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The Examination of Inhibition in Obsessive Compulsive Disorder

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Abstract

Obsessive compulsive disorder (OCD) is characterized by intrusive, anxiety-provoking obsessions and irresistible compulsions that are performed to relieve anxiety. It is theorized that a deficit in inhibition may play a role in obsessive-compulsive symptomology. Areas of cognitive functioning that are affected by inhibition deficits may lead to obsessions and intrusive thoughts, while behavioral inhibition deficits may lead to compulsions. In the current paper, inhibition is examined in individuals with OCD, how such a deficit affects attention, recall, and response control, and how this relates to the disorder's symptoms. A better understanding of these relationships would help conceptualize core deficits in affected individuals and an understanding for treatments that target inhibitory deficits.

Keywords: Inhibition, Obsessive compulsive disorder, OCD, attention, recall, response inhibition, cognitive inhibition

The Examination of Inhibition in Obsessive Compulsive Disorder

Obsessive compulsive disorder (OCD) is a debilitating anxiety disorder in which a person is plagued with intrusive anxiety-provoking obsessions and irresistible compulsions that are performed to relieve the anxiety. The disorder can significantly impair daily functioning and cause individuals with severe OCD to spend most of their waking hours engaged in their obsessions and compulsions. Lifetime prevalence is estimated at 2.3% and it is considered to be one of the most disabling psychiatric conditions in the developed world (Kalanthoff, Avnit, Aslan, & Henik, 2014; Pinto, Mancebo, Eisen, Pagano, & Rasmussen, 2006). While there may be similar symptomatic characteristics between individuals whose OCD falls within a specific subgroup, obsessions and compulsions are unique and vary from person to person. Pinto et al. (2006) report that after initial onset, individuals with OCD tend to live with the disorder for more than 17 years before receiving treatment and many also have comorbid disorders such as major depressive disorder, social phobia, generalized anxiety disorder, substance abuse, panic disorder, or specific phobia.

In the effort to better understand OCD, researchers have examined how the brain of individuals with OCD might differ from other populations. One key area is inhibition. Inhibition is constantly occurring and allows our brains to rapidly analyze incoming information to determine which stimuli are relevant from those that are irrelevant (Enright & Beech, 1993b). In this way, relevant stimuli are processed and brought into conscious attention while irrelevant stimuli are suppressed. This optimizes functioning and occurs so rapidly that individuals are not consciously aware of the process. Inhibition prevents the expenditure of mental energy on irrelevant stimuli making it vital for efficient mental functioning (Bohne, Keuthen, Caffier, & Wilhelm, 2005).

It is theorized that in OCD there may be a global deficit in the ability to inhibit the processing of various stimuli. A deficit in inhibition would lead to irrelevant internal and external stimuli to be processed as relevant (Cohen, Lachenmeyer, & Springer, 2003; Kalanthroff et al., 2014; Kaplan et al., 2005). This not only depletes attention, but also allows for unrealistic thoughts to be processed as real threats. In this way, a deficit in inhibition may account for the frequent unwanted and intrusive thoughts that characterize obsessive-compulsive symptomology (Enright & Beech, 1993b). A deficit in inhibition would also affect the ability to efficiently perform cognitive tasks (Cohen et al., 2003; Kalanthroff et al., 2014; Kaplan et al., 2005). To assess inhibition capabilities, researchers look at key areas of executive functioning including attention, recall, and response control. A difference in these areas between control and OCD groups could indicate a decrement in inhibition. Understanding the role of inhibition in OCD would allow researchers and practitioners to better conceptualize the obsessive-compulsive brain and how to treat it. In the present paper, the relationship between inhibition and OCD is explored by analyzing current research that focuses on these areas of executive functioning and what they suggest about inhibitory capabilities in OCD.

Evidence of Inhibition Deficits in OCD

Negative Priming: A Measurement of Inhibition Through Selective Attention

Many recent papers build on studies from the 1990s that explored cognitive inhibition (Enright & Beech, 1993a, 1993b; Enright, Beech, & Claridge, 1995). In one of these studies, Enright and Beech (1993b) explored negative priming in OCD as a function of attention. Negative priming is when a distractor from previous trials becomes the target in subsequent trials. In a negative priming task, the brain is required to inhibit past responses and quickly shift attention to something that was previously irrelevant and ignored. Successful performance of this

task should indicate effective cognitive inhibition. Enright and Beech (1993b) created a study examining the effect of negative priming in OCD and several other experimental groups. A negative priming effect examines how a participant's response time is effected by the priming phase of the study when compared to their response time in the test phase of the study. The OCD group exhibited the lowest negative priming effect, which was interpreted as evidence of a deficit in cognitive inhibition (Enright & Beech, 1993b). However, these findings have since been supplanted by more recent research that suggests individuals with OCD tend to experience a high negative priming effect, or even none at all (Clayton, Richards, & Edwards, 1999; Kaplan et al., 2006; Moritz, Kloss, & Jelinek, 2010).

This new direction is exemplified in a study by Kaplan et al. (2005), which found that participants with OCD actually experienced a large increase in response time, in comparison to healthy controls, when switching from the priming phase to the test phase. Error rate also increased for the OCD group. This directly contradicts the findings of Enright and Beech (1993b), and suggests individuals with OCD experience an increase in response time and a decrease in accuracy during priming tasks. A high negative priming effect, would mean that in the test phase of the study, the participant took more time to respond than in the priming phase. A low priming effect would mean the individual took less time to respond in the test phase than in the priming phase. Rather than finding a low effect as Enright and Beech (1993b) did, Kaplan et al. (2005) found a high effect, which more accurately reflects a deficit in the ability to inhibit. This makes sense since when compared to other anxiety disorders and control groups, individuals with OCD exhibit more difficulty switching tasks, experience significant impairment on tasks requiring selective attention, and experience slowed reaction time on priming tasks (Clayton et al., 1999; F.D. Geus, Denys, Sitskoorn, & Westernberg, 2007; Kaplan et al., 2006;

Moritz et al., 2010). Difficulty in these areas suggests a deficit in the ability to inhibit. This would be expected to result in a high negative priming effect, or an increase in response time, rather than a low effect, since a low effect would suggest facilitation, not a deficit. This aligns with recent studies that have found an increase in the time needed to respond on tasks that involve switching attention rather than a decrease.

It has been theorized that Enright and Beech (1993b) found a low negative priming effect, or decrease in response time, because there was a flaw in their methodology. Moritz, Kloss, & Jelinek (2010) argue that the method of priming used by Enright and Beech (1993b) actually made the task easier for participants who experienced a slower response time due to greater difficulty switching their attention from what was previously a target. Since the task was made easier for this population, they exhibited a reduced reaction time. This all arose from Enright and Beech's (1993b) utilization of a masked paradigm to measure the effect of negative priming. In this masked design, the target is presented for 100msec and then is immediately followed by different image called a pattern mask. This method makes primes hard to see since the presentation time is short and a new image is then presented. To prove this effect, a study was designed that employed short but unmasked and sufficiently visible primes, as opposed to masked and shortly presented primes (Moritz et al., 2010). In this design, the target is presented for a longer time and not replaced by a pattern mask. As predicted, a high negative priming effect occurred in the OCD group due to a delayed ability to switch attention. This suggests an inhibition deficit. These findings also contradict Enright and Beech's (1993b) position that a deficit in automatic processing was present in the OCD group, indicating a deficit in inhibition. It is theorized that the short prime presentation used by Enright and Beech (1993b) did not test automatic processing (the processing of information on a subconscious level) since automatic

processing occurs during a response-to-stimulus interval target lower than what was used. Their masked paradigm might not allow for individuals with slower responsiveness to fully perceive the prime. This, rather than a deficit in automatic processing, led to a reduced negative priming effect (Clayton et al., 1999).

Evidence of Cognitive Inhibition and its Uniqueness to OCD

While there appears to be a difference in the ability to inhibit between OCD and control groups, a difference may also exist between OCD and other anxiety groups. A study conducted by Clayton, Richards, and Edwards (1999) examined selective attention in OCD compared to other anxiety disorders and controls. When patients were given a series of tests that provides researchers with scores sensitive to selective attention, sustained attention, attention switching, and divided attention, there appeared to be a deficit in attention capabilities in those with OCD (Clayton et al., 1999). Individuals with OCD experienced an increased difficulty with switching tasks and sustained attention, suggesting a reduced ability to selectively ignore (Geus et al., 2007). These particular tasks require an individual to switch from one task to another quickly and to be able to stay focused during these tasks. A decrement in the ability to ignore thoughts and stimuli in the environment manifests as slower responses or an increased error rate. If individuals with OCD possess a greater deficit in their ability to inhibit than other anxiety disorders, then it is possible that this contributes to the unique symptoms of the disorder.

These findings seem to suggest that in OCD, there is diminished inhibition in several cognitive processes. Individuals with OCD appear to have a more difficult time than healthy controls or other persons with anxiety disorders in ignoring unimportant stimuli and switching between tasks. This deficit could lead individuals with OCD to experience difficulty sustaining attention and ignoring intrusive thoughts. Even healthy individuals experience intrusive thoughts

but, unlike individuals with OCD, healthy controls can recognize these thoughts as irrational and quickly switch their attention to another task. Conversely, an individual with OCD may fixate on intrusive thoughts and struggle to shift attention to something more rational, functional, or adaptive. As such, a deficit in inhibition may play a unique role in obsessive-compulsive symptomology.

Attention Bias: An Indicator of a Deficit in Inhibition and its Effect on Functioning

Diminished inhibition in OCD has also been explored by looking at how situational anxiety affects selective attention. Situational anxiety refers to anxiety that is brought on when an individual is exposed to anxiety-provoking stimuli. Individuals with OCD may be hyper aware of potential threats and express a bias for threats related to OCD obsessions. Therefore, individuals with OCD may be more prone to and affected by situational anxiety (Cohen et al., 2003). With this in mind, one study examined how participants performed on tasks after being exposed to paragraphs with realistic threat cues (Cohen et al., 2003). This explores the affect anxiety levels have on future task performance in individuals with and without OCD. This was examined by having participants read neutral or anxiety-provoking paragraphs and then complete the Stroop Reading Task and the Stroop Color-Word Task. The Stroop Reading Task (SRT) has participants read the name of color words printed in black ink (Cohen et al., 2003). Contrasting this, the Stroop-Color Word Task (SCWT) requires participants to read color words that are printed in a different color ink than that of the word (The word “red” printed in blue ink). The SRT demands little selective attention, while the SCWT demands a lot. Results showed the OCD group performed slower than the control group even in the absence of situational anxiety, but there was no difference in error rate. When subjected to situational anxiety, the OCD group again performed significantly slower, but also made more errors than the control group (Cohen et al.,

2003). This suggests that individuals with OCD have less ability to ignore fear-provoking stimuli than non-OCD individuals. It also suggests that individuals with OCD perform cognitive tasks slower when not experiencing situational anxiety, which may reflect a tendency towards excessive caution (Cohen et al., 2003). These results suggest that anxiety alters how much attention is needed to perform accurately. Inhibition may be impaired on a subconscious level and deteriorate in the presence of situational anxiety.

A deficit in selective attention has also been found in individuals with OCD in relation to recall. If information is recognized as irrelevant and the individual deliberately suppresses it, then it is called intentional inhibition. Intentional inhibition is key to tasks involving recall. Research shows that individuals with OCD experience a diminished ability to intentionally ignore emotionally important stimuli. A study by Bohne, Keuthen, Caffier, and Wilhelm (2005) found that in OCD there appears to be deficit in the ability to disregard thoughts after they have reached conscious awareness. This seems to be especially true when the thoughts are emotionally relevant to their core OCD fears. The study found that individuals with OCD, in contrast to those with trichotillomania (TTM) and healthy controls, are more likely to remember negative words irrespective of their relevance to directions. Individuals with OCD also exhibited greater recall of negative words than neutral words in general (Bohne et al., 2005). These results suggest a deficit in cognitive inhibition— specifically intentional and recall inhibition. This supports the likelihood that emotional bias affects cognition leading to inhibitory deficits and the inability to ignore stimuli with emotional importance to the individual. This could also suggest why individuals with OCD experience a higher frequency of intrusive thoughts than healthy individuals, since there seems to be a deficit in the ability to suppress them once they have reached conscious awareness.

Response Inhibition in OCD: A Function of Obsessions and Compulsions

In addition to deficits in cognitive inhibition, response inhibition is another area of interest in OCD. Response inhibition is the ability of an individual to resist automatic behaviors, in favor of a targeted response. This allows for more functional behaviors. It has been shown, through the use of tasks that target response inhibition, that individuals with OCD have less success inhibiting more automatic responses, exhibit slower reaction times, and make more errors than healthy controls (Bannon, Gonsalvez, Croft, & Boyce, 2002; Linden, Ceschi, Zermatten, Dunker, & Perroud, 2005; Pendés et al., 2007). These findings suggest a deficit in inhibition, specifically in regards to automatic responses. Response inhibition, a specific type of executive functioning, is necessary for switching tasks and coping with novelty since the individual is required to suppression past responses in favor of new ones (Clayton et al., 1999; Geus et al., 2007; Kaplan et al., 2006; Moritz et al., 2010). This deficit may lead to difficulty inhibiting automatic cognitive schemas, the thought patterns that make up the disorder's obsessive symptomology. Subsequently, these schemas become integrated into consciousness and thought processes (Linden et al., 2005).

Response inhibition might also play a role in obsessions and compulsions. When performing cognitive tasks that require response inhibition, OCD groups made more errors than healthy controls and social phobia groups. This suggests that diminished response inhibition is unique to OCD (Bannon et al., 2002; Linden et al., 2005). An impairment in this ability is also strongly correlated with clinical symptoms, such that individuals with more severe OCD made more errors (Bannon et al., 2002; Pendés et al., 2007). In addition, studies examining response inhibition in OCD have found an overall deficit in the ability to inhibit automatic response in favor of ones that are less natural. This was correlated with the presence of compulsions (Linden

et al., 2005). These findings strongly suggest that in OCD there is an impairment of inhibition in both behavioral and cognitive domains, with poor cognitive inhibition associated with obsessions and intrusive thoughts, and poor behavioral inhibition associated with compulsions (Bannon et al., 2002).

Response inhibition is important for understanding OCD and how its symptomatic thoughts, emotions, and behaviors interact. Unlike healthy controls, individuals with OCD exhibit a deficit in the ability to distinguish irrelevant from relevant thoughts. Because unimportant or illogical thoughts more readily come into consciousness, the individual experiences an emotional response to the thought, which then leads to a behavior that relieves the emotion. Through negative reinforcement such behavior can be strengthened into a compulsion, and the precipitating intrusive thought may increasingly be viewed as a true threat. If poor cognitive inhibition is already present, then individuals with OCD are appraising potentially irrelevant thoughts as important every time they engage in a compulsion. Over time the combination of intrusive thoughts being appraised as important and the individual failing to resist the urge to engage in a compulsion makes the OCD more severe and debilitating. By understanding this cycle, it can be seen how diminished inhibition plays an important role in the maintenance of obsessive-compulsive symptomology.

Discussion

A deficit of inhibition in OCD, as suggested by the findings presented, likely accounts for many of its symptoms. Diminished cognitive inhibition is associated with obsessions, a strong attention bias to possible threat, and the inability to resist automatic schemas. Based on reaction times in tasks measuring inhibitory processes, the ability to inhibit appears to be compromised. It therefore seems reasonable that irrelevant information is not inhibited on an automatic or

subconscious level, allowing it into conscious awareness. Once the irrelevant information becomes conscious, the individual struggles to disregard it. In contrast to healthy individuals who can successfully disregard intrusive thoughts, individuals with OCD show greater difficulty doing so, which could explain the symptomology of obsessions. Paralleling this, a deficit in behavioral inhibition is predictive of compulsions. It is believed that obsessions and compulsions reinforce each other to create a perpetually vicious cycle (Kalanthroff et al., 2014). By gaining a better understanding of this relationship, researchers and clinicians can potentially develop more effective ways to treat OCD. If the interaction of thoughts, emotions, and behaviors in OCD is affected by deficits in inhibition, then effectively targeting a part of this interaction could break the cycle. One cannot control their thoughts or their emotions, but they can control their behaviors. Exposure and Response Prevention Therapy (ERP) is a form of therapy that is thought to be particularly successful for OCD, likely because it targets the more accessible behavioral components of the disorder. The treatment works from the outside in to correct inhibitory deficits. It is thought that by changing one's behaviors— by inhibiting compulsive behavior— one can slowly change one's thoughts, which then change feelings. While ERP is challenging in that it requires exposure to an anxiety provoking stimulus along with resisting escape or performing a compulsion, it is successful when correctly implemented. Despite research that indicated impairments in OCD are global, ERP could be a key step towards retraining how the individual interacts with both their external and internal environments by teaching inhibition on a conscious level. Therefore, it is important to further explore what effects OCD treatments have on inhibitory capabilities. In addition, teaching individuals with OCD compensative strategies that increase task-switching, multi-tasking, and selective attention skills could also strengthen

inhibition in functional ways, such that deficits of inhibition might be better viewed as challenges to be overcome than as traits that are unchangeable.

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