Sympathetic Skin Response in Social Anxiety Disorder and Its Relationship with Empathy Skills, Alexithymia

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ABSTRACT

Introduction: Psycho-behavioral studies have shown that sympathetic skin response (SSR), which is an indicator of sympathetic function, is associated with emotional responses. It has been reported that SSR, which is claimed to be a biological indicator of empathy, has increased in Social Anxiety Disorder (SAD) patients. The aim of this study was to evaluate the relationship between SSR and alexithymia, empathy in patients with SAD.

Method: SAD patients and control group were applied Liebowitz Social Anxiety Scale, Hamilton Depression Rating Scale, Hamilton Anxiety Rating Scale, Toronto Alexithymia Scale, Empathy Quotient, Facial Emotion Identification and Discrimination tests (FID, FDSC); during the application FID, SSR were measured. The relationship between alexithymia and empathy levels were investigated.

Results: The number of SSR was higher in all visual stimuli of SAD patients (11.13±3.01) compared to the control group (7.4±3.57). More autonomous activity to negative stimuli (SAD: 10.55±2.82, control: 6.36±3.64), sensitivity to positive stimuli (SAD: 0.58±0.69, control: 1.03±0.8) was less than control group. While 41.7% of SAD patients had alexithymic features, 36.1% were diagnosed with depressive disorder.

Conclusion: It was thought that depressive and alexithymic features may have contributed to increased sympathetic sensitivity to negative stimuli in SAD patients. Further studies are needed to examine the effects of this situation on the selection and creation of the treatment modalities.

Keywords: Social anxiety, alexithymia, sympathetic skin response

INTRODUCTION

Social Anxiety Disorder (SAD), also known as social phobia is defined as a distinctive and continuous fear of the individual for being judged by others or that he/she will be ashamed or disgraced in social environments (1). While the prevalence ratio of SAD varies between 4–16 %, it has been determined in our country between 9–22% (2, 3).

It is reported that sympathetic skin response (SSR) as an indicator of sympathetic function is related with emotional responses and increases in SAD patients (4). SSR defined as a change in electrical potential in the skin due to an internal or external stimulus (5) is an easily applicable method of diagnosis that can be used for the evaluation of pseudomotor functions (6). It may be defined in more detail as an instantaneous and non-permanent change in the electrical potential of the skin of the palms or soles against an internal stimulus such as strong coughing, recoil, painful stimulant or external stimulus such as electrical stimuli from peripheric nerves (6).

Conceptually, it is reported that the prevalence of alexythmia indicating "lack of words for emotions" or difficulty in defining and identifying emotions is around 28.3-58.0% in SAD patients (7, 8). It has been reported that alexythmic individuals have weak "empathy" skills defined as the ability to view events by placing himself/herself in the place of others for an accurate perception of their emotions and thoughts and the process of transmitting this to others (9, 10). It can be assumed that the difficulties experienced by these individuals to define and express their emotions disrupt the necessary stages for the empathy process.

Physiological evaluation of empathic processes brings to mind the connection of symptoms that emerge as the response of a series of cognitive and emotional processes with the autonomous nervous system. Various studies have been carried out evaluating the relationship between the responses resulting from the stimulation of the autonomous nervous system with empathy as well as the relationships between empathy and SSR, changes in pupil size. The patients and the observer were subject to an empathy scale following the therapy during a study with psychotherapists and patient groups that know each other with the participation of an independent observer monitoring the interview records and the skin conductances of the patients and the therapists were measured during the session. It was determined that the empathy scores of the observer were high during the periods when the changes in the skin conductances of the patients and the therapists were in accordance while the empathy scores of the observer and the patient were observed to be low at other times. This result was interpreted such that the accordance with regard to the change in skin conductance is related with

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the empathy scores and that it may be a biological indicator of empathy (11–14). It has been reported that the basal autonomous nervous system (ANS) activity is high in alexithymic patients and that the autonomous system activity is higher during cognitive processes induced by a visual stimulus in comparison with non-alexithymic individuals (15). Literature data lead us to think that ANS activity may be different for SAD patients in comparison with the healthy volunteers and that the changes in SSR for this patient group may be related with empathy skill due to the impact of alexithymic characteristics.

The purpose of the present study was to examine SSR during the implementation of Facial Emotion Identification Test (FEI) and to assess the relationship between alexithymia and empathy based on the assumption that the SAD patients may be different with regard to SSR from healthy individuals in identifying the emotions, that their SSR may increase with negative emotions and decrease with positive emotions and that it may be related with the accompanying alexithymia and that it can be affected by empathy skills.

METHOD

Sample Group
The study was carried out with 36 patients with similar age, gender, education status selected randomly from among all patients in the 18-60 age period who applied to Pamukkale University Faculty of Medicine Psychiatry Department Polyclinics diagnosed with SAD in accordance with Diagnostic and Stastical Manual of Mental Disorders (DSM- IV-TR) (16) in compliance with the inclusion criteria for the study who approved to take part.

Inclusion criteria for the patient group were determined as; meeting the SAD diagnosis in accordance with the DSM-IV diagnostic criteria, volunteering to take part in the study and giving consent, being literate. Those with education and intelligence issues that may prevent psychiatric interviews and the tests to be carried out, those with evere depression, physical limitations, any physical disorder with impacts on the central nervous system, trauma or substance abuse and those diagnosed with psychotic disorder, neurological and organic mental disorder along with those who did not approve to take part in the study were excluded.

Ethics Council Approval: The study has been approved by the Pamukkale University Faculty of Medicine Ethics Council with the document dated 27,02,2013 and numbered 2013/32.

Measurement and Evaluation
The form prepared by the researchers including 28 questions on the sociodemographic data and clinical characteristic of the patients were applied to the case and control groups. SAD diagnosis was placed by applying SCID-I and in accordance with DSM-IV-TR diagnostic criteria. In addition, Liebowitz Social Anxiety Scale (LSAS) was used for determining the social anxiety intensity (17). Hamilton Depression Rating Scale (HAM-D) (18) and Hamilton Anxiety Rating Scale (HAM-A) (19) were used for evaluating depressive symptoms and general anxiety intensity respectively (19). Toronto Alexithymia Scale (TAS-20) was used for measuring the level of alexithymia (20), those with scores of 61 and above were evaluated as alexithymic properties. Facial Emotion Identification (FID) (22) evaluating social functionality and Empathy Quotient (EQ) (21) were applied to the participants. SSR measurements were made during the FID application. The acquired SSR data were compared among both groups and with other scale results.

The electrophysiological examinations of the cases were carried out at the Pamukkale University Faculty of Medicine Neurology Department Electromyography (EMG) laboratory. The patient was prepared in

accordance with the related procedures prior to SSR. SSR measurements were started in a proper setting. The patient and control groups were taken into examination during the same hours of the day. Ag-AgCl superficial disc electrodes were used for preventing transmission decrease during the recordings. The recording procedure was carried out by placing active superficial electrodes inside the palm and reference superficial electrodes on the back of the hand after the right wrist-right hand skin were cleaned thoroughly.

FID was applied to the patients during measurement recording the SSR responses that may develop against an emotional (joy, sadness, anger, fear, surprise, shame) visual stimulus. The patients were allowed to rest for 10 minutes in between the repeated procedure carried out with 19 emotional stimuli displayed at 10 second intervals for 4 times in different order. Receiving a response to any one of the 4 consecutive measurements was assumed as a response, while failure to receive a response to any measurement was assumed as no-response.

Statistial Analyses
The data were analyzed via Statistical Package for the Social Sciences (SPSS 21.0) software. Shapiro-Wilk normality test was used for examining the accordance of the variables with normal distribution. Chi square (X^2) test was used for examining the categorical variables. Significance of the Difference Between Two Means Test was used when the parametric test assumptions were met during independent group comparisons; while Mann-Whitney U test was used when the parametric test assumptions could not be met. Significance of the Difference Between Two Correlations was used for dependent group comparisons when test assumptions were met; while Wilcoxon Paired Two Sample Test was used when parametric test assumptions were not met. Spearman Correlation Coefficient was used for examining the relationship between the variables. Statistical significance was evaluated as $p<0.05$ for all tests.

RESULTS

Sociodemographic Characteristics
The study was completed with the participation of 66 individuals comprised of 36 SAD patients with similar age, gender, education status and marital status ($p>0.05$) and 30 controls.

Of the participants in the SAD patient group, 20 (55.6%) were male, 16 (44.4%) were female, age average was 22.02±0.33 (19–34), average duration of education was 14.19±0.41 years. With regard to marital status, 34 (94.4%) were single, 2 (5.6%) were married.

Of the healthy control group, 17 (56.7%) were male, 13 (43.3%) were female with an age average of 21.2±0.37 (18–37), average education duration of 14.23±0.41 years. 26 (86.7%) were single, 4 13.3%) were married.

Clinical Characteristics
Table 1 presents the comparison of the groups according to clinical scale scores. Accordingly, there were statistically significant differences between the groups with regard to all scale scores excluding FID and EQ scores.

When the number of total SSR during FID application is compared (min 0, max 19); it is 11.13±3.01 for SAD patients and 7.4±3.57 for the control group; it was determined that the response ratio in SAD patients is higher at a statistically significant level in comparison with the control group (p=0.0001). It was determined when the positive and negative emotions are considered separately that the SSR number (min 0, max 2) against visual stimuli with positive emotions is 0.58±0.69 for SAD patients and 1.03±0.8 for the control group with a statistically significant difference

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Table 1. Comparison of scale scores among groups

Scales	SAD Mean ± SD	Control Mean ± SD	U/t	P
HAM-A	15.56±4.29	6.13±3.99	U=64	0.001***
HAM-D	9.86±3.59	6.83±4.73	U=275	0.001***
LSAS	73.14±19.76	18.7±11.62	U=1	0.0001***
LSAS-anxiety	39.33±10.25	10.9±6.59	U=4.5	0.0001***
LSAS-avoidance	33.58±11.2	7.8±5.16	U=1	0.0001***
EQ	40.36±9.17	44.37±8.49	t=-1.828	0.072
TAS-20	57.53±8.95	46.07±10.54	U=291	0.001***
TAS-1	20.42±5.34	14.8±5.61	t=4.157	0.0001**
TAS-2	16±3.6	12.07±3.35	U=222	0.0001***
TAS-3	21.19±3.95	19.2±3.56	U=355	0.017*
FID	15.61±1.54	16.07±1.36	U=508	0.231

U, Mann-Whitney U test; t, independent groups t test; *p<0.05; **p<0.01; ***p<0.001; Mean± SD, mean± standard deviation; SAD, sosyal social anxiety disorder; HAM-A, Hamilton anxiety rating scale; HAM-D, Hamilton depression rating scale; LSAS, Liebowitz social anxiety scale; EQ, Empathy quotient; TAS, Toronto alexhithymia scale; FID, Facial emotion identification test.

(p=0.022). The SSR number (min 0, max 17) against visual stimuli with negative emotions was determined as 10.55±2.82 and 6.36±3.64 respectively for SAD patients and the control group with a statistically significant difference (p=0.0001). Table 2 evaluates the different emotion expressionse in FID content (joy, sadness, anger, fear, surprise, shame) separately and the SSR numbers are summarized. The number of SSR against "Joy" was observed to be high for the control group at a statistically significant level (p=0.022). SSR number against emotions of "Fear, anger, sadness and shame" were observed to be higher in SAD patients at a statistically significant level (p=0.001).

It was observed when the data were compared with regard to alexithymic properties that; 15 of the SAD patients were classified as alexithymic (41.7%) and 21 as non-alexithymic (58.3%). Table 3 presents a summary of the clinical scale data for alexithymic and non-alexithmic SAD patients. The empathy scores of alexithymic patients were observed to be lower at a statistically significant level in comparison with non-alexithymic patients (p=0.029). It was observed when the SSR numbers were examined with regard to emotions that the SSR number is high at a statistically significant level for the alexithymic group for the "fear" emotion (p=0.002). The total

Table 2. Comparison of the number of sympathetic skin responses against visual stimuli including different emotional expressions according to groups

Emotion	Number of sympathetic skin responses	SAD Mean ± SD	Control Mean ± SD	U	P
Joy	0–2	0.58±0.69	1.03±0.8	374	0.022*
Fear	0–6	4.36±1.45	2.6±1.69	238.5	0.0001***
Anger	0–4	2.66±1.37	1.56±1.25	294.5	0.001***
Sadness	0–3	1.47±0.69	0.9±0.99	361	0.016*
Shame	0–2	1.22±0.76	0.7±0.71	341.5	0.006**
Surprise	0–2	0.83±0.77	0.6±0.67	453	0.224

U, Mann-Whitney U test; t, independent groups t test; *p<0.05; **p<0.01; ***p<0.001; Mean ± SD, Mean ± standard deviation; SAD, Social anxiety disorder

Table 3. Comparison of data among alexithymic and non-alexithymic groups for SAD patients

Scales	Alexithymic Mean ± SD	Non-Alexithymic Mean ± SD	U/t	P
HAM-D	10.8±3.36	9.19±3.67	U=118.5	0.207
HAM-A	16.93±4.19	14.57±4.17	t=-1.669	0.104
LSAS total	78.93±22.29	69±17.1	U=113.5	0.157
Anxiety	42.06±12.15	37.38±8.42	t=-1.368	0.180
Avoidance	36.33±11.69	31.61±10.67	U=119.5	0.221
EQ	36.46±6.6	43.14±9.85	t=2.28	0.029*
SSR total (0–19)	12.33±2.55	10.28±3.08	t=-2.105	0.043*
SSR negative (0–17)	11.53±2.23	9.85±3.03	t=-1.813	0.079
SSR positive (0–2)	0.8±0.77	0.42±0.6	U=115.5	0.133
SSR-joy (0–2)	0.8±0.77	0.42±0.6	U=115.5	0.133
SSR-fear (0–6)	5.26±0.8	3.71±1.48	U=62.5	0.002**
SSR-anger (0–4)	2.6±1.29	2.71±1.45	U=145	0.677
SSR-sadness (0–3)	1.66±0.98	1.33±0.96	U=125.5	0.283
SSR-shame (0–2)	1.13±0.74	1.28±0.78	U=138.5	0.511
SSR-surprise (0–2)	0.87±0.74	0.8±0.81	U=149.5	0.783

U, Mann-Whitney U test; t, independent groups t test; *p<0.05; **p<0.01; ***p<0.001; Mean± SD, mean± standard deviation; HAM-A, Hamilton anxiety rating scale; HAM-D, Hamilton depression rating scale; LSAS, Liebowitz social anxiety scale; EQ, Empathy quotient; SSR, Sympathetic skin response

SSR number for negative emotions in the alexithymic group was also observed to be higher than those of non-alexithymic patients though the difference was not statistically significant (p=0.079).

Mild major depressive disorder (MDD) was observed in 13 (36.1%) of the SAD patients, specific phobia in 5 (13.9%), attention deficit and hyperactivity disorder (ADHD) in 4 (11.1%), obsessive compulsive disorder (OCD) in 4 (11.1%), generalized anxiety disorder (GAD) in 1 (2.8%) and tic disorder in 1 (2.8%).

DISCUSSION

It is indicated that facial emotion identification is among important precursors of social functionality. It has been reported that SAD patients are prejudiced with regard to defining the emotional expressions of others as negative (23, 24). It was put forth as a result of the present study that the patients were able to define emotions in facial expressions less in comparison with the control group even though there were no statistically significant differences between the results. Reduced social functionalities which is among their clinical characteristics and alexithymic attributes that are observed with a ratio of about 42 may have reduced their awareness. There were distinctive differences in the autonomous nervous system responses measured simultaneously with the visual stimulant during FID. SSR was observed more frequently in the patients against stimuli of shame, sadness, anger, fear in comparison with the healthy group. It is known that there are changes in the SSR levels against positive and negative stimuli in patients with SAD and other anxiety disorders (25). Simonian et al. (2001) reported that child and adolescent SAD patients struggle with defining emotions and that their anxiety symptoms increased to difficulties in identifying emotions especially for the expressions of happiness, sadness and disgust (26). The fact that the sympathetic sensitivity of the patients increased against negative stimuli may be explained with the social threat perception induced by the fear of negative evaluation and anxiety response. While it

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can be considered that they are more familiar to positive stimuli such as joy due to disorders in their social skills and functionalities.

A precise relationship has not been put forth between the two in studies evaluating SAD and empathy skill; the reactions against the positive or negative emotions of others are not very clear. It is considered that the irregular empathic functions observed in patients may have developed due to issues in interpersonal relations, limitations and social disorder. Morrison et al. (2016) reported that the SAD patients differ from the controls only with regard to the positive emotion empathy and that their abilities to openly share the positive emotions of others are less. This result was considered to be due to poor emotional clarity and interpersonal perceptions (27). The empathy scores of SAD patients in our study were observed to be lower at a statistically insignificant level in comparison with the controls and it was determined that about half of them display alexithymic characteristics. It is known that the ratio of alexithymic individuals among SAD patients is greater than the general community. It is reported that there may be a stronger relationship between SAD and alexithymia in the presence of accompanying MDD (8). The fact that alexithymia remained constant despite the decrease in depression during the study emphasizing the relationship between alexithymia and depression led to the opinion that alexithymia may be a permanent personal trait (7). The depressive symptoms were observed to be greater in alexithymic patients in our study in comparison with non-alexithymic patients. The number of sympathetic skin response against negative stimuli such as total and "fear" was observed to be greater. The number of sympathetic responses increasing in relation with negative emotions may be due to the affinity for critical, judgmental and ironic perception of other people in connection with anxiety inducing situations as well as the resulting selective attention. This result may be related with increased depressive symptoms and contribution of anxiety or insufficiency in empathy skills even though it has not been reflected to statistical significance. It has been put forth in literature that the empathy skills of alexithymic individuals are lacking (11). The empathy quotient scores of alexithymic individuals in our study were observed to be lower at a statistically significant level in comparison with others. Alexithymic individuals experience problems in understanding their own emotions and the feelings of others. This may be the reason for the limitations in their empathy skills.

Psychiatric comorbidity was determined more than half of the SAD patients in our study. It is indicated that SAD is observed at earlier ages especially in cases of accompanying depression and that it is a precursor for MDD development (28). ADHD comorbidity ratio was determined as 11.1% in SAD patients in our study. Diagnosis can be easily missed if attention deficit is prevalent (29).

One of the limitations of our study is the low number of samples and hence the limited representation ability of the sample group. Small sample size also decreases that statistical power of the analysis. Another limitation of our study is the probability that the different treatments applied on the patients in our study group will have an impact on SSR measurements. Moreover; data analysis makes the relationship with pure SAD a matter of debate since the presence of depression and anxiety disorder comorbidities in SAD patients in our study may affect SSR results. The fact that additional measurement methods that increase the reliability ratio have not been used for sympathetic system symptom evaluation other SSR measurement used for autonomous system activity measurement is another limitation of the study.

In conclusion; even though there are no differences between the SAD patients and healthy controls with regard to facial emotion identification; it was observed with the FID application that SSR has increased with more sympathetic sensitivity against negative stimuli. It was observed

that alexithymic characteristics are observed frequently in the SAD patient group and that alexithymic and low empathic features contribute to incrased sensitivity against negative stimuli. It is suggested to carry out similar studies with larger sample size based on the assumption that the reliability of the results will increase for SAD patients without comorbidity. The results of these studies may contribute to the development of treatment methods for learning the emotion identification and proper response reactions of SAD.

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