Comparison of checking behavior in adults with or without checking symptom of obsessive-compulsive disorder using a novel computer-based measure

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ARTICLE INFO

ABSTRACT

Easy to administer behavioral measures of checking are needed to improve the assessment of this hallmark feature of OCD. We recently developed a new computer-based behavioral assessment of OCD in a previous study. As a follow-up experiment for this method, the goal of this study was to examine whether the new computer-based behavioral assessment would be capable of differentiating behaviors in adults with OCD characterized by checking behavior from those without checking behavior. We compared 22 OCD patients with compulsive checking behaviors (OCD checkers), 17 OCD controls without checking behavior (OCD controls), and 31 healthy controls (HCs) on a novel computer-based behavioral measure of checking behavior. Despite similar levels of successfully completed tasks, OCD checkers demonstrated longer duration of checking behaviors than OCD controls or HCs. Interestingly, no differences were found between OCD controls and HCs in any of the dependent variables. Our new behavioral measure offers a novel, objective, and ecologically valid measure of checking behaviors in a sample of adults with OCD.

1. Introduction

Obsessive-compulsive disorder (OCD) is a chronic and debilitating anxiety disorder characterized by obsessive intrusive thoughts and negatively reinforced compulsive behavior that functions to temporarily decrease obsessions. Although all patients with OCD have repeated obsessive and compulsive behavior, the exact nature of these symptoms varies considerably across patients. Because OCD is a clinically heterogeneous condition, patients with the same diagnosis as OCD can display distinct symptom patterns [1]. Accordingly, it may be useful to develop and validate measurement tools for OCD symptoms that discriminate between OCD subtypes.

Moreover, patients with specific OCD symptom subgroups show distinct patterns of brain activation [2,3]. For example, studies with OCD checkers show distinctive neural activation compared to those with OCD characterized by washing or hoarding. Specifically, the OCD checkers revealed excessive activity in dorsal cortical areas (dorsolateral prefrontal cortex and dorsal anterior cingulate cortex) upon presentation of provocative checking-related pictures. These brain regions are

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particularly involved in a wide range of cognitive functions, such as error recognition, conflict detection and response selection [4–7].

Factor analysis studies for OCD provide classifications according to their clinical phenotype [8–13]. However, most previous studies for OCD using these subtypes have addressed distinction in cognitive symptoms among OCD types [14–16]. To be able to probe the pathophysiological base and the cognitive behavioral treatment effect of subtypes in OCD, behavioral measures are needed to improve the characterization of different behavioral subtypes of OCD (e.g., checking, hoarding, washing). To our knowledge, there are only preliminary studies designed to develop new behavioral measures for OCD subtypes [17,18], including our previous study [19]. Despite evidence that checking symptoms are the most common form of compulsive behavior in OCD patients [20], to our knowledge, there is no standardized computer-based behavioral measure of checking behavior. Thus, in the current study, we used a computer-based assessment of checking behavior to examine the behavioral patterns of OCD checkers.

Common strategies for evaluating OCD patients are measuring their self-reported symptoms, impairment in daily functioning, and overall quality of life [21–23]. These measures provide important descriptive information about the type and severity of obsessions and compulsions (checking, washing, etc.), social, occupational, and academic functioning, and general quality of life. In our previous study, we found positive correlations between the behavioral measures of checking and the symptoms/functioning of OCD patients [19].

To examine OCD using objective behavioral indices, we developed a computer-based task that uses virtual reality (VR) to simulate realistic environments (house and office) in which individuals are asked to engage in OCD-relevant tasks (e.g., lock doors) [19]. A key advantage of this measurement approach is that the task includes objective measures of checking behavior frequency and duration behavioral trajectory inside the virtual environment, as well as time spent gazing at OCD-relevant stimuli [19]. In the previous study, we found that behavioral measures obtained from this task differentiated individuals with OCD from healthy controls. The goal of the present study is to extend our previous findings by examining task performance among three groups of participants: patients with OCD characterized by checking compulsions (OCD checkers), patients with OCD characterized by other compulsions (OCD controls), and healthy controls (HCs). In addition to recruiting different participants, we modified following aspects in this experiment from the previous experiment [19]: First, according to the relationship between task performance and a subjective measure of real world checking urge, there was no significant correlation in office environment in the previous experiment. Therefore, we excluded the office environment in the previous program (house and office). Second, according to the result of previous experiment, gazing time during distraction task was not significantly different between OCD patients and matched HCs. Therefore, we excluded the gazing time during the distraction task among dependent measures. Third, according to previous experiment, checking time was the key variable among VR dependent measures. To see the checking time in different areas, we divided the total area into several small areas

(33 areas) and calculated checking time in each area. Lastly, we included medication history in this experiment as it was found to be one of the key limitations of the first experiment.

The goal of this study was to examine whether a new computer-based behavioral assessment would be capable of differentiating behaviors in adults with OCD characterized by checking behavior from those without checking behavior. To increase the ecological validity of the task, an ordinary home environment was used as the virtual environment in which checking behavior was assessed. We hypothesized that OCD checkers would demonstrate more checking behaviors than OCD controls and HCs based on increased checking time, frequency of checking behavior, gazing time, length of behavioral trajectory, and hit-map.

2. Materials and methods

2.1. Participants

Seventy volunteers participated in this study. All participants were recruited via local or bulletin board advertisements in the Kangnam Severance Hospital in Korea, and screened with a medical health questionnaire. Exclusion criteria for patients and healthy controls included auditory or visual impairment, mental retardation (IQ scores < 70), traumatic brain injury, presence or history of any neurological illness, proficiency in Korean, and criteria met for concurrent substance abuse or dependence. DSM-IV diagnoses were made by fully certified consultant psychiatrists using clinical interview based on the Mini International Neuropsychiatric Interview [24]. OCD severity was assessed with the Yale-Brown Obsessive Compulsive Scale (Y-BOCS) [21,25], and types of OCD were verified by psychiatrists based on the Yale-Brown Obsessive Compulsive Scale symptom checklist [21,25]. For the purpose of this study, we also asked participants about their checking urges in their own house using visual analog scales (VAS; 1–10). Finally, there were 22 OCD patients who have checking symptom as their main symptom and reported high levels (VAS ≥ 6) of checking symptoms in their own home environment (OCD checkers), 17 OCD patients who did not have checking symptoms (OCD controls), and 31 healthy controls (HCs). All participants were provided written informed consent forms and paid the equivalent of $15 per hour for participation. Demographic information and clinical characteristics of all participants are presented in Table 1.

2.2. Clinical assessment

Three types of clinical aspects – symptoms, functioning, and quality of life – were included in this study. To assess *symptoms*, Y-BOCS [21,25] was used, a widely used clinically administered interview. Comprehensive reviews of psychometric literature [26] suggest that the measure possesses sound reliability, validity, and sensitivity to treatment effects. For the *functioning* assessment, the Global Assessment of Functioning (GAF) in the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* [22] was used. GAF is a numeric scale (1–100) used by mental health professionals to rate the severity of social, occupational, and psychological impairments. To assess