

•Original research article•

Comparison of cognitive flexibility and planning ability in patients with obsessive compulsive disorder, patients with obsessive compulsive personality disorder, and healthy controls

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Background: Cognitive functioning in individuals with Obsessive Compulsive Disorder(OCD) and with Obsessive Compulsive Personality Disorder (OCPD) has not been adequately studied.

Aim: Examine the cognitive flexibility and planning ability of individuals with OCD and OCPD.

Methods: Twenty patients with OCD and 25 patients with OCPD who had not taken medication in the previous two weeks were identified in an outpatient psychology clinic in Tehran, and 25 healthy control subjects were identified from the university staff and local community residents. All participants were administered the 28-item version of the General Health Questionnaire (GHQ-28), the Wisconsin Card Sorting Test (WCST), and the Tower of London (TOL) test. Two measures of the WCTS (number of perseverative errors and number of categories completed) were used to assess cognitive flexibility and three measures of the TOL (total number of moves in 12 trials, total response time, and planning time) were used to assess planning ability.

Results: The level of current psychological distress in the two patient groups was significantly greater than that in the control group. After adjusting for demographic variables and the level of psychological distress, both OCD patients and OCPD patients made more perseverative errors on the WCST than control subjects, and the OCD patients (but not the OCPD patients) completed significantly fewer categories than the control subjects. Both the OCD patients and OCPD patients required significantly more moves than control subjects to complete the 12 TOL tasks and OCD patients took significantly longer than both OCPD patients and control subjects to complete the tasks.

Conclusions: Individuals with OCD and OCPD have impaired cognitive flexibility and planning ability compared to healthy controls, and there are some differences in these measures of cognitive functioning between OCD and OCPD. Long term follow-up studies of OCD and OCPD that assess changes in cognitive measures as the severity of obsessive compulsive symptoms wax and wane will be needed to determine whether or not such cognitive measures have diagnostic or clinical relevance for obsessive compulsive disorders.

Keywords: obsessive compulsive disorder; obsessive compulsive personality disorder; executive function; neuropsychology; Iran

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1. Introduction

Individuals with obsessive compulsive disorder (OCD) suffer from recurrent intrusive thoughts or images (i.e., obsessions) and ritualistic behaviors (i.e., compulsions). Individuals with obsessive compulsive

personality disorder (OCPD) are preoccupied with mental and interpersonal control and orderliness, and are considered rigid, obstinate, and perfectionistic. These conditions are listed as two separate disorders in both the fourth and fifth editions of the *Diagnostic*

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and *Statistical Manual of Mental Disorders* (DSM-IV, DSM-V),^[1,2] but there is, nevertheless, considerable overlap of the core behavioral symptoms for the two conditions.^[3] Neurobiological investigations report that specific characteristics of the monoamine neurocircuitry of individuals with OCPD are also seen in individuals with OCD; for example, blunted fenfluramine-mediated prolactin responses has been reported in both OCPD and OCD, suggesting similarities in the serotonergic processing in these disorders.^[4]

Another method for assessing the overlap between OCPD and OCD is to determine whether or not they exhibit similar cognitive profiles.^[5] Tükel and colleagues^[6] and Kashyap and colleagues^[7] found that OCD patients have impairments in working memory, attention, problem solving, visuospatial ability, inhibition, and decision-making. Several studies have focused on impaired cognitive flexibility in OCD^[8,9] and in persons with obsessive compulsive personality traits.^[10] Other studies have reported impaired problem solving and planning among persons with OCD,^[11] findings supported by data from neuroimaging studies which suggest that the impairments in planning in individuals with OCD are associated with frontal lobe dysfunction.^[12]

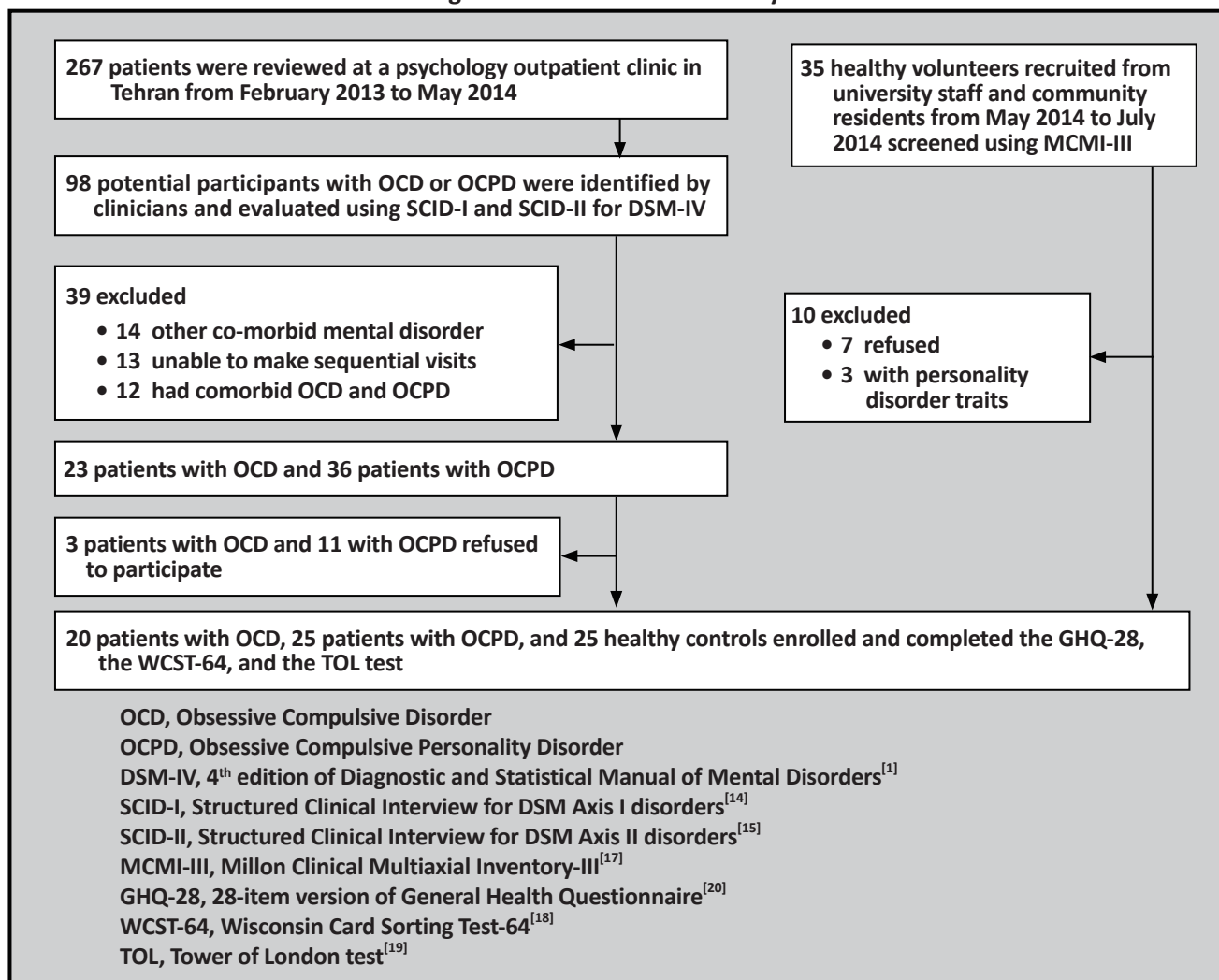
Previous studies of OCPD have focused on population-based samples, so they include few individuals with moderate to severe disability due to their personality disorder. Moreover, several issues about cognitive dysfunction in OCD and OCPD remain controversial. For example, Kuelz and colleagues^[12] reported that set shifting and planning abilities might be intact in patients with OCD, and Sasso^[13] found no significant correlation between OCPD and cognitive inflexibility. To provide additional information about this issue, the current study enrolled patients with OCPD (i.e., those who are significantly disabled due to the condition) and compared cognitive flexibility and planning ability across three groups of individuals: OCPD patients, OCD patients, and healthy controls.

2. Methods

2.1 Participants

As shown in Figure 1, a total of 98 potential participants were identified from patient records and by using recruitment fliers over a 4-month period at a psychology outpatient clinic specializing in mood and personality disorders in Tehran. These individuals were assessed

Figure 1. Flowchart of the study



for eligibility by clinic psychiatrists. Inclusion criteria for the two patient groups included: (a) meets DSM-IV diagnostic criteria for OCD or OCPD (but not both) based on administration of the Structured Clinical Interview for DSM-IV Axis I disorders (SCID-I)^[14] and the Structured Clinical Interview for Axis II disorders (SCID-II)^[15]; (b) aged 20 to 50 years old; (c) Intelligence Quotient (as assessed using Raven Progressive Matrices^[16]) of 85 or higher; (d) had not used any psychotropic medications in the two previous weeks; and (e) no history of serious head injury, neurological disorder, or other co-morbid mental disorder.

Potential control group participants included staff members at Alzakra University and community members recruited through local advertisements. They were asked to complete the self-completion Millon Clinical Multiaxial Inventory-III (MCMI-III)^[17] and the Raven Progressive Matrices^[16] to exclude individuals with possible personality disorders, mental retardation, or common mental or substance abuse disorders.

Enrolled patients and controls were asked to return to the clinic to complete a battery of psychological measures. All participants received general information about the study and signed an informed consent statement before participating. The study received approval from the ethics committee of Alzakra University.

2.2 Measures

2.2.1 Millon Clinical Multiaxial Inventory-III (MCMI-III)

The MCMI-III^[17] is a self-report questionnaire consisting of 175 true-false items which assess 14 DSM-IV Axis II personality disorders and 10 DSM-IV Axis I clinical syndromes. A weighted score that ranges from 0 to 115, the Base Rate Score (BRS), is generated for each of the personality disorders and clinical syndromes: scores between 75 and 84 are classified as 'traits' and scores of 85 and higher are considered 'disorders'. In this study this inventory was administered to potential control participants to screen out individuals with possible personality disorders or other common mental disorders such as anxiety, major depression, and somatoform disorders.

2.2.2 Wisconsin Card Sorting Test (WCST)

The WCST^[18] has been widely used to examine set shifting or cognitive flexibility. We used a computerized version of WCST-64 and asked participants to sort a series of cards according to one of three possible categories (color, number, or form). We extracted the scores for perseverative errors and for number of categories completed from the WCST for the current analysis.

2.2.3 Tower of London test (TOL)

Planning ability was evaluated by the computerized version of the TOL^[19] in which participants were asked to solve a number of problems by moving three colored

beads (red, green, and blue) among three sticks with different heights. The test used in this study consisted of 12 trials that required from 2 to 5 moves each; the total number of moves, the total response times, and time of planning (i.e., the time between the start of the trial and the first move) across all 12 trials were the outcome measures used in the current study.

2.2.4 General Health Questionnaire

The GHQ-28^[20] was used to measure the level of current psychological distress. It is subdivided into four subscales, including somatic symptoms, anxiety and insomnia, social dysfunction, and depression. Each question was scored from 0-3, with a total possible score ranging of 0-84; a total score of 24 was the cut-off point for classifying 'significant social distress'.^[21]

2.3 Statistical methods

All analyses were conducted using SPSS 17. Chi-square tests were used to compare the gender and educational status (i.e., with or without college degree) of the three groups of subjects. One-way analysis of variance (ANOVA) was used to compare the age, IQ, and total and subscale scores of the GHQ-28 across the three groups. The two measures from the WCST (considered perseverative errors and categories completed) and the three measures from the TOL (considered total number of moves, total response time, and planning time) were compared using analysis of covariance (ANCOVA) adjusting for age, gender, IQ, educational status, and total score on the GHQ-28. The two WCST measures, which assessed cognitive flexibility, were simultaneously considered in a multivariate analysis of covariance (MANCOVA), and the three TOL measures, which assessed planning ability, were simultaneously considered in a second MANCOVA. Statistical tests were two-tailed and the level of statistical significance was set at $p < 0.05$. Post-hoc comparisons between the OCD, OCPD, and normal control groups were conducted adjusting the level of significance using the Bonferroni correction.

3. Results

As shown in Table 1, there were no statistically significant differences in the gender, age, IQ, or educational attainment of the participants in the three groups.

As expected, patients in the OCD and OCPD groups had significantly higher levels of psychological distress than control group subject (assessed by GHQ-28). This is also the case for the three GHQ-28 subscale scores – somatic symptoms, social dysfunction, and depressive symptoms (Table 2). The total score of the GHQ-28 was significantly higher in the OCD group than in the OCPD group, but this was not the case for any of the subscales. Based on the cutoff for the total GHQ-28 score of 24, 45% (9/20) of OCD patients, 24% (6/25) of OCPD patients, and 4% (1/25) of control subjects had clinically significant psychological distress ($\chi^2=10.62, p=0.005$).

Table 1. Characteristics of patients with obsessive compulsive disorder (OCD), patients with obsessive compulsive personality disorder (OCPD), and healthy controls

characteristic	OCD (n= 20)	OCPD (n= 25)	controls (n= 25)	statistic (p-value)
mean (sd) age	29.4 (6.1)	35.3 (9.4)	33.2 (8.9)	F= 2.37 (0.182)
mean (sd) Intelligence Quotient	105.6 (18.3)	107.8 (19.1)	111.0 (21.4)	F= 1.98 (0.310)
female, n (%)	13 (65%)	16 (64%)	19 (76%)	$\chi^2=1.00$ (0.606)
college degree, n (%)	14 (70%)	19 (76%)	20 (80%)	$\chi^2=4.27$ (0.075)

Table 2. General Health Questionnaire (GHQ-28)^[20] results of patients with obsessive compulsive disorder (OCD), patients with obsessive compulsive personality disorder (OCPD), and healthy controls

subscale/ scale	[A] OCD (n=20) mean (sd)	[B] OCPD (n=25) mean (sd)	[C] controls (n=25) mean (sd)	F (p-value)	multiple comparison test
somatic symptoms subscale	5.8 (3.0)	4.8 (2.2)	1.7 (1.3)	6.73 (0.002)	A,B>C
anxiety and insomnia subscale	8.0 (4.9)	5.8 (3.5)	2.6 (2.4)	8.20 (0.001)	A,B>C
social dysfunction subscale	7.4 (3.0)	7.3 (2.8)	3.0 (2.1)	5.69 (0.005)	A,B>C
depression subscale	6.3 (4.6)	6.4 (2.6)	2.3 (1.0)	8.39 (0.001)	B,A>C
GHQ-28 total score	25.8 (9.2)	20.2 (6.0)	9.5 (4.2)	15.10 (<0.001)	A>B>C

As shown in Table 3, even after adjusting for demographic variables and the level of psychological distress, there were statistically significant differences between the three groups in both measures of cognitive flexibility assessed by the WCST. Follow-up multiple comparison tests found that perseverative errors were significantly more common in the two patient groups than in the control group but not significantly different

Table 3. Results of Wisconsin Card Sorting Test (WCST)^[18] and Tower of London test (TOL)^[19] of patients with obsessive compulsive disorder (OCD), patients with obsessive compulsive personality disorder (OCPD), and healthy controls

scale/ measure	[A] OCD (n=20) mean (sd)	[B] OCPD (n=25) mean (sd)	[C] controls (n=25) mean (sd)	F (p-value) ^a	multiple comparison test
WCST					
perseveration errors	5.55 (5.88)	2.96 (2.74)	1.20 (1.44)	7.93 (0.001)	A,B>C
categories completed	4.20 (2.06)	5.16 (1.37)	5.60 (0.81)	5.24 (0.008)	C>A
TOL					
total number of moves	20.1 (4.6)	17.8 (3.5)	14.6 (3.6)	9.82 (<0.001)	A,B>C
total response time (sec)	613 (502)	346 (122)	357 (152)	5.71 (0.005)	A>C,B
planning time (sec)	164 (69.68)	165 (65)	147 (73)	0.53 (0.591)	---
^a Analysis of covariance (ANCOVA) adjusting for age, gender, Intelligence Quotient, educational status, and total score on the 28-item General Health Questionnaire ^[20]					

from each other; the number of categories completed was significantly greater in control group subjects than in OCD patients, but not significantly different from the number of categories completed by OCPD patients. Combining the results for the two measures of cognitive flexibility in a MANCOVA also identified significant differences between the groups ($F(4, 132) = 3.79, p = 0.006; Wilks' \lambda = 0.80$).

Table 3 also shows the results of the ANCOVA for the three measures of planning assessed by the TOL. After adjusting for demographic variables and level of distress, there were statistically significant differences between the three groups in the number of moves required to complete the 12 tasks and in the total response time for the 12 tasks, but the differences in the planning time for the 12 tasks were not statistically different across the three groups. Follow-up multiple comparison tests showed that the two patient groups required a significantly greater number of moves to complete the tasks than the control group, but the number of moves used by the OCD and OCPD patient groups was not statistically different. Unexpectedly, the time required to complete the tasks in the OCD group was significantly greater than that required both by the control group and by the OCPD group, but there was no significant difference in response time between the

OCPD and control groups. Combining the results for the three measures of planning ability in a MANCOVA, there were significant differences between the three groups ($F[6, 130] = 4.87, p < 0.001$; Wilks' lambda = 0.66).

4. Discussion

4.1 Main finding

As expected, we found that persons with OCD and OCPD experience significantly higher levels of psychological distress than individuals without mental disorders. We also found that the overall level of distress was greater among individuals with OCD than among individuals with OCPD.

There are several studies that assess the relationship between OCD and OCPD^[3-5] but, to our knowledge, this is the first study that compares the cognitive flexibility and planning ability of OCD and OCPD patients to that of healthy controls. We found that after adjusting for demographic variables and severity of overall distress, OCD patients had significantly worse functioning than normal controls on both measures of cognitive flexibility assessed by the WCST and on two of the three measures of planning ability assessed by the TOL. OCPD patients also had worse functioning than normal controls on one of the two measures of cognitive flexibility and on one of the three measures of planning ability. The overall psychological distress reported by OCD patients on the GHQ-28 was greater than that reported by OCPD patients, and for one of the five cognitive measures considered – total response time on the TOL – OCD patients were significantly more impaired than OCPD patients; but none of the other four cognitive measures showed significant differences between the two patient groups.

Our findings are in agreement with previous published studies which examined cognitive flexibility in patients with OCD. Tükel and colleagues^[6] reported that OCD patients, independent of medication use, show high numbers of perseverative errors and low numbers of completed categories when completing the WCST. A recent study examining the neuropsychological characteristics of a community-based sample reported that individuals with OCPD have significant cognitive inflexibility and executive planning deficits, though their decision-making abilities are intact.^[22] Studies of clinical samples report that individuals with obsessive-compulsive personality traits underperform on specific executive function tests related to set-shifting and planning abilities.^[10] Another report found that individuals with co-morbid OCD and OCPD had more impaired cognitive flexibility than those with OCD without co-morbid OCPD,^[4] suggesting that cognitive inflexibility is a symptom of both OCD and OCPD, and that the severity of the cognitive impairment parallels the clinical severity of the obsessive compulsive symptoms.

Our results about planning ability in OCD and OCPD are also in line with previous studies, but there are some unique results in our study.^[9] Both groups of patients required more moves to complete the twelve TOL tasks than healthy controls, indicating that their ability to plan and resolve complex problems was impaired. Despite this poorer performance, the OCD patients also took significantly longer to complete the tasks than controls, suggesting that they think much longer than others before trying a complex task. Thus the need to perform tasks based on a 'perfect standard' and the intolerance of uncertainty often reported in OCD patients^[22,23] may be associated with the cognitive dysfunction reported among these patients. However, our study found that despite their relatively poor performance on the TOL tasks, OCPD patients did not take longer to complete the tasks than control subjects and, in fact, completed the tasks significantly faster than OCD patients.

Recent brain imaging studies^[24,25] report similar changes in the activity of several brain regions (e.g., the dorsolateral prefrontal cortex and the orbitofrontal cortex) of both OCD and OCPD patients while performing tasks that require cognitive flexibility, planning ability, and decision making ability. These findings appear to support the hypotheses that the underlying mechanisms in both clinical disorders are similar. But our detailed assessment of cognitive flexibility and planning ability identified differences between the two conditions which suggest that additional, as yet unknown, condition-specific factors influence the relationship between obsessive compulsive symptoms and cognitive functioning.

4.2 Limitations

The present study had some limitations that should be noted. First, the sample size was relatively small, so the failure to identify differences between OCD and OCPD patients on several of the measures may have been due to Type II errors. Second, we used a relatively limited number of cognitive measures that may not have assessed all aspects of cognitive flexibility and planning ability, and definitely did not include other aspects of cognitive functioning that may be impaired in OCD and OCPD. Third, individuals with OCD, OCPD, and other mental disorders were excluded from the control group based on a self-completion measure (MCMI-III) which may not have identified all such individuals. Finally, the study did not include a control group of individuals with co-morbid OCD-OCPD, so it was not possible to assess the increased (or decreased) effect of the comorbid condition on cognitive functioning.

Future studies should recruit larger samples, include a comorbid OCD-OCPD group, conduct a more comprehensive neuropsychiatric battery, and follow subjects over time to assess the evolution of the cognitive impairment as the obsessive compulsive symptoms wax and wane.

4.3 Implications

We found significant impairments in the cognitive flexibility and planning ability of patients with OCD and OCPD, even after adjusting for demographic factors and the patients' level of psychological distress. Defects in cognitive flexibility and planning abilities are potential neurocognitive fingerprints for obsessive compulsive disorders that may have diagnostic value and treatment implications, because they could be employed as measures of changes in the functional severity of the disorders over time and with treatment. However, further work, particularly long-term follow-up studies that monitor changes in cognitive function and obsessive compulsive symptoms, will be needed to clarify whether or not such neurocognitive measures are of practical value. Interestingly, OCPD patients appeared relatively unaffected in some aspects of cognitive functioning, highlighting a potential area of difference with OCD that deserves further study. Importantly, in our study, the neurocognitive profile was examined in a medication-free group of participants, and, thus, our results were not confounded by the potential effects of medication on cognitive functioning.

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Conflict of interest statement

All authors declare that they have no conflict of interest related to this manuscript.

Informed consent

All participants provided written informed consent to participate in the study.

Ethics approval

All procedures performed in this study were approved by the ethics committee of Alzahra University.

Authors' contributions

NP and ZH conceived and designed the study and acquired the data. NP, AHM, and MS analyzed and interpreted the data. NP, AHM, and MS drafted the manuscript. The manuscript was critically revised by AHM and MA. All authors read and approved the final version of the manuscript.

强迫症患者、强迫型人格障碍患者和健康对照者之间的认知灵活性和计划能力比较

Paast N, Khosravi Z, Memari A, Shayestehfar M, Arbabi M

背景: 强迫症患者 (Obsessive Compulsive Disorder, OCD) 与强迫型人格障碍患者 (Obsessive Compulsive Personality Disorder, OCPD) 的认知功能还没有得到充分的研究。

目标: 验证 OCD 和 OCPD 患者的认知灵活性和计划能力。

方法: 本研究在德黑兰心理咨询门诊选定了 25 例 OCD 患者和 20 例 OCPD 患者, 他们在既往两周都没有服药, 并且从大学工作人员和当地社区居民中选定了 25 名健康对照者。对所有参与者均进行 28 项一般健康问卷 (28-item version of the General Health Questionnaire, GHQ-28)、威斯康星卡片分类测验 (Wisconsin Card Sorting Test, WCST)、和伦敦塔试验 (Tower of London test, TOL)。本研究运用 WCTS 的两个测量指标 (持续错误数和完成分类数) 评估认知灵活性以及 TOL 的三个测量指标 (12 个试验总共的移动次数、总应答时和计划时间) 评估计划能力。

结果: 2 组患者的当前心理困扰程度显著高于对照组。在控制人口学因素和心理困扰水平后, OCD 患者和

OCPD 患者在 WCST 测试中比对照组更容易出现持续性错误, 而 OCD 患者 (不包括 OCPD 患者) 的完成分类数比对照组显著减少。OCD 患者和 OCPD 患者都比对照组需要更多的移动次数来完成 12 项 TOL 任务, 并且 OCD 患者比 OCPD 患者和对照组需要花更长的时间来完成任务。

结论: 与健康对照组相比, OCD 和 OCPD 患者的认知灵活性和计划能力都有所受损, 并且 OCD 和 OCPD 患者之间的认知功能测试也存在一些差异。我们需要对 OCD 和 OCPD 患者进行长期随访研究评估在强迫症状严重性加重与减轻时认知功能的改变, 从而决定此类认知评估指标对于强迫症是否有诊断或临床关联性。

关键词: 强迫症; 强迫型人格障碍; 执行功能; 神经心理学; 伊朗

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