the child developed a cognitive schema of general support availability for reducing stress during new and potentially threatening situations. Based on these assumptions, Mary Ainsworth developed a standardized test to investigate mother–child interactions and a system to classify child behavior in these situations [8,9]. According to this classification, an infant might be

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classified either as securely or insecurely (ambivalent, avoidant, or disorganized) attached to the parent. Hazan and Shaver [10] applied the theoretical framework of attachment security to adult relationships. Although there is still controversy in the literature regarding the stability of attachment styles over the life span and the number of attachment styles and their assessment (cf., Refs. [11,12]), an impressive number of studies have shown an association between attachment and the quality of relationships (e.g., Refs. [13–20]). Specifically with regard to social support, secure attachment was positively associated with the general perception of social support, support seeking, and the evaluation of received support [21,22]. Insecure attachment, in turn, was shown to interfere with the individual ability to use support when it is offered [23].

More recently, biopsychological models have attempted to explain the influence of secure attachment on health in humans via altered stress physiology, use of external regulators of affect, and altered use of health-protective behaviors and health care [24,25]. Secure attachment was conceptualized in terms of arousal regulation [26]. Securely attached persons probably seek social support to modulate physiological reactivity to stress [27]. In contrast, based on data regarding attachment and stress physiology in animals [28,29], insecurely attached individuals were suggested to show exaggerated reactivity of the hypothalamic-pituitary-adrenal (HPA) axis and the autonomic nervous system following stress. Accordingly, attachment might be a potent candidate for explaining the role of interpersonal factors in stress and arousal regulation in stress-related disorders.

In their review on attachment and psychosomatic medicine, Maunder and Hunter [25] proposed three ways by which insecure attachment might influence stress responses in humans: via (1) the increase of perceived stress, (2) the impairment of the physiological responses to stress, and (3) the reduced success of social support in buffering stress. In a recent study, Maunder et al. [30] addressed paths 1 and 2 of their theory, investigating the influence of attachment security on subjective responses and heart rate variability to standardized stress. They found low anxious attachment to reduce subjective stress levels and, interestingly, avoidant attachment to be negatively associated with high-frequency heart rate variability. The authors interpreted their findings in terms of a diminished capacity to exert neural control over visceral states in insecure attachment.

To our knowledge, most studies to investigate attachment and endocrine stress measures have been conducted in mother–child dyads ([31–34], as also reviewed in Ref. [35]). Associations between attachment security and HPA axis reactivity in adults during couple conflict were investigated in a recent study [36], which reported a relationship between avoidant attachment and cortisol concentrations in women and anxious attachment and cortisol concentrations in men. The interaction of attachment and social support in the regulation of the HPA axis has not been evaluated to date [37,38]. More importantly, the validity of Path 3 of Maunder and Hunter's model remains to be determined on an endocrine level.

In light of Maunder and Hunter's theory and based on the relatively few data on the endocrine mechanisms of attachment, we sought to investigate the interaction between attachment and social support and their influence on psychological and endocrine responses to stress in adults. In addition, we were particularly interested in disentangling effects of social support on the anticipation of stress and effects of social support on stress reactivity. We therefore measured the psychophysiological stress response repeatedly before, during, and following stress exposure. Notably, the investigation of the interaction between attachment security and social support poses a serious methodological challenge. The two concepts are highly intercorrelated and were even suggested to refer to the same underlying personality aspect [21]. To address this overlap of the two concepts, we decided to study instructed social support in an experimentally controlled laboratory trial. With respect to the assessment of adult attachment, it is important to note that the strongest associations between adult attachment and social support occur within the same type of relationship [39]. We therefore decided to specifically assess attachment in current close relationships. Self-report adult attachment instruments were shown to predominantly measure two dimensions of interpersonal behavior and cognitions: attachment anxiety and attachment avoidance [40]. Following this conceptualization, to put it briefly, attachment anxiety is characterized by an intense fear of losing the partner, whereas attachment avoidance describes a strong motivation to remain independent of the partner.

Based on these two attachment dimensions, we hypothesized that instructed social support provided by the female partner would buffer the negative effects (subjective and endocrine) of a standardized psychosocial stressor only in securely attached men (low levels of anxiety and avoidance).

Methods

Subjects

Sixty-three healthy men aged from 20 to 31, who had been married or cohabiting with a significant other for at least 3 months, participated in the study. Exclusion criteria for participation were medical or psychiatric illness, substance abuse, medication, and smoking. Four of the original 67 subjects were excluded: one subject refused to fill out all of the questionnaires, one subject elicited baseline cortisol measures 2 S.D.'s above the mean of the total group, and two showed elevated scores in the Self-Rating Depression Scale (SDS) (index score > 50). Subjects were recruited from the Zurich area through posters and newspaper advertisements. During telephone-screening interview, they were randomly assigned to either bring their female partner

with them or to participate alone in the experiment. After the experiment, subjects were paid 50 Swiss francs for their participation. Subjects were informed about the course and aim of the study and provided written, informed consent prior to participation. The study was approved by the institutional review board of the University of Zurich.

Procedure

Psychosocial stress was induced by the Trier Social Stress Test (TSST), consisting of a 5-min job interview and a subsequent serial subtraction task performed out loud in front of an unknown panel of one man and one woman [41]. The TSST has repeatedly been shown to reliably induce significant psychological and endocrine stress responses, with two- to threefold increases in cortisol concentrations [41].

After being shown the TSST room containing the panel of evaluators and a conspicuous video camera, subjects received social support by their partner (n=29) or prepared alone (n=34) during the following 10-min preparation phase. In the social support condition, partners were briefly told about the job interview. They were asked to verbally support their partner to the best of their ability during this preparation phase and that they would know best what to say to support the subjects' individual coping preferences [42]. After the preparation phase, partners left the laboratory and all subjects then underwent the stress protocol without their partner present. All experimental sessions lasted for 1.5 h and were conducted between 2:00 and 6:00 p.m. in order to capture maximum cortisol reactivity [43].

Endocrine and psychological measures

Physiological responses to psychosocial stress were assessed by repeated measures of salivary free cortisol levels. Salivary cortisol is considered a valid measure of the biologically active fraction of cortisol and is highly correlated with the unbound cortisol concentration in plasma [44,45].

Cortisol levels were collected at baseline (−20 min relative to the onset of stress), and immediately before (Minute 0) and after stress (Minutes 10, 20, 30, 40, 55, and 70) using a commercially available sampling device (Salivette; Sarstedt, Rommelsdorf, Germany). The Salivette tubes were stored in the laboratory at −20°C until required for biochemical analysis. Before assaying for free cortisol, samples were thawed and centrifuged at 3000 rpm for 10 min to obtain 0.5–1.0 ml clear saliva with low viscosity. The free cortisol concentration in saliva was analyzed using a time-resolved immunoassay with fluorescence detection, as described previously [46]. The inter- and intra-assay coefficients of variation were below 12% and 10%, respectively.

Attachment style was assessed with the German version of the Experiences in Close Relationships—Revised (ECR-R) questionnaire [40,47]. The ECR-R is a self-rating questionnaire with 36 items focusing on attachment attitudes regarding the current close relationship. Each statement is scored on a seven-point Likert scale. The ECR-R questionnaire was designed based on criteria of item response theory and has shown satisfactory internal consistency and validity [40].

To control for possible group differences in depressive symptoms, generally perceived social support, and the quality of the relationship, which might have influenced the results, the validated German versions of the following questionnaires were included: the SDS [48], the Interpersonal Support Evaluation List (ISEL) [49], and the Marriage Diagnostic Questionnaire (PFB) [50]. Affective responses were repeatedly assessed with the state scale of the State-Trait Anxiety Inventory (STAI) [51] and the Multidimensional Mood Questionnaire (MDBF) [52] prior to the presentation in front of the panel (straight after the preparation phase) and immediately after the presentation.

Data analyses

Baseline differences between the two groups were examined with t tests for independent groups. Homogeneity of variance was assessed using the Levene test, and normal distribution of dependent variables was tested with the Kolmogorov–Smirnov test. Associations between interval-scaled data were calculated as Pearson correlations with two-tailed tests of significance. Interactions between attachment style and group assignment and their effect on psychological and physiological stress responses were analyzed using three-way analyses of variance (ANOVAs) with repeated measurement [attachment style (low levels vs. high levels of anxiety and avoidance, respectively) by group (social support vs. alone) by time (repeated measures: two for psychological assessments, eight for cortisol)]. Individuals were divided by median splits into groups with high and low levels of attachment anxiety or avoidance, respectively. Repeated-measures results were verified with Greenhouse–Geisser corrections where appropriate (heterogeneity of error covariances in the Mauchly test of sphericity). All analyses were conducted using SPSS version 13 (Chicago, IL, USA), and the level of significance was set at P<.05.

Results

There were no statistical differences between the two groups in terms of age, body mass index, and relationship satisfaction. Subjects in the alone and social support groups did not differ with respect to trait anxiety, depressive symptoms, perceived availability of general social support, and anxious or avoidant attachment (Table 1).

Anxious and avoidant attachment dimensions significantly correlated with generally perceived social support

Table 1
Demographic and clinical characteristics

	Control group [mean (S.D.)]	Social support group [mean (S.D.)]	*t*	*P*
Age (y)	24.09 (2.67)	23.21 (2.74)	1.28	.204
BMI (kg/m^2)	23.07 (2.43)	22.35 (2.10)	1.22	.227
Marital quality (PFB)	71.53 (9.51)	71.97 (8.24)	−1.93	.848
Trait anxiety (STAI)	30.97 (4.39)	33.97 (7.47)	−1.90	.064
Depressive symptoms (SDS)	36.84 (4.98)	38.58 (5.10)	−1.37	.177
Generally perceived social support (ISEL)	72.12 (13.69)	78.34 (16.56)	−1.63	.107
Anxious attachment (ECR-R)	2.39 (.86)	2.38 (.93)	.06	.96
Avoidant attachment (ECR-R)	2.01 (.72)	2.07 (.82)	.34	.74

(ISEL) (anxiety: r=−.370, P=.003; avoidance: r=−.373, P=.003), with subjects of the high-anxious and high-avoidant groups perceiving less general social support. Anxious attachment was significantly correlated with higher scores of trait anxiety (STAI) (anxiety: r=.576, P<.001; avoidance: r=.108, P=.40, NS). Subjects with high anxious attachment (median split) did not differ in age or BMI from subjects with low anxious attachment but reported significantly higher levels of depressive symptoms (t=2.07, P=.04) and lower levels of relationship quality (t=3.24, P=.002). Similarly, subjects with high avoidant attachment (median split) showed no differences in age and BMI but again showed significantly more depressive symptoms (t=3.31, P=.002) and lower relationship quality (t=3.84, P<.00) as compared to subjects with low avoidant attachment.

Psychological stress responses

The total group of subjects showed significantly reduced anxiety levels (STAI) [F(1.0,59.0)=40.76, P<.001] and elevated calmness (MDBF) [F(1.0,59.0)=12.44, P=.001] after stress compared with prestress levels.

Subjects in the social support group and subjects in the alone group did not differ in their psychological stress responses. Notably, there was a significant influence of low vs. high anxious attachment style (ECR-R) [F(1.0,59.0)=4.99, P=.03] on decreases in state anxiety from pre- to poststress, with stronger decreases in persons with low anxious attachment. In line with our hypotheses, there was a significant interaction between anxious attachment style and social support in terms of their influence on state anxiety decreases [F(1.0,59.0)=4.15, P=.046]. Whereas subjects characterized by a low anxious attachment style (securely attached persons) benefited from social support by their spouse, subjects with high anxious attachment did not (Fig. 1A). Consistent with this, low avoidant attachment style (ECR-R) was associated with significantly stronger decreases in state anxiety from pre- to poststress [F(1.0,59.0)=4.0, P=.05] compared to high avoidant attachment style. In addition, there was a trend toward an interaction between avoidant attachment style and social support [F(1,59)=3.58, P=.064] (Fig. 1B). There was no effect of attachment and social support on mood (MDBF).

Endocrine stress responses

The stress protocol induced significant increases in salivary free cortisol levels [main effect of time: F(2.76,168.03)=74.62, P<.001] in the total group. There was a significant group by time interaction effect [F(2.76,168.03)=3.13, P=.03], with lower cortisol levels in the social support group particularly during stress anticipation (Fig. 2). Post hoc univariate ANOVAs revealed no significant differences in baseline cortisol levels between groups but showed significantly attenuated cortisol levels in the social support group immediately before stress [F(1,61)=3.85, P=.05]. There was no significant effect of attachment

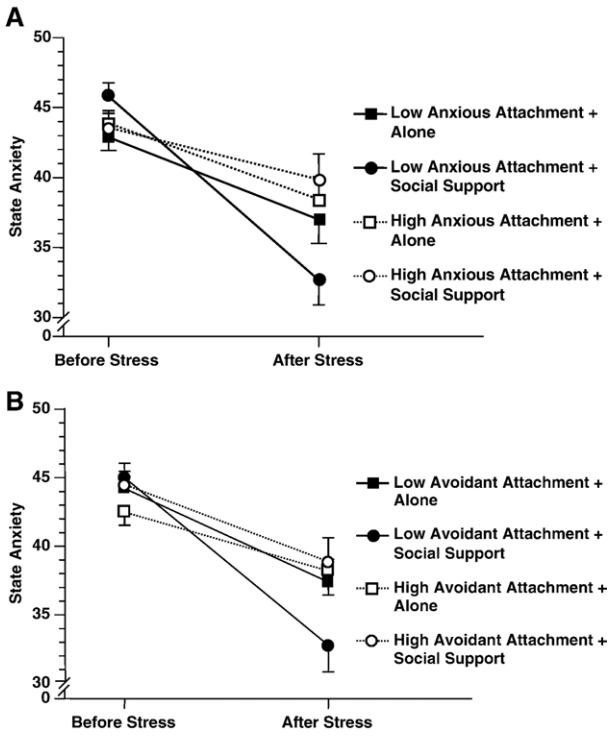

Fig. 1. Attachment, social support, and anxiety levels (STAI-state) before and after a standardized psychosocial laboratory stressor in men. (A) Interaction between anxious attachment (ECR-R, high vs. low anxious attachment) and social support (no support vs. social support provided by the partner). (B) Interaction between avoidant attachment (ECR-R, high vs. low avoidant attachment) and social support (no support vs. social support provided by the partner). Error bars are S.E.M.'s.

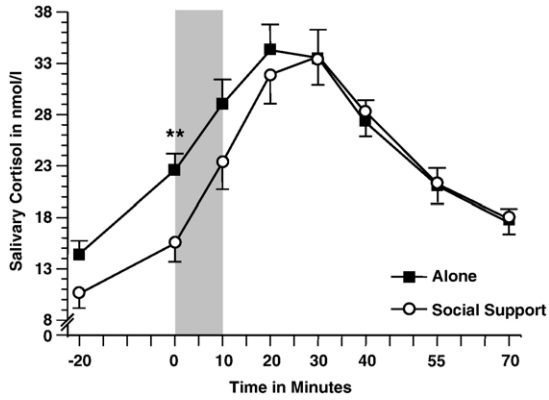

Fig. 2. Mean salivary cortisol concentrations (with S.E.M. bars) before, during (shaded area), and after a standardized psychosocial stressor in men with either no social support or social support provided by the partner before stress. There were no differences in cortisol stress responses between high anxious/low anxious and high avoidant/low avoidant groups.

style on cortisol levels and no interaction between attachment as a covariate and group by time interaction.

Correspondence between psychological and endocrine stress responses

Mean anxiety levels before and after stress were unrelated to aggregated cortisol levels (area under the individual response curve) (see Ref. [53]) in the total group (r=.18, P=NS). Interestingly, this lack of correspondence between psychological and endocrine stress measures was based on the low correspondence between these measures in high avoidant attachment (r=.081, P=NS). In subjects with low avoidant attachment, these measures were significantly correlated (r=.473, P=.007), and groups significantly differed in their association of psychological and endocrine stress measures (Z=2.246, P=.025) (according to Ref. [54]). There was no relation of anxious attachment style with correspondence of psychological and endocrine stress measures.

Discussion

This is the first study to investigate the interaction between adult attachment and social support in terms of their influence on subjective and endocrine responses to psychosocial stress in humans. In line with attachment theory, our findings suggest that secure attachment and social support interact to attenuate anxiety during stress exposure.

In their review on attachment and psychosomatic medicine, Maunder and Hunter [25] proposed an influence of insecure attachment on stress responses in humans via (1) the increase of perceived stress, (2) the impairment of the physiological responses to stress, and (3) the reduced effectiveness of social support in buffering stress. In light of this theory, we investigated these three pathways experimentally in a standardized stressful situation.

In our study, both high anxious and high avoidant attachment were associated with increased perceived stress (state anxiety before and following stress). Thus, our experimental data are in line with Mechanism 1 in Maunder and Hunter's model. Our results further agree with recent findings on the influences of anxious attachment on psychological stress responses [30] and with the interpretation of secure attachment as an anxiety-regulating mechanism in animals and in humans [27].

The interaction effect of secure attachment and social support in buffering anxiety before and following stress supports Mechanism 3 of the proposed model [25]. The results are also in line with the social competencies and interpersonal processes model by Mallinckrodt [55] and with recent data reported by his group [56], suggesting that adult attachment anxiety and avoidance are both negatively associated with perceived support and positively related to psychosocial distress in general. In the present study, the active mobilization of social support was experimentally controlled by group assignment, thereby extending previous results on attachment and the perception of generally available support [57] and on increased support seeking under stress [58]. Notably, in our study, social support alone did not reduce psychological stress. This is in line with earlier studies, which in contrast to the clearly positive effects of generally perceived availability of support, found incongruent results regarding the effects of actually received social support on psychosocial stress [21,42,49,59–62]. In light of these findings, the interaction effect of attachment and social support in the present study suggests an important potential of attachment theory to close the gap between the apparently discrepant results on generally perceived vs. actually received social support. Our results might lead to fertile research on this interaction effect in a larger sample and help to further identify psychosocial and neurobiological mediating factors of secure attachment.

With regard to endocrine stress responses, our data replicate and extend earlier findings on the stress protective effect of social support. In a study conducted by Kirschbaum et al. [62], social support by the female spouse significantly reduced the total amount of cortisol during psychosocial stress in men compared to a control (alone) condition. In a placebo-controlled, double-blind study on the effects of the neuropeptide oxytocin on psychosocial stress, we recently investigated cortisol stress responses comparing social support from the best friend vs. no social support before stress exposure in men (following either oxytocin or placebo administration) [42]. Cortisol levels were significantly attenuated by social support in response to stress. More importantly, the combination of social support and oxytocin exhibited the lowest cortisol concentrations as well as increased calmness and decreased anxiety during stress.

The current data are in line with these studies and specify that social support during anticipation of the stressor might be particularly important in order to buffer endocrine stress responsiveness. In fact, our data suggest that the stress

protective effect of social support on cortisol levels particularly occurs during the anticipation phase when the partner was still present. Interestingly, in the social support group, cortisol levels later increased to a peak level similar to that of the alone group, which might be interpreted in terms of delayed cortisol responsiveness to psychosocial stress. This cortisol increase might also be interpreted in terms of a beneficial effect of social support during stress appraisal rather than during stress reactivity.

In our study, the effect of social support on cortisol levels during stress anticipation was not moderated by attachment. Thus, our data are not in accordance with Mechanism 2 in the proposed model by Maunder and Hunter [25] and do not parallel earlier results on reduced heart rate responses to stress in secure attachment [63], reduced heart rate variability in avoidant attachment [30], and patterns of reduced cortisol reactivity and faster recovery during the anticipation of marital conflict in secure attachment [36].

In relation to the latter study on couple conflict, the lack of association between attachment and cortisol stress responses in our study deserves further attention. Our data do not answer the question of whether secure attachment might influence cortisol responses to stress in women. Recent studies from our laboratory suggest sex-specific effects of different kinds of social interaction (e.g., social support, physical contact) on physiological responses to acute psychosocial stress [42,64]. This would also be in accordance with the theoretical framework of a 'tend-and-befriend' behavior in females following stress and its physiological underpinnings as suggested by Taylor et al. [65]. Future research might elucidate possible sex differences in the interaction of attachment security and social support in terms of physiological responses during stress.

A further possible interpretation is that attachment security is associated with cortisol levels during an intracouple stress situation but not during stress that is external to the couple (such as socioevaluative stress during the TSST), presumably based on the stronger interrelation between intracouple measures. Attachment might modulate the effect of social support on physiological stress responses in subjects suffering from a stress-related disorder as opposed to healthy nonaffected persons like those in our study sample. This interpretation would be in line with an earlier study by Scheidt et al. [66] who compared patients with idiopathic spasmodic torticollis and healthy controls. They found that attachment style, classified via the Adult Attachment Interview [67], was related to cortisol responses during the attachment interview only in the clinical sample, and not in healthy controls. Stress and the administration of corticotropin-releasing factor, the main regulating hormone of the HPA axis, have been shown to activate the attachment system in animals [68,69] and in humans [27], and illness events as extreme stressors are thought to trigger the mobilization of attachment behavior [25]. In line with this, Schmidt et al. [70] report relations between acute stress and higher numbers of insecure attachment classifications in patients suffering from breast cancer, chronic leg ulcers, and alopecia. Further research should explore the interaction between stress, attachment, and social support in clinical samples or chronically stressed persons.

In line with earlier studies (among others [60,64,71,72]), psychological and physiological stress responses were not related in the total group in our sample. However, most interestingly, our data indicate that this effect was based on the low correspondence between these measures in subjects with high avoidant attachment. The observed mismatch between psychological and endocrine stress measures in avoidantly attached individuals is in line with a study in young children [31]. In this study, particularly high cortisol levels were found in insecurely attached children with high behavioral inhibition during a mother–infant separation task. The dissociation of psychological and endocrine data might indicate the incapacity of avoidantly attached individuals to correctly interpret their physiological involvement during the stress task. In this way, our data might add important information to the ongoing scientific discussion on stress coping in insecure attachment and associated physiological and disease processes [30,73–75].

In summary, our results outline the importance of attachment security in psychological stress regulation. They specify the buffering effect of social support on endocrine stress responses but indicate that attachment security in healthy men does not seem to directly modulate this effect. Research comparing the influence of attachment security on stress responses in women compared to men, comparing different kinds of enacted social support (e.g., mere presence of the partner vs. verbal support), and comparing patients suffering from a chronic stress-related disorder with healthy controls might provide further insight into the suggested relationship on a physiological level.

Acknowledgments

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