



Physiological blushing in social anxiety disorder patients with and without blushing complaints: Two subtypes?

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ABSTRACT

This study investigates whether social anxiety disorder (SAD) patients with blushing complaints show heightened physiological blushing and arousability in social situations than SAD patients without blushing complaints and healthy controls. SAD blushers ($n = 32$), SAD non-blushers ($n = 34$), and healthy controls ($n = 25$) conducted two social tasks. The physiological responses cheek and forehead blood flow, cheek temperature, and skin conductance were recorded, as well as confederates-observed blushing. The SAD blushers showed more physiological blushing (cheek temperature and blood flow) than SAD non-blushers and observers detected this difference. This finding was also present in comparison to the controls, except for blood flow. For blood flow SAD blushers and controls did not differ but SAD non-blushers showed a 'suppressed response': a smaller cheek blood flow increase during the interaction and no recovery compared to the other groups. Furthermore, on skin conductance no differences between groups were observed. Discussed is to what extent SAD blushers and SAD non-blushers represent two qualitative distinct subgroups of SAD.

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Patients with social anxiety disorder (SAD) fear negative evaluation by others. In 1872 Darwin stated that it is "the thinking about what other people can think of us which excites a blush" (Darwin, 1955, p. 325). As a result, people who think that others evaluate them negatively would be more prone to blush. Indeed, blushing is a frequently reported anxiety symptom of patients with SAD (Edelmann, 1990). A proportion of SAD patients even develop a blushing phobia or erythrophobia (Bögels and Stein, 2009; Bögels et al., 1997; Edelmann, 1990; Mersch et al., 1992; Scholing and Emmelkamp, 1993).

The phobic properties of blushing may result from several features. First, as blushing is an overt manifestation of responses regulated by the autonomic nervous system, it is not under subjects' voluntary control. Second, in contrast to other physiological anxiety symptoms like heart palpitations, blushing can be noticed by others. Third, blushing serves to increase self-focused attention (Bögels and Mansell, 2004), thereby making the blusher more aware of own anxiety symptoms, and, as a result, increase the fear of negative evaluation by others because of showing anxiety symptoms. Finally, as concomitants of blushing are to avoid gaze and bend the head (Leary and Meadows, 1991), blushing may interfere with social behaviour.

Although a characteristic of normal human functioning is the capacity to blush, individuals differ in their blushing propensity and intensity (Leary et al., 1992). Therefore, one of the etiological markers of the development of SAD might well be vulnerability for more frequent and/or intense blushing. If a heightened blushing propensity is indeed a marker for SAD, it could be hypothesized that individuals with SAD blush more. However, studies so far have produced conflicting results.

Blushing is measured in various ways: temperature of the cheek and ear lobes, or photoplethysmograph recordings of cheek or forehead. Researchers measure mean blushing level, and/or blushing responsiveness in socially challenging situations. Four studies found evidence for a heightened physiological blush response in SAD. This evidence consists of a higher mean blushing level in socially anxious individuals (Bögels et al., 2002), and a greater blushing response in both socially anxious students (Hofmann et al., 2006), people seeking treatment for blushing complaints (Drummond, 2001) or with SAD patients recruited by advertisements (Gerlach et al., 2001). It is worth noting that Gerlach et al. (2001) only recorded differences in physiological blushing while participants watched an embarrassing video, and not during a speech and an interaction task. Four other studies did not find evidence for social anxiety to be marked by heightened blush responses. These studies included analogue populations with high versus low blushing fearful or high versus low blushing propensity students (Drummond et al., 2007; Mulkens et al., 1997, 1999) and a population of patients with SAD recruited through

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advertisements versus normal controls (Edelmann and Baker, 2002). In other words, there is conflicting evidence as to whether individuals with SAD blush more frequently or more intensely than normal controls.

One explanation for the lack of clarity concerning whether or not SAD is characterized by blushing, is that not all people with SAD blush more than those without SAD. There might be large variability within the group of individuals with SAD with respect to blushing propensity and blushing intensity. Only one study (Gerlach et al., 2001), examined whether SAD patients ($n = 15$) with blushing as their primary complaint differed in their psychophysiological responses from other patients with SAD ($n = 15$). They were not able to identify a different blushing response, as measured with a cheek photoplethysmograph, to their social tasks (e.g., watching an embarrassing video, conversation and speech) between these two groups of SAD patients. However, this might be due to power problems. Moreover, it is worth noting that their patients were recruited by advertisements and were not seeking help through regular mental health care. Gerlach et al. (2001) did, however, find SAD patients with blushing complaints to show higher heart rate during their three social tasks than SAD patients without these complaints. The latter finding is in line with the findings of Laederach Hofman et al. (2002), who found that erythrophobia patients have higher heart rates during a mental stress task than healthy subjects. However, they did not assess whether their patients fulfilled the diagnosis of SAD and did not compare their sample to SAD patients without blushing complaints. Hofmann et al. (2004) argue that rather than blushing per se, one subtype of SAD would be a fearful subtype that reacts with a more intense general psychophysiological response to social stress. Therefore, SAD patients with blushing complaints might suffer from heightened general arousability rather than heightened vascular blushing.

In conclusion, although SAD is characterized by blushing, so far only a few studies have been able to detect differences between socially anxious and non-socially anxious individuals in physiological blushing measurements such as cheek temperature and cheek and forehead blood flow. This lack of consistency in the literature might reflect the heterogeneity of SAD patients and it seems necessary to differentiate SAD patient with and without blushing complaints. However, the only one study that did differentiate between these two groups of SAD patients did not find differences in physiological blushing responses. Still, it might be that only those SAD patients who complain about blushing, can be characterized by more (intense) physiological blushing or by a general heightened psychophysiological response to social stress.

This study aims to investigate physiological blushing and arousability in patients with SAD with and without blushing complaints that were seeking help in regular mental health care,

and in healthy control participants. To that end, SAD patients characterized as blushers ($n = 32$) and non-blushers ($n = 34$), and normal controls ($n = 25$) conducted both a speech and a conversation. Two social tasks were included to increase reliability of the assessments. The physiological responses cheek and forehead vasodilatation, cheek temperature, and skin conductance were recorded during baseline, interaction, and recovery. It was hypothesized that SAD patients with blushing complaints have a stronger blush response or blush more intensely and have a general heightened arousability than SAD patients without blushing complaints and healthy subjects in social situations.

1. Method

1.1. Participants

The SAD patients were referred to the community mental health centre of Maastricht, The Netherlands, for out-patient treatment. Diagnoses were determined with the Structured Clinical Interview for DSM-IV Axis-I disorders (SCID-I, First et al., 1997) by trained therapists. Of the 81 SAD patients that were approached, 66 (81%) participated. Reasons for non-participation were: in five patients their confidentiality was at risk, as they were students or employees at the university and could be recognized by the student-confederates, three refused because of the time investment and six because of anxiety. Two patients, overwhelmed by anxiety, dropped out during the assessment. Except for two patients, all patients fulfilled the criteria of generalized SAD (97%). The SAD patients were divided into two groups based on an extra question added to the SCID-I interview: 'whether they 'suffered from blushing during social interactions'. Those who responded affirmatively ($n = 32$) are regarded as the blush group whereas those who responded not affirmatively ($n = 34$) are regarded as the non-blush group.

The normal control group ($n = 25$) was recruited from a general list of people willing to participate in research. None of them fulfilled criteria of either SAD or depression, as assessed with the SCID-I. All participants completed the Social Phobia and Anxiety Inventory (SPAI; Turner et al., 1989; Dutch validation by Bögels and Reith, 1999). Characteristics of the participants are depicted in Table 1.

It was checked whether the two SAD groups differed on variables that could influence physiological responses. First, no differences in symptom severity were found between the two SAD groups on the SPAI, $t(56) = 0.8$, $p = .41$, total psychopathology score on the Symptoms Check List (SCL-90), $t(56) = 0.4$, $p = .68$, and number of criteria of avoidant personality rated by trained therapists using the SCID-II, $t(56) = 0.9$, $p = .38$. However, the groups did differ in number of life-time mood disorders (SAD blushers 37.5% versus SAS non-blushers 61.8%, $\chi^2(1) = 3.9$, $p = .049$). Second, although no evidence is present (see Leary et al., 1992) it is generally believed that age and sex might affect blush symptoms. No differences were found between the two SAD groups on age, $t(56) = 1.1$, $p = .29$. However, there was a sex difference between the groups, $\chi^2(1) = 5.5$, $p = .02$. The SAD blushers group consisted of more women than men (19 women and 12 men), whereas, the SAD non-blushers group consisted of more men than women (9 women and 20 men). The control group did not differ in gender distribution from the SAD blushers $\chi^2(1) = 0.3$, $p = .62$, but the SAD non-blushers consisted of a higher percentage of men than the control group, $\chi^2(1) = 4.2$, $p = .04$.

Due to equipment failure for eight participants (one SAD blusher, five SAD non-blushers and two controls) all physiological data were lost. In addition, during recording for six participants the equipment partly failed and some of their data were lost (five SAD non-blushers: one cheek temperature, two skin conductance, two both cheek temperature as well as cheek and forehead blood flow, and one normal control: skin conductance).

Table 1
Characteristics of the participants.

	SAD blushers $n = 32$ (S.D.)	SAD non-blushers $n = 34$ (S.D.)	Normal controls $n = 25$ (S.D.)
Age	30.3 (8.7)	33.1 (10.1)	32.5 (11.3)
Sex	38% male a	71% male b	52% male a
Education level ^a	8.0 (2.1)	8.0 (2.3)	7.7 (1.7)
SPAI, social phobia subscale	129.9 (31.8) a	124.0 (28.2) a	57.2 (28.7) b
Avoidant personality ^b	3.6 (2.1) a	3.1 (2.1) a	–
SCL-90 total score	183 (61) a	187 (61) a	–
Life-time depression ^c	37.5% a	61.8% b	–
Blush item of SPAI (item 32)	5.1 (1.2) a	3.3 (1.5) b	2.8 (1.5) b
Number of blushing–fearful social situations	2.0 (2.3) a	0 (0) b	–
Self-rating blushing	5.4 (2.1) a	3.3 (1.7) b	3.3 (1.8) b
Observer rating blushing	4.3 (1.5) a	2.8 (1.2) b	2.8 (1.3) b

Note: Means with different letters differ significantly ($p < .05$, two-tailed).

^a On a 11-point scale, from 1 = no completed education, 2 = elementary school, to 11 = masters degree.

^b Number of criteria of avoidant personality disorder assessed by a SCID II interview.

^c Life-time mood disorder assessed by a SCID I interview.

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