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Components of inhibition in autogenous- and reactive-type obsessive-compulsive disorder: Dissociation of interference control

Jie Fan[a], Wanting Liu[a], Hui Lei[a,b], Lin Cai[c], Mingtian Zhong[d], Jiaojiao Dong[a], Cheng Zhou[a], Xiongzhao Zhu[a,*]

[a] Medical Psychological Institute, Second Xiangya Hospital, Central South University, Changsha 410011, PR China
[b] College of Education, Hunan Agriculture University, Changsha 410128, Hunan, PR China
[c] School of Sociology and Psychology, Southwest University for Nationalities, Chengdu 610041, Sichuan, PR China
[d] Center for Studies of Psychological Application, South China Normal University, Guangzhou 510631, PR China

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ABSTRACT

Obsessive–compulsive disorder (OCD) is characterized by unwanted, intrusive thoughts (obsessions) and/or repetitive, ritualistic behaviors (compulsions). Findings related to the two components of inhibition, namely interference control and behavioral inhibition, among OCD patients have been inconsistent. It might be that this inconsistency is due to the heterogeneity among OCD cases representing multiple subtypes of OCD, such as autogenous obsessions and reactive obsessions types (AOs vs. ROs). AOs and ROs are distinguished by the category of their most disturbing obsessions. The purpose of this study was to systematically examine whether inhibition functions differ between AO and RO patients. We assessed interference control and behavioral inhibition with the emotional Stroop task (EST) and stop-signal task (SST), respectively, in 42 AOs, 55 ROs and 62 healthy controls (HCs) and event-related potentials (ERPs) were recorded in a random subset of these subjects (25 AOs, 25 ROs, and 31HCs). Results showed that in the EST, AOs exhibited longer reaction times (RTs) for color-naming positive-, negative-, and neutral-valence word stimulus than both ROs and HCs, and demonstrated larger P2 and less negative N450 amplitudes than HCs and larger P3 amplitudes than ROs and HCs. In the SST, both AOs and ROs showed lengthened stop signal reaction time (SSRT) and reduced Stop-P3 amplitudes in successful inhibition (SI) trials compared to the HC group. These present findings suggest that behavioral inhibition impairment may reflect a common pathology in both the autogenous- and reactive-type OCD patients, whereas interference inhibition impairment appears to be specific to patients with autogenous obsessions. These findings strengthened the insight into the clinical heterogeneity and pathophysiology of OCD.

1. Introduction

Obsessive-compulsive disorder (OCD) is a relatively common and potentially debilitating neuropsychiatric disorder characterized by recurrent intrusive thoughts, urges or images (obsessions), and/or repetitive behaviors or mental acts (compulsions) (APA, 2013). Although the neurobiological mechanism underlying OCD is not yet fully understood, numerous neuropsychological studies have pointed to likely inhibitory deficits in OCD patients (Bannon, Gonsalvez, Croft, & Boyce, 2002; Lei et al., 2013; Penadés, Catalán, Andrés, Salamero, & Gasto, 2005). Consequently, it has been suggested that an inhibition deficit may be a major contributor to OCD pathophysiology and potentially characterizes an OCD endophenotype (Chamberlain, Blackwell, Fineberg, Robbins, & Sahakian, 2005).

Inhibition encompasses two domains, namely interference control and behavioral (motor) inhibition (van Velzen, Vriend, de Wit, & van den Heuvel, 2014). Interference control refers to the ability to inhibit one's attention from being drawn to irrelevant information (Nigg, 2000). Classical assessments of interference control include Flanker tasks and (classical or emotional) Stroop tasks. Behavioral inhibition involves the regulation of prepotent and automatic responses. Historically, behavioral inhibition has been assessed primarily with Go/No-go tasks and stop-signal tasks (SSTs). OCD patients tend to perform poorly in Stroop tasks, Go/No-go tasks, and SSTs, pointing to characteristic impairments in both domains of inhibition (Kang et al., 2013; Kwon et al., 2003; Penadés et al., 2005; Rao, Arasappa, Reddy, Venkatasubramanian, & Reddy, 2010). How-

* Corresponding author.
E-mail address: xiongzhaozhu@163.com (X. Zhu).

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ever, there have been inconsistencies among some of the findings (Maltby et al., 2005; Moritz et al., 2008). Specifically, Kowalczyk (2006) reviewed a number of neuropsychological studies examining cognitive inhibition function in patients with OCD (mainly negative priming, thought suppression, and directed forgetting domains) and concluded that the results may be not support the hypothesis of general cognitive inhibitory deficits in OCD patients.

It could be that inconsistencies in OCD research findings are due to the heterogeneous nature of OCD, wherein different OCD types may be characterized by differences in inhibition function. One of the most popular ways to deal with the heterogeneity of OCD is to derive symptom dimensions using the factor analytic approach based on responses to Yale-Brown Obsessive Compulsive Scale-Symptom Checklist (Y-BOCS-SC). For example, Mataix-Cols, Rauch, Manzo, Jenike, and Baer (1999) used a category-based factor analysis in 354 OCD patients and identified five OC symptom dimensions which contained symmetry/ordering, hoarding, contamination/cleaning, aggression/checking and sexual/religious; Katerberg et al. (2010) recently item-level factor analyzed 1224 OCD patients and derived a five-factor model which included taboo, contamination/cleaning, doubts, superstitions/rituals and symmetry/hoarding. As above, due to the use of different methodologies and varying sample sizes, some inconsistencies in the results of factor analysis were existed, though generally more similarities than differences. Previous literatures have revealed that different clinical symptom dimensions presented in OCD patients may be account for their differences in comorbidity patterns (Hasler et al., 2005), treatment responses (Mataix-Cols et al., 1999), genetic underpinnings (Iervolino, Rijsdijk, Cherkas, Fullana, & Mataix-Cols, 2011; Katerberg et al., 2010) and neuroimaging findings (Mataix-Cols et al., 2004). However, regarding to neuropsychological studies, the results were mostly negative (Mataix-Cols, Rosario-Campos, & Leckman, 2005).

Recently, a somewhat different two-group classification model for OCD patients was proposed by Lee and Kwon (2003). These authors proposed that obsessions can be categorized as autogenous or reactive. Autogenous obsessions usually have no clear external triggers, or only a symbolic trigger and they are always perceived as ego-dystonic and aversive. Typical autogenous obsessions include thoughts, images, or impulses that are often about aversive, immoral, aggressive, or sexual contents. Meanwhile, reactive obsessions are triggered by identifiable external stimuli in somewhat realistic, logical, or rational ways. Reactive obsessions include thoughts, concerns, or doubts commonly related to contamination, mistakes, accidents, asymmetry, or loss. Evidence for this two-type classification of obsessions was obtained by a factor-analysis of responses to the Revised Obsessive Intrusion Inventory (ROII), which was developed by Purdon and Clark (1993, 1994) and designed to focus on the obsessive, intrusive thoughts, images and impulses (obsessions). Lee and Kwon (2003) confirmed the two-factor structure of ROII corresponding to autogenous and reactive obsession, and this structure was also replicated by Belloch, Morillo, Lucero, Cabedo, and Carrió (2004) Moulding, Kyrios, Doron, and Nedeljkovic (2007) and He, Ewing, Shaw, Wang, and Chasson (2014) in different samples. According to this model, each OCD patient can be further classified into autogenous or reactive obsessions subtypes (AO vs. RO subtype) on the basis of the category of their reported primary and most disturbing obsession (Lee & Kwon, 2003; Lee, Kwon et al., 2005). The autogenous-reactive OCD subtypes classification has been validated and supported by several type of discriminating studies (Belloch, Cabedo, Carrió, & Larsson, 2010; Besiroglu et al., 2011; Lee & Kwon, 2003; Lee, Kwon et al., 2005; Lee, Lee et al., 2005; Lee & Telch, 2010; Subirà et al., 2013).Compared to other existing symptom dimensions models, the autogenous-reactive subtype model was only based on obsessional presentations without regard to the overt behavioral symptoms, which were proposed to be grouped with obsessions together, and it only conceptualized core symptoms of OCD across different domains and thus reduced the problem of multiple (traditional) subtypes in the same individual with OCD (McKay, Abramowitz, & Taylor, 2008). The autogenous-reactive subtype model was also proved to have good temporal stability (Besiroglu et al., 2007).

Moreover, it's interesting that some studies have revealed that AO and RO subtypes of OCD patients may differ in inhibition performances. For example, utilizing a Go/No-go task with a reversal component, which referred to that previously learned go and no-go stimulus were presented in reversed roles, and was sensitive to assessment of inhibition of previous distracter information), Lee, Yost, and Telch (2009) found longer response delays between the standard and reversed stimulus sets in autogenous-type patients as compared to reactive-type and healthy control groups (HCs), which indicated poor inhibition processing of irrelevant distracters in AOs. Additionally, using a latent inhibition task, Lee and Telch (2010) found that an autogenous group failed to display latent inhibition (LI) effect, whereas reactive and control groups did. LI effect was defined as the delay of learning to a stimulus that was previously presented as a distracter as compared with learning to a novel stimulus (Lubow & Gewirtz, 1995). Therefore LI was also primary an index of attentional inhibitory processing deficits. Hence, both of these studies suggest that inhibition deficits may be a selective characteristic of autogenous OCD patients and heterogeneity among OCD cases, such as AO and RO types can probably help us to identify the inconsistence among inhibition in OCD patients. However, this distinction was not replicated by Aydin, Koybasi, Sert, Mete, and Oyekcin (2014), who found similarly impaired inference inhibition performance in AOs and ROs when performing a Stroop task.

The inconsistent findings may be due, at least in part, to sample limitations. The prior studies were conducted with undergraduate student populations, not clinical samples (Lee & Telch, 2010; Lee et al., 2009), and the study by Aydin et al. (2014) had a small sample size (30 reactive patients, 14 autogenous patients). Besides, the abovementioned studies have other limitations. First, the study designs may not have been well-suited to elucidating behavioral inhibition in OCD. The Go/No-go task used in Lee et al's (2009) study had been modified such that the Go stimulus probability was 50% (rather than the standard 75%). The resultant 1:1 ratio may have rendered the task too easy, and thus be insensitive to potential group differences. Second, since the aforementioned studies were reaction time (RT) studies, the cerebral mechanisms underlying the putative interference control and behavioral inhibition dysfunctions of autogenous and reactive OCD patients have not been explored. In this regard, event-related potential (ERP) electrophysiology is a useful tool for probing real-time aspects of cognitive processes because it reflects discrete changes in brain activity (Friedman, 2000). In light of these limitations, further studies which conduct in larger clinical samples and use more classical paradigms and more sensitive measures, are needed to clarify whether and how AO and RO OCD patients differ in both the interference and behavioral inhibition functions.

Emotional Stroop task (EST) is a widely used instrument for assessment of interference inhibition. In this task, participants are presented with emotional words (negative, positive and neutral words) in different colored fonts. They are instructed to ignore word meanings and respond to the text color as soon as possible. As the processing of word meaning is somewhat automatic and habitual, the EST then actually accesses the extent to which persons can inhibit the automatic processing of emotional word meanings. Compared with the classical Stroop task, the EST can further illustrate the attentional biases of emotional salience as emotional words were used in this paradigm. Attentional biases