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Comparison of Executive Function in Obsessive Compulsive Disorder Patients With Good Insight, Poor Insight and Healthy People

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Abstract

Background: This research seeks to make a comparison between executive functions of the obsessive compulsive disorder (OCD) patients, with poor and high insight levels and normal people.

Patients and Methods: In this casual comparative study, 22 OCD patients with high insight level, 5 OCD patients with poor insight level (based on YBOCS' 11th item score) and 23 normal subjects were selected using convenience sampling technique. The subjects were evaluated using two groups of clinical and neuropsychiatric instruments. The clinical instruments included Y-BOCS, BDI-II and GHQ-12. The executive functions were assessed using the Tower of London test, the Stroop and the Wisconsin Card Sorting tests.

Results: The obtained results showed a significant difference between OCD patients and normal people in a number of executive functions. However, comparison between OCD patients with high and poor insight levels showed no significant difference in the executive functions variables.

Conclusions: Executive functions (EF) may contribute to the psychopathology of OCD. Therefore examining EF can play an important role in assessment and treatment of OCD.

Keywords: Obsessive-Compulsive Disorder, Insight, Executive Functions, Neuropsychological Function

1. Background

Obsessive-compulsive disorder (OCD) is the fourth most common disorder among psychological disorders [1]. It is manifested with repeated thoughts, images and behaviors, leading to the patient's disability [2]. In some studies, characteristics of it have been compared with other those of psychological diseases and/or with normal people, with respect to different variables.

During the last decade, the progress in neurological sciences has contributed to the probable impact of neuropsychiatric and neurobiological mechanisms on the disorder's etiology [3]. Such progress have consolidated previous models of OCD etiology and explained the fundamental role of anxiety, cognitive functions and a range of executive functions of the brain, which are related to the symptoms of this disorder, in the etiology of OCD. Results from neuropsychiatric studies indicate that OCD patients have deficiency in some cognitive functions [4]. Therefore, a number of strong neuropsychiatric basics have been proposed for OCD disorder, including executive function as of the most important ones. The term "executive functions" is used to describe a range of self-regulating processes [5].

The most investigated deficits of executive functions in OCD patients, compared to normal people, are as follows: conflict resolution/inhibitory response, set shifting, nonverbal memory, fluency, planning, decision-making, spatial working memory, attention, processing speed and verbal memory organization [6]. The findings about the contribution of poor executive function in OCD are contradictory [4, 6].

Insight is one of the most important variables which are capable of distinguishing between OCD patients. Insight is defined as ability in detecting the reason and meaning of an individual's condition, as well as his awareness of the disease [1] DSM defines poor insight as one's disability in diagnosis of the excessiveness and irrationality of his/her symptoms. Some researchers suggested having a continuous and spectral view on insight, instead of taking it as a bipolar concept [7]. Therefore, what is called poor insight in DSM-IV-TR has changed into the good insight or relatively good insight, poor insight and lack of insight in DSM-V [2]. However, it should be noted that OCD has been traditionally considered as a disease with a good insight to the symptoms [8]. Although, DSM-IV-TR suggests that about a quarter of OCD patients are not sure that their symptoms are unreasonable or excessive [9]. Therefore, ex-

amining the clinical correlates of insight is so important, and have received increasing amount of attention form the researchers. Regarding this and the results from the performed studies, the insight levels can be an important indicator of prognosis and response to treatment in OCD patients and associated with some clinical characteristics [7]. In the relevant literature, there are only three studies that have investigated the relationship between the neuropsychological performance and the insight. The results of these studies reported poorer neuropsychological performance in OCD patients with poor insight [8, 10, 11].

2. Objectives

With regard to the role of culture in the incidence of OCD symptoms [12] and variety of results, and regarding to the relationship between neuropsychological functions and insight in OCD patients, as well as what has already been mentioned about the difference between some psychological variables in OCD patients with high and poor insight and normal people, the present study addresses following these questions: 1) Whether executive functions (conflict resolution/response inhibition assessment, planning, making changes) of OCD patients differ from those of normal people? 2) Whether executive functions of OCD patients with poor insight differs from those of OCD patients with high insight?

3. Patients and Methods

In this casual-comparative study, research population of the present study includes OCD patients and normal people in Tehran, Iran. The research sample includes two groups of subjects:

OCD patients: the investigated sample includes 27 OCD people (22 with high insight and 5 with poor insight). Degree of insight was evaluated by 11th item of Y-BOCS. The OCD subjects were selected from Rouzbeh Hospital, Mostafa Khomeini Hospital and the Clinical Psychiatric and Behavioral Sciences Specialized Clinic, using convenience sampling technique.

Research inclusion criteria: those who received OCD diagnosis by a psychiatrist or a clinical psychologist based on DSM-IV-TR diagnosis criteria, those who earned minimum score of 9 in Yale-Brown scale (based on previous research [13], adults between 18 to 65, and those having, at least, primary school educational level. Patients with the history of tic, schizophrenia and other psychotic disorders, bipolar disorder, substance abuse, as well as neurological condition or surgery such as brain damage, tumors and epilepsy were excluded from the study.

Normal people: this group was selected from mental disorders-free people who had not visited psychological and psychiatric centers over the last six months, using convenience sampling technique. In addition, they did not receive medicine for behavioral problems during the study. Moreover, it has been attempted to select those with close demographic characteristics to the OCD subject. They matched, as far as possible, with OCD patients in terms of age, gender and educational level.

Measures used in the study included clinical scales and neuropsychological test as follows:

1. Demographic and clinical information questionnaire: this questionnaire includes demographic information of the subjects such as age and gender, as well as their clinical information like physical and psychological history. The given data were gathering by interviewing the subjects.

2. Yale-Brown OCD scale: this scale was designed by Goodman et al. and applied to determine the severity of OCD [14]. It is an unstructured interview, composed of two parts: the first part includes symptoms checklist (SC) consisting 58 types of OCD, and the second part in composed of the symptoms severity scale (SS), consisting ten items. In this checklist, there are two secondary scales for assessing obsession and compulsion. In Iran, Rajezi-Esfehani et al. investigated the validity of this instrument through examining its correlation with OCD sub-scale SCL-90. They reported Kendall's coefficient of internal consistency for SC obsession factor, SC compulsion factor, SC and SS total score and SCL-90 obsession-compulsion sub-scale score of 0.47, 0.46, 0.48 and 0.22, respectively. They also reported Y-BOCS convergent validity with obsession-compulsion diagnosis of 0.69. They reported the internal consistency and severity scale of 0.97 and 0.95, reliability of split half for SC and SS of 0.93 and 0.89, and test-retest reliability of 0.99. They suggested cut-off point of 9 for distinguishing the patients from healthy people [13]. This scale has introduced as a golden scale in assessment of treatment results [15]. In addition to the ten items of the scale, researchers have used the 11th item to assess insight level [16]. Shimshoni et al. showed a high compliance between all insight scales (DSM-IV-TR insight criterion, overestimated beliefs scale, Yale-Brown's 11th item and the Brown assessment of the beliefs scale), except cognitive insight scale [17]. The insight on the YBOCS item-11 insight scale is graded as follows: 0 = excellent, 1 = good insight, 2 = fair insight, 3 = poor insight (overvalued ideas), 4 = lacks insight (delusional). A score of 3 or 4 was considered as poor insight [18]. In the present study, this scale has been employed to measure subjects' OCD and insight levels.

3. Beck Depression Inventory (BDI-II): This instrument includes 21 self-reported items, used for assessing depression symptoms [19]. The overall score ranges from 0 to 63, where 10 to 20 are considered as the sign of mild depression and over 20 is taken as moderate depression by the designers. This inventory has been translated into Persian and its validity and reliability have been proved [20]. The mentioned inventory was used to determine the subjects' depression level.

4. Twelve item general health questionnaire (GHQ-12): It has been developed in 1972 by Goldberg for diagnosing mental disorders in different centers and environments. The questionnaire's items investigate the patient's condition over the last four weeks. It is in 12 items, 28 items, 30 items and 60 items forms. The 12 items form has been very applicable in other countries. In Iran, Yaghoobi et al. reported Cronbach's alpha value of 0.92 and split-half and Spearman-Brown reliability value of 0.91. They measured the construct

validity through investigating the correlation between subscales and the total score, and reported a strong and significant correlation. In addition, they suggested cut-off points of 15 and 9 as the best cut-off values for single-phase and two-phase studies, respectively [21]. This questionnaire was used to investigate the health status of normal group.

5. Stroop test: Stroop test is an instrument to assess executive functions (conflict resolution/response inhibition). The conflict arose from not reacting to a stimulus-related dimension and reacting to a stimulus-unrelated dimension comprises the basis of Stroop phenomenon [22]. The software edition of this test has been developed by Ravan Tajhiz Sina Company. It takes two seconds to present each stimulus on the screen, with the presentation interval of 800 ms between two stimuli. In a study, Alilo et al. obtained 0.71 for consistency coefficient of the test-retest with two weeks interval. In addition, the face validity of the test was examined and confirmed based on the comments from two clinical psychologists and one neurologist [23]. In the present study, this test has been used to measure conflict resolution/response inhibition. The software edition of the problem solving test has been run on an ASUS notebook with 12.1 inch screen size.

6. The Tower of London test: the most famous test for planning and problem solving is the Tower of London [24]. This test uses three rods fixed on a flat base and three beads with different size. The subject should change the starting position to the target position by moving a bead on the rods. One should transfer the beads from position A to C with seven moves. Shallice widely used this test to assess executive planning in relation to prefrontal [cortex], and introduced the conceptualization of information processing with respect to prefrontal function [24]. The software edition of this test has been prepared by Ravan Tajhiz Sina Company. The goal is the subject's use of his/her maximum ability to achieve the best performance, quickly. Before the test, subject's capability in using computer mouse should be ensured.

Scoring is based on the number of attempts a subject makes to solve the problem. In this way, when the problem is solved at the first attempt, at the second attempt, or at the third attempt, the scores 3, 2, and 1 are given, respectively. Otherwise, the subject is given zero. Therefore, the maximum score in this test is 3. It has good construct validity in planning and problem solving assessment [25]. There is a significant correlation (0.41) between this test and the Porteus maze test [26]. Validity of the test (0.79) has also been confirmed [27]. In this research the software edition of the test has been used to assess planning and problem solving capabilities. The software edition of problem solving test has been run on a 12.1 screen ASUS notebook.

7. Wisconsin Card Sorting test: this test includes 64 dissimilar cards with different shapes and colors. It is a useful instrument for studying the mental damages-induced cognitive deficits, and also a standard neuropsychological test for measuring cognitive flexibility skill. In this test, the subject should maintain the concept or rule discovered at the first stage for successive periods, and when classification rules change, he/she changes the previous concepts, too. This test is comprised of 64 cards with different shapes of different colors and number. The Iranian software edition of this test has been prepared by Ravan Tajhiz Sina Company. The test follows a certain structure, in which four main cards (including one red triangle, two green stars, three yellow pluses, and four blue circles) are displayed on top of the screen during the whole test. The remaining 60 cards are displayed on the bottom right corner of the screen, with completely random order and one-by-one.

When a card is shown, the subject should decide to put the card under one of the main cards. Immediately after the subject's response, a written feedback (in form of correct or incorrect text) appears on the screen. These texts are accompanied with 2 kHz and 100 kHz voices, respectively, implying correct and incorrect feedbacks. The interval between the subject's response and the feedback is 100 ms, feedback length is 200 ms, and the interval between the end of feedback and the next card appearance is 700 ms.

Shahgholian et al. have confirmed the validity of this instrument. To investigate the differential validity, these researchers ran software edition of this test for two groups of students with high and low anxiety, and showed the significant different between the results from them. To examine the reliability of the developed software, they have used the internal consistency (Cronbach's alpha) and the split-half methods. They reported the Cronbach's alpha values of 0.73 for the number of completed categories and 0.74 for perseverative errors, and the split-half coefficient values 0.87 for the number of completed categories and 0.87 for the preservative [28]. In this study, software edition of the test has been used for assessing the set shifting. The software edition of the problem solving test has been run on a 12.1 ASUS notebook.

Research procedure: Before the examination, inform consent was obtained from the participants. The approximately 90 mintes assessment session included a semi-structured interview, using demographic questionnaire, and then the administration of the mentioned instruments. After the session, the participants all received gifts.

Data analysis: in this study, descriptive statistical methods were first used to obtain descriptive indexes of the variables of the dual and triple samples. Then, regarding the data from the dual and triple groups (two groups of OCD patients and one group of normal people), independent t-test has been employed to compare the variables of the two groups of OCD patients and the healthy subjects. Mann-Whitney U test has also been used to compare the variables of the two OCD groups with high and poor insight levels. Moreover, χ^2 test has been used to compare some demographic variables in the two OCD groups and the one non-OCD groups. Acceptable significance level in this study is 0.05 ($P \leq 0.05$). For data analysis, SPSS-20 has been employed.

4. Results

Before addressing the results from the research vari-

ables, demographic characteristics of the two OCD and non-OCD groups; and the differences and similarities between them have been presented in Table 1. The obtained results show that the two OCD and non-OCD groups do not significantly differ with respect to age, gender, marital status, and educational level.

The comparison between neuropsychological (executive functions) results of the two OCD and non-OCD groups are presented in Table 2. These findings show that the two OCD and non-OCD groups are significantly different in the number of completed categories and perseverative errors in Wisconsin test, as well as the response to congruent stimuli in Stroop test.

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As can be seen in Table 3, the comparison between Mann-Whitney U test results of the OCD patients with high and poor insight levels, there is no significant difference between the two groups in the neuropsychological tests (executive functions).

Table 1. Comparison Between Descriptive Indexes of Demographic Characteristics of the OCD Patients and the Healthy Subjects

Demographical Characteristics	Patient (N = 27)	Non-Patient (N = 23)	P Value
Age, y [a]	23.91 ± 3.78	25.55 ± 3.67	0.31
Gender			0.94
Male	12	10	
Female	15	13	
Marital status			0.186
Single	19	12	
Married	8	11	
Educational level			0.99
Primary school to BA	22	19	
MA	4	3	
PhD	1	1	

[a]Values are presented as mean ± SD.

Table 2. Comparison Between Neuropsychological Tests' Results in OCD and Non-OCD Groups

Variables	Patient (N = 27)[a]	Non-Patient (N = 23)[a]	P Value
The Tower of London test			
Problem Solving	30.03 ± 4.33	30.52 ± 5.20	0.72
Wisconsin test			
Number of Categories	3.70 ± 1.76	5.13 ± 1.27	0.001
Perseverative Error	6.56 ± 5.07	2.30 ± 2.22	0.0001
Stroop test			
Reaction Time to Congruent Stimuli	1056.33 ± 190.04	960.35 ± 135.34	0.049
Reaction Time to Incongruent Stimuli	1100.59 ± 203.88	1001.65 ± 138.52	0.055
Interference Score	1.07 ± 2.36	0.09 ± 0.94	0.055

[a]Values are presented as mean ± SD.

Table 3. Comparing Neuropsychological Tests' Results in OCD Patients With High and Poor Insight Levels

Variables	High Insight (N = 22)[a]	Poor Insight (N = 5)[a]	P Value
The Tower of London test			
Problem solving	29.90 ± 4.52	30.60 ± 3.78	0.75
Wisconsin test			
Number of categories	3.86 ± 1.67	3 ± 1.87	0.309
Perseverative error	6.18 ± 4.99	8.20 ± 5.71	0.31
Stroop test			
Reaction time to congruent stimuli	1057 ± 199.90	1052 ± 157.87	0.85
Reaction time to incongruent stimuli	1100 ± 210.54	1100 ± 193.58	0.95
Interference score	1.32 ± 2.53	0 ± 1	0.18

[a]Values are presented as mean ± SD.

5. Discussion

The findings revealed a significant difference between OCD patients and normal people in a number of executive functions. However, comparison between OCD patients with high and poor insight levels showed no significant difference in the executive functions variables.

The results from the present study on the executive function of problem solving task (the Tower of London Test) showed no difference between OCD patients and healthy people. These results are in agreement with previous researches [29, 30]. To explain this finding, it can be said that the executive function deficits may be related to the problems in organization and strategization of the cognitive stimuli and resources for achieving the highest efficiency [6]. Planning is an executive function, which is usually assessed by the Tower of London test. Some researchers suggest that the deficits observed in this test relate to the planning time, and not to the number of problems correctly solved with minimum moves. In other words, OCD patients perform slower in this test. This may be due to such factors as the need for more time for checking and providing substitute answers, following the adoption of wrong strategies. On the other hand, some suggest that this latency is only seen in the first problems. It means that the problem is due to the exposure to new situations. Therefore, the role of supervisory attention system (SAS) [31] in response to unusual situations [6] can be mentioned. Therefore, insignificance difference in the present study may support above hypothesis maintaining that planning and problem solving are not difficult tasks for the OCD patients to accomplish.

The set shifting refers to the capability in shifting the focus among different aspects or characteristics of a stimulus in response to feedback change [32]. Therefore, those who cannot adjust their behavior in response to feedback change commit perseverative errors and are weak in executive function of set shifting. Wisconsin is the best test for assessing executive functions of frontal and prefrontal areas, to the extent that some researchers have referred to it as the golden standard for assessing the activities of these areas [28, 33]. Investigating the neuroimaging examinations showed significant increase in neural activity and metabolism of the frontal and prefrontal cortex during Wisconsin test, for example [34]. In accordance with previous studies [6, 8, 20, 35], the results from the present research have shown that OCD patients perform poorer in performance test. Some researchers have mentioned that the lower number of completed categories in Wisconsin test may be related to the problem in organization. Completing the categories requires considering the characteristics of a stimulus: shape, color and number, distinguishing the meaningful categories from the mentioned stimuli and finally categorizing the stimuli into the identified categories. All of these activities require using organization strategies [6]. Therefore, those who identify fewer numbers of categories may have difficulty in the organization of the stimuli. Neuroimaging with magnetic resonance has displayed exclusive involvement of prefrontal areas over the execution of Wisconsin test. During the reception of negative feedback and shifting to a new response, the activity of the ventral-lateral prefrontal cortex of caudate and posteromedial thalamus nucleus (basal ganglia ring) had increased [36]. Therefore, the poor performance on the Wisconsin's number of categorization in the OCD patients relates to the mentioned conflict in the ring's activity [35]. In addition, the perseverative behaviors such as compulsions have been attributed to the disruptive ability of frontal lobe circuits in inhibiting cognitive or motor planning of basal nuclei. Despite this, it should be noted that determining the specific brain regions, responsible for bad performance of set shifting, is a difficult task. Since, ability in shifting the focus from one stimulus to another depends on the complex interactions of multiple brain regions [4]. It also may be due to the contents, gained from different experiences and nested in the brain, especially with respect to the prefrontal activities.

Stroop test's results in the present study are consistent with previous findings [23, 37], maintaining no difference between the OCD patients and the healthy people. Kashyap et al. suggests that one's performance on the Stroop test is connected to the integrity of the medial prefrontal cortex [6]. The Stroop test assesses the executive functions of conflict resolution/response inhibition tasks. Response inhibition deficit in the OCD patients has been proved in a number of studies. Therefore, the results of the present study showed no difference between the performance of the OCD patients and the healthy people on Stroop test (conflict resolution/response inhibition). In explaining the existing findings, suggest that deficits of executive functions can be due to other diseases such as depression [37] or schizophrenia [38]. Therefore, when OCD is merely investigated, no difference in performance between the patients and healthy people is seen, and so normal performance of the OCD patients is due to the absence of other accompanied disease.

In general, Abramovitch et al. in a meta-analysis study on neuropsychological functions assessment put that the medium to large effect size relate to non-verbal memory, and the executive function is significantly related to that memory. They reported mean of medium effect size in neuropsychological functions shows that they are not clinically significant, and suggests that they may not be a reliable endophenotypic index for OCD [39].

The obtained results from the tests on executive functions do not show any difference between the OCD patients with high and poor insight. These findings are inconsistent with previous research [8]. Kashyap et al. in a study investigated the relationship between insight and neuropsychological actions, including executive functions (Auditory verbal learning test, the Tower of London Test, Wisconsin Card Sorting test, Stroop test and

Controlled oral word association test) and showed the relationship between executive functions and insight. In explaining these findings, it can be said that the insight may not decrease one's executive function ability by it; rather it should be accompanied with another disease. In addition, it should be noted that the instrument type, used for distinguishing poor and high insight people, as well as the limitation in subject size may affect the obtained results [8].

To our knowledge, however, the present research is the first study on executive functions of the OCD patient with poor and high insight levels. Therefore, it can provide researchers with new research area. Limitation of the study is also worth mentioning. In this study, insight assessment has been based on a self-reported question (in accordance with previous work) [7]. Is just one question, per se, capable of distinguishing people perfectly? In addition, assessment of this feature is not an easy task as it is expressed. Particularly, with respect to the question, mentioned in many references, asking whether one can measure insight level or not (i.e. poor or high). It should immediately be mentioned that assessment culture, as well as some cognitive features in Iranian samples may fluctuate the results from investigation into the insight.

On the other hand, even if a question is capable of assessing insight appropriately, yet compared to the patients with high insight, the number of poor insight patients is very limited (i.e. 5 out of 27). Therefore, the mentioned lack of difference may be due to the limited number of patients with poor insight level. Another point, not investigated in this study and ignored, is whether the patients have come for treatment in consequence of their own recognition of the symptoms or because of insistence by others. Examination of this point could show us how much a person was aware of his condition. Then, we could investigate to what extend this awareness was in agreement with the results from the insight question. In addition, it is worth mentioning that, although, insight level of the OCD patients has been addressed in the fourth and fifth editions of the Diagnostic and Statistical Manual of Mental Disorders [2], this question should also be taken into consideration that whether comorbid OCD determines the insight level better when it is accompanies by other diseases.

Based on this, the follows are recommended for further studies: 1) using larger sample size of poor insight OCD patients, 2) making comparison between OCD patients with other OCD patients who have also other comorbid disorders, 3) considering a plan capable of examining other neuropsychological variables such as intelligence, attention and so forth and 4) most importantly, it should be capable of using reliable and accurate instruments for measuring insight level.

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