

Implicit and explicit memory in patients with obsessive-compulsive disorder: An event-related potential study

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Abstract

The implicit and explicit memory in patients with obsessive-compulsive disorder (OCD) was investigated using the event-related potential (ERP). For the assessment of implicit memory, a lexical decision task was administered. Among a total of 320 words and 140 non-words, 200 words were repeated, while the remaining 120 words and the 140 non-words were not repeated. For explicit memory, a continuous recognition task was administered, in which 280 words were repeated and 100 were not repeated. On the recognition task, both the controls and OCD patients showed more positivity to the old words than to the new words during the 200–600 ms period post-stimulus. Both groups showed faster response time to the old words than to the new words. On the lexical decision task, the controls showed the old/new effect during the 200–500 ms period post-stimulus, while the OCD patients did not. However, OCD patient showed faster response time to the old words than to the new words, although OCD patients showed prolonged response times to the old words compared to the controls. These results indicate that OCD patients have preserved explicit and implicit memory. The absence of old/new effect on ERP in OCD patients was discussed in terms of dysfunction of fronto-striatal system, which plays an important role in both OCD and implicit memory.

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1. Introduction

Obsessive-compulsive disorder (OCD) is characterized by obsession and compulsion severe enough to interfere with a person's ability to function on a daily basis (American Psychiatric Association, 1994). It has long been believed that the key features of OCD, such as repetitive rituals or obsessional doubts as to whether an action has been completed correctly, might result

from impaired recall of past events (Coles and Heimberg, 2002). However, the extant research has provided an inconsistent pattern of results concerning memory function in OCD, since memory is a complicated cognitive process consisting of several subtypes.

Typically, memory is divided into explicit and implicit memory (Schacter et al., 1993; Squire and Zola-Morgan, 1991). Explicit memory reflects the intentional or conscious recollection of events or facts, while implicit memory is defined as stored knowledge that does not require intentional conscious recollection. For the measurement of explicit and implicit memory, recall/recognition tests and repetition priming, respectively, are widely used (Rugg, 1995; Swick, 1998).

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In terms of explicit memory, most studies have reported that verbal explicit memory is not impaired in OCD patients (Christensen et al., 1992; Dirson et al., 1995; Radomsky and Rachman, 1999; Schmidtke et al., 1998), although a few studies have found verbal memory deficit in OCD patients (Deckersbach et al., 2000; Savage et al., 2000). In contrast to verbal explicit memory, impairment of explicit aspect of nonverbal memory, measured by such a test as Rey-Osterrieth Complex Figure Test (RCFT), has been consistently observed in OCD patients (Boone et al., 1991; Savage et al., 1999, 2000; Tallis et al., 1999). Furthermore, nonverbal memory impairment in OCD patients was still observed, in spite of the improvement of the OCD symptoms after 4 months of treatment (Kim et al., 2002). However, it is not clear at present whether memory dysfunction observed in OCD patients is due to memory impairment per se or is secondary to the impairment of executive function. Some studies have found that memory impairment in OCD patients is mediated by poor organizational strategies, (Deckersbach et al., 2000; Savage et al., 1999, 2000), while others have reported that OCD patients have both poor memory function and organizational deficit (Shin et al., 2004).

Only a few studies have attempted to investigate implicit memory in OCD patients, but the results are inconsistent. For example, some studies have reported that OCD patients showed impaired incidental and implicit learning (Deckersbach et al., 2002; Jurado et al., 2001) or abnormally enhanced procedural memory during the early course of learning compared to the normal controls (Roth et al., 2004), while others have found the preserved implicit memory in the OCD patients (Foa et al., 1997).

In spite of a disagreement about the nature of memory dysfunction in the OCD patients, most researchers agree that OCD patients show impaired performances on less defined or unstructured memory tasks requiring incidental encoding, but not on well-structured ones requiring active or elaborate encoding, which indicates that OCD patients have encoding difficulties, i.e., an inability to identify or organize meaningful information, in order for it to be stored (Greisberg and McKay, 2003).

There is a growing body of evidence, derived from studies on brain imaging techniques and neuropsychological tests, to suggest that neurobiological abnormalities play a crucial role in the etiology and course of OCD (Kim et al., 2004; Kuelz et al., 2004). In other words, OCD is a neuropsychiatric disorder, which is subserved by the neural loops connecting the prefrontal area, particularly the orbito-frontal area and the basal ganglia (Gross-Isseroff et al., 1996; Mataix-Cols et al., 1999; Rauch, 2000).

The neuroanatomical substrates underlying explicit and implicit memory are now known to be different. The structures of the medial temporal cortex and the

prefrontal cortex play a crucial role in explicit memory (Haxby et al., 1996; Squire, 1992), whereas the prefrontal cortex and basal ganglia seem to be involved in implicit memory (Fletcher et al., 2001; Petri and Mishkin, 1994). All of these findings indicate that OCD and implicit memory share common structures such as prefrontal cortex and basal ganglia.

Furthermore, several studies have found the abnormal brain activation in OCD patients compared to the normal controls while performing the implicit memory. For example, Rauch et al. (1997) and Roth et al. (2003) have reported that OCD patients show increased activation in medial temporal cortex but little striatal activation in OCD patients, while normal participants showed the increased striatal activation but little activation in the medial temporal cortex during the implicit memory.

For the study of memory, the event-related potential (ERP), which is the electrical brain activity time-locked to the external events, has been widely used due to its high temporal resolution. Numerous studies have shown that the ERPs elicited by repeated items are generally more positive-going than those elicited by items presented for the first time, with this being referred to as the old/new effect or repetition effect. The old/new effect is observed both in the explicit and implicit memory tasks (Friedman et al., 1993; Neville et al., 1986; Rugg and Nagy, 1989; Rugg, 1995; Smith and Halgren, 1989; Swick, 1998; Zhang et al., 1997). The old/new effect usually begins at about 250–300 ms after stimulus onset and lasts for several hundred milliseconds.

Since the exact nature of the memory deficit in OCD patients is still elusive, in this study, we attempted to investigate implicit and explicit memory in OCD patients using ERPs. For the measurement of implicit and explicit memory, a lexical decision task and a continuous recognition task were used, respectively. The primary objectives of this study were to investigate whether OCD patients have explicit and/or implicit memory deficits and, if so, whether these deficits are reflected in the ERPs. Based on previous findings, it was expected that the OCD patients would show impaired implicit memory but preserved explicit memory, and that this impaired implicit memory would be reflected in either a reduced old/new effect in the lexical decision task or its complete absence. To the best of our knowledge, no ERP studies investigating implicit memory in OCD patients have previously been reported.

2. Methods

2.1. Subjects

Seventeen right-handed OCD patients (male: 9; female: 8) were recruited from Seoul National University

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