Journal of Anxiety Disorders 28 (2014) 679–686

Contents lists available at ScienceDirect

Journal of Anxiety Disorders

Does "thinking about thinking" interfere with memory? An experimental memory study in obsessive–compulsive disorder

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ARTICLE INFO

Article history:
Received 18 February 2014
Received in revised form 12 June 2014
Accepted 4 July 2014
Available online 21 July 2014

Keywords:
Obsessive–compulsive disorder
Verbal memory
Cognitive self-consciousness
Proactive interference

ABSTRACT

Neuropsychological assessments of participants with obsessive–compulsive disorder (OCD) indicate impaired verbal memory if to be remembered material has to be organized. People with OCD also tend to focus their attention on their thoughts (heightened cognitive self-consciousness). We tested the hypothesis that cognitive self-consciousness causes verbal memory deficits by provoking a division of attention between study task and thoughts. Thirty-six participants with OCD, 36 matched healthy controls and 36 participants with major depressive disorder (MDD) learned under proactive interference in three study conditions: single-task condition, condition with heightened cognitive self-consciousness and condition with an external secondary task. Memory was impaired in the cognitive self-consciousness condition compared to both other conditions. Independent of condition, participants with OCD showed a reduced memory performance compared to healthy controls, but did not differ from participants with MDD. Our results are in line with the hypothesis that cognitive self-consciousness causes memory impairment.

1. Introduction

Obsessive–compulsive disorder (OCD) is characterized by recurrent thoughts or impulses (obsessions) and repetitive behaviors (compulsions) to avoid anxiety or to neutralize the obsessions (American Psychiatric Association, 1994). The phenotype of the disorder suggests that the underlying mechanism might be a malfunction of inhibition (Chamberlain, Blackwell, Fineberg, Robbins, & Sahakian, 2005) and/or memory (Sher, Mann, & Frost, 1984).

Indeed neuropsychological assessments of people with OCD indicate impaired cognitive and behavioral inhibition (Bannon, Gonsalvez, Croft, & Boyce, 2002; Chamberlain et al., 2005) as well as impaired verbal memory (see for review Kuelz, Hohagen, & Voderholzer, 2004; Muller & Roberts, 2005). Even though studies report mixed results concerning verbal memory deficits in general (Muller & Roberts, 2005), deficits seem to be more consistently found if to be remembered material has to be organized (Cabrera, McNally, & Savage, 2001; Olley, Malhi, & Sachdev, 2007). However, the origin of these memory deficits is so far not explained sufficiently.

Another line of research assumes metacognitive beliefs and processes to be an important vulnerability factor of OCD. According to Wells (Fisher, 2009; Wells, 2000) people with OCD tend to focus attention on their thoughts to check for threatening intrusive thoughts and thus display heightened cognitive self-consciousness. Essentially cognitive self-consciousness is a type of threat-monitoring; people with OCD consistently monitor their thoughts for "thoughts which should not be there" (e.g. intrusions). In fact, a number of studies confirmed that people with OCD monitor their thoughts more strongly than people suffering from other anxiety disorders (Janeck, Calamari, Riemann, & Heffelfinger, 2003), people with major depressive disorder, generalized anxiety disorder (GAD) or healthy controls (Barahmand, 2009).

There might be a link between memory deficits and heightened cognitive self-consciousness. That is, cognitive self-consciousness can be conceptualized as a problematic allocation of attentional resources (Wells, 2000) and thus causes a division of attention between the internal world of thoughts and the external world (e.g. tasks to be solved). Therefore, people with OCD might be permanently in a state of divided attention. In the area of memory research it is a robust finding that memory performance is impaired by a secondary external task, i.e. by a division of attention between study task and secondary task (e.g. Baddeley, Lewis, Eldridge, & Thomson, 1984; Craik, Govoni, Naveh-Benjamin, & Anderson,

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http://dx.doi.org/10.1016/j.janxdis.2014.07.009
0887-6185/

1996; Naveh-Benjamin, Guez, & Marom, 2003). First evidence for the role of cognitive self-consciousness in the development of memory deficits in OCD comes from correlation studies. Two studies reported correlations between cognitive self-consciousness and implicit learning (Goldman et al., 2008; Marker, Calamari, Woodard, & Riemann, 2006). In a study by Exner, Martin, and Rief (2009) participants with OCD showed memory deficits in a verbal memory task compared to healthy controls. This group difference in memory performance was mediated by self-reported levels of cognitive self-consciousness. However, to establish a causal role of cognitive self-consciousness in the development of memory deficits, it is necessary to manipulate cognitive self-consciousness experimentally and assess the effects on memory. Kikul, Vetter, Lincoln, and Exner (2011) and Kikul, van Allen, and Exner (2012) successfully developed a task to influence cognitive self-consciousness experimentally. In their design participants were instructed to pay attention to upcoming thoughts and the mental strategies used for encoding while performing a memory task. In the participants with OCD heightened cognitive self-consciousness caused similar visual (Kikul et al., 2011) and verbal memory (Kikul et al., 2012) deficits as an external secondary task compared to a single task-condition. However, participants with OCD did not differ from healthy controls. One reason might be that the study task that was used did not sufficiently challenge executive functions. Moreover, the instruction for the cognitive self-consciousness condition induced a stronger focus of attention to thoughts, but probably primarily to task related thoughts and less to off-task thoughts (e.g. "what will I have for lunch"). Conversely, OCD is characterized by intrusive thoughts, which mostly interfere with the present task and "should not be there". Furthermore, as pointed out previously, cognitive self-consciousness in OCD is essentially a threat-monitoring strategy; this important aspect is missing in the manipulation used by Kikul et al. (2012).

Memory deficits in people with psychiatric disorder are also a frequent finding in major depressive disorder (MDD) (Trivedi & Greer, 2013), however, so far different underlying mechanisms were assumed for dysfunctions in MDD and OCD. That is, while MDD is associated with abnormalities in brain structures directly involved in memory functioning (smaller hippocampal volumes) (MacQueen & Frodl, 2011), studies report for OCD changes in frontal–striatal structures, which are not directly involved in encoding or retrieval, but might support executive aspects of memory (e.g. organizational strategies) (Chamberlain et al., 2005). Meanwhile Wells (2000) proposes that OCD as well as MDD are characterized by a repetitive self-referential style of thinking, which mainly comprises intrusive thoughts, threat-monitoring and cognitive self-consciousness in OCD and rumination in MDD. Thus, we included MDD as a clinical control group to test whether cognitive self-consciousness is a specific causal factor for memory deficits in OCD.

Successful learning under proactive interference requires a high amount of executive control. Proactive interference refers to the interference between a target memory and previously formed memories. "Paired-associate learning" is one paradigm in which context this phenomenon can be studied. Here the same cue (e.g. apple) is associated with several targets (e.g. apple – blossom; apple – pie) and memory is assessed via cued recall asking for the most recent associate (e.g. apple – ?). According to Blumenfeld and Ranganath (2007), proactive interference might result from the competition between the previously learned association and the new association. Thus, to successfully recall the target word, the engagement of a controlled selection process is necessary, which is the inhibition of the old and selection of the new association. Evidently learning under proactive interference taps functions, which might be impaired in OCD. Proactive interference is especially an interesting design considering the assumption that interference from intrusions and cognitive self-consciousness cause the memory deficits in OCD. To our knowledge proactive interference has not yet been studied in OCD.

As discussed above, even though Kikul et al. (2012) successfully manipulated cognitive self-consciousness, the used manipulation led to a stronger focus of attention to task-related thoughts and did not account for the threat-monitoring function of cognitive self-consciousness.

Thus, the current study had two aims: First, we wanted to strengthen the external validity by adapting the design in two important aspects. We manipulated cognitive self-consciousness using a secondary task that led to a distribution of attention between the study task and interfering off-task thoughts. Furthermore, as explained previously, cognitive self-consciousness is essentially a threat-monitoring strategy; people with OCD monitor their thoughts for "thoughts, which should not be there". We incorporated this threat-monitoring aspect of cognitive self-consciousness. Second, we aimed to investigate the effect of heightened cognitive self-consciousness on a verbal learning task with stronger demands on executive functions.

We expected that learning under proactive interference would be reduced in all three groups when situational cognitive self-consciousness was experimentally heightened in comparison to memory performance when full attention capacity was available. We also hypothesized that participants with OCD would be more vulnerable to this effect than healthy controls, as the disease is characterized by a heightened dispositional cognitive self-consciousness. We also compared participants suffering from OCD with participants suffering from MDD to explore whether this effect is specific for OCD. Furthermore, we included a dual-task condition with an external secondary task, to compare the effects of internal and external secondary tasks.

2. Methods

2.1. Participants

All participants were native German speakers.

2.1.1. Participants with obsessive–compulsive disorder (OCD)

The group consisted of 36 participants who met the criteria for current OCD of the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) (American Psychiatric Association, 1994). Twenty-one of the participants had one to three comorbid psychiatric disorders, while 15 suffered only from OCD. Current comorbid Axis I diagnoses included: major depressive disorder ($n = 11$); dysthymia ($n = 1$), somatoform disorder ($n = 3$), social phobia ($n = 2$), panic disorder with agoraphobia ($n = 2$), agoraphobia without history of panic disorder ($n = 5$), generalized anxiety disorder ($n = 2$) and posttraumatic stress disorder ($n = 2$). Six participants received no treatment, 11 participants were either only on pharmacological ($n = 2$) or psychotherapeutic ($n = 9$) treatment and 19 received both. Participants were recruited from our outpatient psychotherapy clinic ($n = 15$), from another outpatient clinic belonging to a psychiatric hospital ($n = 7$) or from a psychosomatic hospital ($n = 14$).

2.1.2. Participants with major depression disorder (MDD)

The sample comprised 36 participants with a current episode of major depressive disorder (MDD) according to DSM-IV (American Psychiatric Association, 1994). Eight participants had new-onset MDD, while 28 participants met the criteria for recurrent MDD. Fifteen participants suffered from one to two comorbid psychiatric disorders, while 21 were only diagnosed with MDD. Current Axis I diagnoses included: dysthymia ($n = 1$), social phobia ($n = 8$), panic disorder with agoraphobia ($n = 2$), agoraphobia without history of panic disorder ($n = 2$), pain disorder ($n = 1$) and posttraumatic