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Assessment of Executive Functions in Social Phobia Patients Using the Wisconsin Card Sorting Test

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Abstract

Objective: Problem solving and adjusting responses according to feedback are among the executive functions that may be impaired in social phobia patients. The objective of this study was to compare social phobia patients' Wisconsin Card Sorting Test scores with those of controls; thus, our aim was to examine executive functions in social phobia patients.

Method: The study included 36 social phobia patients (16 female [44.4%] and 20 male [55.6%]) whose age, sex, and level of education were matched with those of a healthy control group. Participants were administered the Structured Clinical Interview for DSM-IV Axis I Disorders, Beck Depression Inventory, State-Trait Anxiety Inventory, Liebowitz Social Anxiety Scale along, and Wisconsin Card Sorting Test.

Results: Patients with social phobia scored lower than the control group in terms of the total number of correct responses, number of categories completed, and percentage of conceptual level responses on the Wisconsin Card Sorting Test. The total number of errors and total non-perseverative errors were elevated in the patient group. No differences were observed in perseverative errors and set-maintenance between the patient and control groups. The number of correct responses and the percentage of conceptual level responses were negatively correlated with trait anxiety and social avoidance scores, whereas the number of errors was positively correlated with trait anxiety and social avoidance scores. Non-perseverative errors were positively correlated with state-anxiety, social fear, and social avoidance scores.

Conclusion: Working memory in the social phobia patients was impaired, as compared to that of the healthy controls. High social anxiety scores had a negative impact on working memory.

Key Words: Social phobia, Wisconsin Card Sorting Test, executive functions, working memory.

INTRODUCTION

Social phobia (SP) is characterized by the feeling of marked and persistent fear in social situations, particularly when one is performing or is among unfamiliar people (American Psychological Association, 1994). A person with SP might fear acting in a way that will be embarrassing or humiliating or showing anxiety symptoms. One avoids these feared social situations or performances, or when in these situations has an intense feeling of anxiety (American Psychological Association, 1994). Speaking or writing in the presence of others, meeting with strangers, or joining small group activities are some of the situations that cause fear, which is unique to SP (Stein and Stein, 2008).

According to the National Comorbidity Survey (Kessler et al., 1994), in the USA the lifetime prevalence of SP is 13.3%, which indicates that SP is the most prevalent anxiety disorder. The age of onset of SP is relatively early, the diagnosis and treatment rates are low, and hence, SP usually follows a chronic course (Lépine and Pélissolo, 1999). The education level of patients with SP is lower than that of individuals without SP (Wittchen

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et al., 2000). Van Ameringen et al. (2003) reports that 49% of SP patients stop going to school at a relatively early age due to the SP symptoms. Moreover, patients with SP have low-level productivity at work and their unemployment rate is higher than that of healthy people (Wittchen and Beloch, 1996).

There are a limited number of studies on the neuropsychological performance of patients with anxiety disorders. Purcell et al. (1998) reports that set-shifting, working memory, and attention performance are distorted in patients with obsessive-compulsive disorder (OCD) and in those with panic disorder. Lautenbacher et al. (2002) suggests that the severity of attention problems among patients with panic disorder is similar to that of patients with depression. Vasterling et al. (1998) reported that patients with posttraumatic stress disorder had lower attention and memory test scores than a control group.

Few studies have investigated the cognitive abilities of patients with SP. Asmundson et al. (1994) reported that verbal learning and memory performance in patients with SP and those with panic disorder are lower than in those of control groups, whereas there were no group differences in terms of visual memory functions. Cohen et al. (1996) compared SP patients with OCD patients and healthy controls, in terms of neuropsychological functions, and reported that neuropsychological problems were not only prevalent in patients with OCD, but that patients with SP had problems with executive functions. In contrast to Asmundson et al.'s study (1994) Cohen et al. reported that SP patients have problems with spatial attention and set-shifting. Another study (Airaksinen et al., 2005) compared patients with different anxiety disorders to healthy controls and reported that patients with all anxiety disorders have lower episodic memory and executive functions scores than healthy controls; patients with agoraphobia and without agoraphobia, and OCD patients differed from the control group in terms of episodic memory and executive functions, whereas patients with SP scored lower than controls only on an episodic memory test.

In order to behave in a socially appropriate manner one must have good social perception abilities, problem solving skills, and behavioral abilities (McFall, 1982). Effective evaluation of social cues, planning, repressing inappropriate responses, and selecting appropriate responses play a role in social ability. In short, cognitive abilities are needed for effective social performance. Planning, problem solving, selecting appropriate responses from among a variety of responses, and exhibiting the appropriate behavior regarding changing conditions are collectively known as executive functions (Howieson and Lezak, 2002); these abilities are controlled by the prefrontal cortex. The Wisconsin Card Sorting Test (WCST) is a test that measures executive functions (Heaton et al., 1993). In addition to problem solving abilities, the test measures decision making, cognitive flexibility,

TABLE 1. Demographics of the SP and control groups.

	SP group (n = 36) n (%)	Control group (n = 36) n (%)	t	Chi-square	P
Gender				0.01*	NS
Female	16 (44.4)	16 (44.4)			
Male	20 (55.6)	20 (55.6)			
Education				2.58	NS
Primary school	2 (5.6)	2 (5.6)			
Secondary school	1 (2.8)	1 (2.8)			
High school	13 (36.1)	7 (19.4)			
University/college	20 (55.6)	26 (72.2)			
Age	26.20 ± 7.15	26.3 ± 4.7	-0.05		NS
Scale scores					
BDI	13.78 ± 9.28	2.36 ± 4.00	6.776		0.001*
STAI-Trait	54.1 ± 8.8	36.4 ± 7.5	9.150		0.001*
STAI-State	45.7 ± 11.6	33.2 ± 5.6	5.826		0.001*
LSAS-Avoidance	63.64 ± 14.10	36.50 ± 12.97	8.497		0.001*
LSAS-Fear	66.50 ± 12.85	34.94 ± 10.25	11.521		0.001*

NS: Statistically non-significant; *: statistically significant, P < 0.05; BDI: Beck Depression Inventory; STAI: State Trait Anxiety Scale; LSAS: Liebowitz Social Anxiety Scale.

TABLE 2. WCST scores in the SP and control groups.

	SP group (n = 36)	Control group (n = 36)		
WCST	Mean ± SD	Mean ± SD	t	P
Total number of correct	36.97 ± 12.26	42.58 ± 9.42	2.177	0.030*
Total number of errors	27.03 ± 12.26	21.42 ± 9.42	–2.177	0.030*
Total number of perseverative responses	13.08 ± 10.15	12.33 ± 8.08	–0.347	0.730
Total number of non-perseverative responses	15.31 ± 9.70	10.42 ± 5.91	–2.583	0.012*
Total number of perseverative errors	11.72 ± 7.65	11.00 ± 6.53	–0.431	0.668
Number of completed categories	1.78 ± 1.48	3.97 ± 6.48	1.982	0.051
Percentage of perseverative errors	18.32 ± 11.94	17.07 ± 10.11	–0.480	0.633
Percentage of conceptual level	44.77 ± 24.39	57.13 ± 20.29	2.330	0.022*
Failure in set-maintenance	0.81 ± 1.09	0.42 ± 0.65	1.838	0.070

WCST: Wisconsin Card Sorting Test; SP: social phobia; *: statistically significant, P < 0.05

and shifting response in accord with feedback (Karakaş et al., 1996). Although WCST is related to dorsolateral prefrontal cortex functions, recent studies suggest that the test also indicates the level of functioning in other brain regions (Lombardi et al., 1999). The relationship between anxiety disorders and functioning of various brain regions is not clearly understood; however, some evidence suggests that in addition to the limbic region and basal ganglion, the prefrontal cortex plays a role in anxiety disorders (Mathew et al., 2008). The amygdala, insula, hippocampus, parahippocampal gyrus, fusiform gyrus, globus pallidus, superior temporal gyrus, inferior frontal gyrus, and orbitofrontal cortex are some of the brain regions that are related to SP (Tillfors et al., 2001; Etkin and Wager 2007).

Although SP is involved in such problems as dropping out of school at an early age, low-level job performance, and unemployment, the neuropsychological characteristics of SP have not been sufficiently examined. Executive functions appear to be cognitive abilities that determine complex human behavior. Patients with SP might have problems with executive functions, such as problem solving and shifting responses in accord with feedback. Therefore, the present study aimed to examine executive functioning in patients with SP by comparing The WCST scores of patients with SP and healthy controls.

METHOD

Sample and Control Group

The study included 36 patients with SP (diagnosed according to DSM-IV diagnostic criteria) that presented to the Marmara University Medical School Psychiatry Outpatient Clinic between 1 January 2007 and 1 November 2007. Patients were provided information about the study and they all provided verbal informed consent. Patients with any psychotic disorder or anxiety disorder induced by a general medical condition were excluded from the study. The control group consisted of 36 healthy volunteers that were students or healthcare personnel at the Marmara Medical School Hospital and did not have any Axis I psychiatric disorders; they were matched with patients in terms of age, gender, and level of education. After collecting sociodemographic data on the patients, they were administered the SCID-I clinical version to determine the presence of Axis I disorders. Then, the Beck Depression Inventory (BDI), State Trait Anxiety Inventory (STAI), Liebowitz Social Anxiety Scale (LSAS), and WCST were administered to the patient and control groups.

In all, 66.7% of the SP patients used psychotropic drugs during the study. Patients used selective serotonin reuptake inhibitor (SSRI) antidepressants, valproic acid, and risperidone; SSRIs that were used included paroxetine, sertraline, and escitalopram. During the study no additional treatment was provided to the patients and no changes were made to their drug regimens or drug dosages.

Instruments

Semi-Structured Questionnaire Form: This form included items on gender, age, age of SP onset, marital status, level of education, employment status, economic level, and family history of psychiatric disorders.

Structured Clinical Interview for DSM-IV Axis I disorders, clinical version (SCID-I CV): SCID-I CV is a clinical interview used to diagnosis Axis I disorders according to DSM-IV. Its adaptation and reliability were conducted in Turkish by First et al. (1997) and Çorapçıoğlu et al. (1999).

TABLE 3. Correlation between WCST scores, STAI state and trait anxiety scores, and LSAS total avoidance and fear scores.

	STAI-trait anxiety		STAI-state anxiety		LSAS-avoidance		LSAS-fear	
WCST	r	P	r	P	r	P	r	P
Total number of correct	–0.253	0.032*	–0.206	0.082	–0.262	0.026*	–0.221	0.063
Total number of errors	0.253	0.032*	0.206	0.082	0.262	0.026*	0.221	0.063
Number of non-perseverative errors	0.224	0.059	0.234	0.048*	0.246	0.037*	0.247	0.037*
Percentage of conceptual level	–0.265	0.025*	–0.203	0.087	–0.257	0.029*	–0.224	0.058

*: Statistically significant, $p < 0.05$; STAI: State Trait Anxiety Scale; LSAS: Liebowitz Social Anxiety Scale.

Beck Depression Inventory (BDI): BDI is a self-report inventory that was developed by Beck in order to measure emotional, cognitive, somatic, and motivational aspects of depression. It contains 21 items that are rated on a 4-point Likert-type scale, ranging from 0 to 3. Hisli (1989) conducted the reliability and validity study of BDI for university students. BDI's cut off point is accepted as 17 (Aydemir and Köroğlu, 2000).

State Trait Anxiety Inventory (STAI): STAI is a self-report inventory that was developed by Spielberger et al. in order to measure state and trait anxiety levels. It consists of 40 items on 2 different scales. The state anxiety scale measures how one feels in a given situation and condition. The trait anxiety scale measures how one feels in general. The reliability and validity study of STAI for use in Turkey was conducted by Öner and Le Compte (1985).

Liebowitz Social Anxiety Scale (LSAS): LSAS was developed by Liebowitz in order to measure the severity of fear and avoidance in social situations, and in situations in which performances are needed. It contains 11 items that evaluate social situations and 13 items that evaluate performance-based situations. LSAS is administered by clinicians. The reliability and validity of the LSAS Turkish form was measured by Dilbaz (2001).

Wisconsin Card Sorting Test (WCST): WCST consists of two groups of cards—4 stimulus cards and 64 reaction cards. Each card includes different colors and numbers of signs. Cards have a plus sign, star, and triangle, or a circle sign. There are 1, 2, 3, or 4 signs on each card. Signs can be red, green, blue, or yellow. The test administrator asks the subject to match each card from the group with a stimulus card. Correctly matched cards are arranged according to color, sign, and number categories. When the subject performs 10 consecutive correct matches in one category (for instance, matching colors), the administrator shifts to another category. After each reaction, the subject is provided feedback about whether his/her response was correct or not, but is not given information on the correct match category. When the subject finishes all six categories or uses all cards from the two card groups the test is terminated (Heaton et al., 1993). The following scores are utilized in the evaluation of WCST:

1. Total number of errors: Total number of cards that were not matched correctly with a stimulus card.
2. Total number of correct responses: Total number of cards that were matched correctly.
3. Number of categories achieved: Number of categories for which 10 consecutive correct matches were made.
4. Number of perseverative responses: After 10 consecutive correct responses, the number of repeated responses in accord to match principle of the previous category or perseveration principle of the individual developed by himself/herself.
5. Number of perseverative errors: Number of incorrect perseverative responses.
6. Number of non-perseverative errors: Subtraction of perseverative errors from the total number of errors.
7. Percentage of perseverative errors: Division of total perseverative errors by the total response number multiplied by 100.
8. Number of responses to finish the first category: Total number of responses required to finish the first category.
9. Number of conceptual level responses: Total number of at least three consecutive correct responses.

TABLE 4. WCST scores of the SP patients with major depression and those without major depression.

	MD + SP (n = 27)	SP (n = 9)		
WCST	Mean ± SD	Mean ± SD	t	P
Total number of correct	37.34 ± 12.01	35.42 ± 14.14	0.366	0.716
Total number of errors	26.65 ± 12.01	28.57 ± 14.14	–0.366	0.716
Total perseverative responses	13.20 ± 10.87	12.57 ± 6.92	0.147	0.884
Total number of non-perseverative errors	14.76 ± 9.79	14.57 ± 9.69	–0.683	0.499
Total number of perseverative errors	11.89 ± 8.14	11.00 ± 5.53	0.27531	0.785
Number of completed categories	1.75 ± 1.47	1.85 ± 1.57	–0.156	0.877
Percentage of perseverative errors	18.60 ± 12.72	17.16 ± 8.64	0.282	0.780
Percentage of conceptual level	44.70 ± 24.55	45.04 ± 25.61	–0.330	0.974
Failure in set-maintenance	0.93 ± 1.16	0.28 ± 0.48	1.425	0.163

WCST: Wisconsin Card Sorting Test; SP: social phobia; MD: major depression.

10. Percentage of conceptual level responses: Division of total conceptual level responses by the total response number multiplied by 100.
11. Score on failure to maintain set: Number of response blocks that include 5-9 consecutive correct responses, but not 10 consecutive correct responses.

The adaptation of WCST into Turkish was conducted by Karakaş et al. (1998).

In the present study, before starting the WCST, the subjects read the test information on a computer screen. Four stimulus cards reside on 1/3 of the screen throughout the test. Sixty-four reaction cards are shown to the subject one by one in the center of the screen in an order determined by the computer program. The subject shows the administrator the stimulus card that they think matches the reaction card shown on the screen. The administrator enters the response into the computer program by pushing buttons 1, 2, 3, or 4 on the computer keyboard. Then, the previous card exits the field of view from the top of the screen and a new card appears in the center of the screen (Wisconsin Card Sorting Test, Cyber Metrix Software Services). The researcher (NF) was trained in WCST administration in Ankara on 26 December 2004 and has a WCST administration certificate.

Statistical Analysis

Data were analyzed with SPSS v.12.0. The chi-square test was utilized to compare categorical variables and the independent group t test was used to compare continuous variables. Relationships between continuous variables were measured with Pearson's correlation test. For all statistical analyses the level of significance was $P < 0.05$.

RESULTS

Individuals in the SP and control groups were 18-55 years of age and had at least a primary school-level education. There were no statistically significant differences between the groups in terms of gender, level of education level, or age. In all, 80.6% of the SP patients had major depression, 55.6% had a specific phobia, 33.3% had body dysmorphic disorder, 30.6% had OCD, 27.8% had panic disorder, 19.4% had agoraphobia, and 16.7% had general anxiety disorder comorbid with SP.

A comparison of the SP and control groups' clinical characteristics is presented in Table 1. According to the WCST results, there were statistically significant differences between the 2 groups in terms of the number of correct responses ($t = 2.177$, $P = 0.030$), number of errors ($t = =2.177$, $P = 0.030$), number of non-perseverative errors ($t = –2.583$, $P = 0.012$), and the percentage of conceptual level responses ($t = 2.330$, $P = 0.022$) (Table 2). Total number of correct WCST responses was negatively correlated with STAI trait anxiety score ($r = –0.253$, $P = 0.032$) and LSAS total avoidance score ($r = –0.262$, $P = 0.026$). Similarly, the percentage of conceptual level responses was negatively correlated with STAI trait anxiety score ($r = –0.265$, $P = 0.025$) and total avoidance score ($r = –0.257$, $P = 0.029$). The total number of errors was positively correlated with STAI trait anxiety score ($r = 0.253$, $P = 0.032$) and total avoidance score ($r = 0.262$, $P = 0.026$). Total non-perseverative error scores were positively correlated with STAI state anxiety scores ($r = 0.234$, $P = 0.048$), total fear scores ($r = 0.247$, $P = 0.037$), and total avoidance scores ($r = 0.246$, $P = 0.037$) (Table 3). BDI depression score was not significantly correlated with the total number correct WCST responses ($r = –0.169$, $P = 0.155$), total number of errors ($r =$

TABLE 5. WCST scores of the SP patients that used drugs and those that did not.

	Drugs (n = 24)	No drugs (n = 12)		
WCST	Mean ± SD	Mean ± SD	t	P
Total number of correct	37.62 ± 12.07	35.67 ± 13.07	0.447	0.658
Total number of errors	26.37 ± 12.07	28.33 ± 13.07	–0.447	0.658
Total perseverative responses	13.16 ± 11.27	12.91 ± 7.84	0.069	0.946
Total number of non-perseverative errors	14.54 ± 8.78	16.83 ± 11.58	–0.663	0.512
Total number of perseverative errors	11.83 ± 8.35	11.50 ± 6.35	0.12231	0.904
Number of completed categories	1.91 ± 1.55	1.80 ± 1.31	0.794	0.432
Percentage of perseverative errors	18.50 ± 13.03	17.96 ± 9.90	0.128	0.899
Percentage of conceptual level	45.54 ± 23.80	43.21 ± 26.54	0.267	0.791
Failure in set-maintenance	0.79 ± 1.14	0.83 ± 1.03	–0.107	0.916

WCST: Wisconsin Card Sorting Test.

0.169, P = 0.155), non-perseverative errors (r = 0.228, P = 0.054), or the percentage of conceptual level responses (r = –0.217, P = 0.067).

As 80.6% of the SP group had major depression, we compared the WCST results of the patients with depression and those of the patients without depression. Accordingly, there wasn't a statistically significant difference between these two groups in terms of WCST results. Moreover, there were no statistically significant differences between these two groups in terms of total number of correct responses (t = 0.366, P = 0.716), total number of errors (t = –0.366, P = 0.716), number of non-perseverative errors (t = –0.683, P = 0.499), or the percentage of conceptual level responses (t = 0.330, P = 0.974). These two groups also did not differ in terms of WCST's other test scores (Table 4).

As 66.7% of the SP group used psychotropic drugs, we compared the WCST results of the patients that used drugs and those that did not use drugs. There were no differences between these two groups in terms of number of total correct responses (t = 0.447, P = 0.658), total number of errors (t = –0.447, P = 0.658), number of non-perseverative errors (t = –0.663, P = 0.512), or percentage of conceptual level responses (t = 0.267, P = 0.791). Similarly, there were no differences between these groups according to the other WCST test scores (Table 5).

DISCUSSION

The present study shows that the neuropsychological performance of SP patients differed from that of the control group. The SP group had lower WCST total number of correct responses, number of categories completed, and percentage of conceptual level responses than the control group. There were no statistically significant differences between the SP and control groups in terms of WCST perseverative errors and set-maintenance. These results support Cohen et al. (1996), who reported that executive functions deteriorate in SP.

SP patients had more errors and fewer correct responses than the control group. This might have been due to the high number of non-perseverative errors in the SP group. In the case of non-perseverative errors, patients randomly selected a new category after receiving feedback from the test administrator that they should try a new matching strategy. Patient makes trial-and-errors, but they could not make the correct matching. In most studies WCST perseverative errors were accepted as the primary data, whereas few studies provided any data concerning non-perseverative errors. In Li's study (2004) patients with schizophrenia had significantly more non-perseverative errors. Moreover, perseverative errors were not found to be more than the non-perseverative errors.

The present study shows that WCST results cannot be evaluated based solely on perservative errors. Barceló and Knight (2002) divided non-perseverative errors into productive and random errors. Productive errors usually occured while subjects comprehended a new rule—in other words during category shifts. These errors diminish as the test progresses. Random errors are regarded as pathological. During category shift, the subject confuses the rule or confusion occurs after a few correct responses. Barceló and Knight (2002) reported that patients with frontal lobe damage had a significant number of both perseverative and non-perseverative errors, which indicated that WCST performance was affected by two types of errors. Non-perseverative errors are the result of the rapid loss of information that is acquired during the pre-

vious trial and should be currently active. This error reflects problems with working memory. The high number of non-perseverative errors made by the SP patients in the present study might have been the result of problems with working memory.

While an individual learns new information, they need to keep other information online—so called working memory—in order to solve a problem in a given situation (Baddeley, 1999). Working memory involves actively keeping information online while making several processes on this information in short term cognitive processes. In this sense, working memory is an executive function. Some researchers argue that WCST directly measures working memory performance; however, others assert that WCST measures more than one executive function, including working memory (Keefe, 1995). Barceló et al. (1997) examined the relationship between WCST responses and different brain region potentials. They reported that working memory plays a role in WCST performance. There are several studies that stress this relationship. Er (1996) reported that working memory is related to the number of non-perseverative errors, number of conceptual level responses, and percentage of conceptual level responses, as well as failure in set-maintenance. Similarly, Lehto (1996) reported that working memory is linked to the total number of errors and number of completed categories. Working memory is thought to be composed of two sub-structures that are sensitive to verbal and visuo-spatial information, and a central executor is thought to balance these data (Baddeley, 1999). One of the functions of central executive function is to focus attention on information that is being processed. The central executive of working memory is also known as the monitoring attention system (Baddeley, 1999). Hence, the assumption is that there is a relationship between working memory and attention functions. In a study that investigated the relationship between WCST error types and prefrontal neuronal circuits, Barceló (1999) reported that failure to inhibit interfering stimuli, which results in inattention, is related to working memory performance. Many studies that investigated the relationship between working memory and related brain regions focused mainly on the dorsolateral prefrontal cortex (Howieson and Lezak, 2002); however, Barceló et al. (1997) suggested that the dorsal regions of the brain are also related to working memory performance.

When individuals with SP think that they are negatively evaluated in a social context, an automatic anxiety program launches. Anxiety is comprised of emotional, behavioral, somatic, and cognitive elements, and in the case of social anxiety an individual's attention subsequently shifts from the external social environment to their own psychological or somatic reactions. Thus, the individual cannot adapt to the social environment or their performance in the social context. This biased attentional focus prevents elimination of cognitive biases, which results in enhancement of social anxiety (Clark and Wells, 1995). The evaluation of the reactions and feedback of others in a social context, and in situations in which one should have performance is one of the information processing processes. In order for an individual to correctly evaluate these social cues, proper information processing and working memory are necessary. Anxiety in SP, which is the result of the fear of negative evaluations from others, can interfere with the recognition and processing of social cues in a social context; this can deter correction of cognitive distortions that are source of social fear.

Few studies have examined WCST performance in SP patients. Sachs et al. (2004) investigated the relationship between event related potentials and cognitive processes. Researchers report that there are no differences between patient groups and control groups in terms of WCST total number of correct responses or total number of errors.

Graver and White (2007) studied the effect of comorbid depression in SP patients on neuropsychological test performance (including WCST) by comparing patients with SP, SP patients with comorbid depression, and a control group. When there was no stress variable, neuropsychological test performance was similar in all three groups; however, when subjects were exposed to stress, WCST performance in SP patients with depression improved. There was no such improvement in SP patients without depression. In Graver and White's study there were 19 female (86.4%) and 3 male (13.6%) SP patients, and hence, the study results are primarily indicative of the cognitive processes of female SP patients. A study that investigated the psychological reactions to stress (Carrillo et al., 2001) reported that gender was correlated with stress.

The present study shows that WCST results of SP patients were related to state and trait anxiety, and level of social anxiety. Graver and White (2007) reported that depression and trait anxiety levels were related to Trail Making Test results, but not with WCST results . De Geus et al. (2007) observed a relationship between symptom severity and WCST set-maintenance failure among OCD patients. Moreover, they reported that OCD patients had more set-maintenance failures than

the control group. It is suggested that these results reflect dysfunctional attention, which is exacerbated by increased symptom severity.

The present study is the first to show the aversive effect of social anxiety on WCST performance. Non-perseverative errors that were related to state anxiety indicate the level of anxiety during the test and the level of social anxiety in SP patients. Hence, we posit that an increased level of social anxiety negatively affects working memory. Paterniti et al. (1999) suggest that increased anxiety levels can have a negative impact on a variety of cognitive functions, including working memory. Another study on posttraumatic stress disorder reported that regardless of the severity of depression, symptom severity was related to executive dysfunction (Kanagaratnam and Asbjørnsen, 2007). Similarly, Basso et al. (2007) reported that among patients with unipolar depression, only those with comorbid anxiety disorders exhibited executive dysfunction. In accord with these reports, in the present study there were no differences between SP patients with depression and those without depression in terms of executive function performance, and there wasn't a relationship between severity of depression and WCST results.

A major limitation of the present study is the high comorbidity rate among the SP patients. SP has high comorbidity; in the National Comorbidity Study only 19% of SP patients did not have a comorbid diagnosis (Magee et al., 1996). Gökalp et al. (2001) reported that 51.7% of SP patients have a comorbid diagnosis, which is lower than rates reported in other studies. The comorbidity rate among SP patients in the present study was similar to rates observed in clinical settings. Moreover, we did not observed any differences between the SP patients with depression and those without depression in terms of WCST results; however, our findings should be replicated with a sample of SP patients without any comorbid diagnoses in order to associate these results specifically with SP. Another limitation of the present study is that 66.7% of the SP patients used paroxetine, citalopram, escitalopram, valproic acid, or risperidone. Nevertheless, there were no differences in WCST results between the patients that used drugs and those that didn't.

Mataix-Cols et al. (2002) compared the neuropsychological evaluation of OCD patients that used drugs and those that didn't, and reported that there were no group differences in terms of neuropsychological performance. Our study also shows that drug use might not have affected WCST performance; however, further studies should evaluate the WCST performance of SP patients that do not use drugs. Another limitation of the present study is that IQ levels of the patient and control groups were not evaluated.

To conclude, the present study indicates that SP patients made more WCST non-perseverative errors than the healthy control group. This finding might reflect a working memory deficiency in the SP patients. This study is the first to report a negative effect of social anxiety on working memory. Working memory deficiency observed in SP might be related to assumptions about SP's cognitive model. This model suggests that individuals with SP cannot shift their attention to external stimuli in social situations. We recommend further investigation of the negative/positive effects of drugs used to treat SP on working memory performance and the effect of working memory performance on cognitive behavioral therapy outcomes.

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