Symptom-specific attentional bias to threatening stimuli in obsessive-compulsive disorder

Mara Sizino da Victoriaa, Antonio Leandro Nascimentoa, Leonardo F. Fontenellea, b, c, *

a Anxiety and Depression Research Program, Institute of Psychiatry, Universidade Federal do Rio de Janeiro, CEP: 22290-140, Brazil
b Department of Psychiatry and Mental Health, Institute of Community Health, Universidade Federal Fluminense, CEP: 24033-900, Brazil
c D’Or Institute for Research and Education, Rio de Janeiro, CEP: 22281-100, Brazil

Abstract

Objective: There is mixed evidence as to whether patients with obsessive-compulsive disorder (OCD) have excessive attentional engagement and emotional response to OCD-related stimuli in the environment. Here we investigate the occurrence of an attentional bias toward specific OCD-related stimuli and its relationship with obsessive-compulsive symptom dimensions.

Methods: Forty-eight patients with OCD participated in an attentional bias task containing OCD- and non-OCD-related stimuli and had their performance compared with that of 24 age-, sex-, and education-matched healthy control subjects. Severity of obsessive-compulsive and comorbid depressive symptoms was assessed using the Obsessive-Compulsive Inventory Revised and the Beck Depression Inventory, respectively.

Results: Although there were significant and almost significant group effects on the reaction time (RT) toward OCD- and non-OCD-related figures, respectively, no difference between patients with OCD and controls was noted with regard to RT toward OCD-related figures minus RT toward non-OCD-related figures. Nevertheless, within the OCD group, partial correlational analysis controlled for age and severity of depression unveiled positive correlations between (1) obsessional symptoms and RT toward checking-related pictures and (2) ordering symptoms and RT toward ordering-related pictures.

Conclusions: The positive correlations between RT to content-specific stimuli and the severity of corresponding obsessive-compulsive symptoms suggest that patients with OCD experience difficulty in disengaging attention from personally salient stimuli.

© 2011 Elsevier Inc. All rights reserved.

1. Introduction

An attentional bias refers to increased allocation of attentional resources toward threatening as compared with neutral stimuli [1]. Attentional biases have been consistently found in most anxiety disorders, including generalized anxiety disorder [2,3], social phobia [4,5], posttraumatic stress disorder [6,7], specific phobias [8,9], and panic disorder [10,11]. In contrast, evidence supporting the occurrence of an attentional bias in OCD is more mixed, that is, although some studies have found such a bias [12-14], most have failed to find processing differences for emotional material [15-18]. The ambiguity about existence of attentional biases in OCD is unfortunate because the identification of an attentional bias in OCD has potential diagnostic [19], cognitive [20], pathophysiologic [21,22], and therapeutic implications [23].

There are a number of potential reasons for the heterogeneity of findings regarding attentional bias in OCD. First, as a multidimensional disorder, OCD is associated with different symptoms (eg, obsessions/checking, washing, symmetry, and hoarding) that may need quite specific stimuli to reveal an attentional bias. Unfortunately, research on the topic has been plagued either by very unspecific or poorly validated stimuli used in heterogeneous samples or by specific stimuli in categorically defined subtypes. Second, several studies have used isolated verbal stimuli (ie, words), which have been shown not to sufficiently grab attention of patients with OCD. Third, a range of different tasks aimed at assessing attentional bias has been used by different studies (emotional stroop, inhibition of return, or dot probe), some of which (emotional stroop) are unable to identify types of attentional bias. Finally, a number of studies have neglected the role of...
comorbid depressive symptoms in OCD, which could explain either increased [24] or decreased [25] attentional bias toward threatening words.

Attentional biases toward threat may be composed of attentional facilitation or difficulty disengaging attention away from threat [1]. Briefly, attentional facilitation refers to the relative promptness or easiness with which attention is drawn to a threatening stimulus, whereas difficulty in disengaging refers to the degree to which a threatening stimulus captures attention and impairs switching attention from the threat to another stimulus [1]. Because it has been suggested that different components of attentional bias are mediated by different brain systems [26], research on this issue might contribute to build pathophysiologic models of OCD. To the best of our knowledge, only 2 studies used tests that were able to identify these forms of attentional bias in OCD [13,14], both of which revealed evidence for delayed disengagement from OCD-related stimuli, that is, patients with OCD responded significantly slower to targets that were preceded by an OCD-relevant cue. Interestingly, there is evidence suggesting that attentional biases attenuate after successive exposures to idiosyncratically selected threatening words in individuals with subclinical OCD symptoms [27].

In the present study, we investigated whether patients with OCD have an attentional bias toward OCD-specific stimuli. To do so, we developed a task that allowed 2 different aspects of attentional bias to be detected, namely, facilitated detection and difficult dismissal. Novel approaches adopted in this study included an assessment of the severity of different OCD symptom dimensions and the use of a short task that included few presentations of OCD-related figures, thus avoiding habituation [28]. Using these strategies, we intended to evaluate whether existing attentional biases are (1) related to specific obsessive-compulsive symptom dimensions and (2) detectable with exposure to minimal, but carefully selected, visual stimuli. Of note, each one of the OCD-related figures was thought to capture the core aspects of a given dimension.

Because previous studies have reported difficulties in disengaging attention from threat in OCD [13,14], we predicted that, compared with healthy controls, patients with OCD would exhibit longer reaction time (RT) toward OCD-related stimuli and similar RT toward neutral stimuli. We further predicted that the severity of obsessive-compulsive symptoms in a given dimension (eg, washing) would correlate positively with RT toward stimuli representing that same dimension (eg, picture of feces).

2. Methods

2.1. Patients and controls

Fifty-one consecutive patients with OCD who sought treatment at Anxiety and Depression Research Program of the Institute of Psychiatry of the Federal University of Rio de Janeiro were selected according to the following inclusion criteria: (1) having Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV) OCD (a) as diagnosed by the Structured Clinical Interview for DSM-IV Axis I disorders and (b) as the primary psychiatric diagnosis (ie, the one exhibiting the earliest onset and the greatest severity), as reported by the attending physicians; (2) displaying at least high school education; and (3) being between 18 and 65 years old. All patients were under treatment with a serotonin reuptake inhibitor. Three patients who exhibited some degree of intellectual impairment according to their attending physicians were preliminarily excluded from this research protocol. Twenty-four healthy age-, sex-, and education-matched subjects were selected from individuals from the hospital’s administrative staff to serve as controls. The local institutional review board approved the study. All volunteers provided their written consent after a complete explanation about the procedures involved in the research protocol was given.

2.2. Measures

Patients had their severity of obsessive-compulsive and depressive symptoms assessed by means of the Brazilian Portuguese version of the Obsessive-Compulsive Inventory–Revised (OCI-R) [29] and the Beck Depression Inventory (BDI) [30], respectively. The OCI-R is a self-administered Likert scale that contains 18 items and evaluates the severity of a series of obsessive-compulsive symptoms, including checking, obsession, ordering, hoarding, washing, and neutralizing. It generates a total score and the corresponding 6 specific subscores. The maximum score on the OCI-R is 72, with 21 reflecting clinically significant levels of symptoms. Conversely, the BDI evaluates the severity of depression using 21 items, each consisting of 4 statements describing increasing intensities of symptoms of depression. Items of BDI are rated on a scale from 0 to 3, reflecting how participants have felt over the past week. The maximum score for BDI is 63, with scores above 19 reflecting at least moderate levels of depression.

2.3. Attentional bias task

A computerized content-related RT task composed of 2 sessions, each with 3 presentations of 8 different stimuli, was administered. Stimuli were presented on a PC laptop with a graphic resolution of 750 × 500. Participants viewed the monitor from a distance of approximately 60 cm. The initial display contained 1 image (cue stimuli) on a black background at the lower half of the screen and 2 boxes containing the words neutral or nervous at the upper half of the screen, one on the left and the other on the right side. Cue stimuli were presented randomly, according the number of times set for each session.

Before each session, participants were instructed to associate the cue stimuli (OCD-related or non–OCD-related figures) to the words nervous or neutral, on the upper half of the monitor, as fast as they could. They were taught to press
the letter “e” when they thought that the cue stimuli was associated with the word on the left upper side of the monitor and the letter “i” when they thought that the cue stimuli was associated with the word on the right upper side of the monitor. On the first session, the word neutral was presented on the left upper side and the word nervous on the right upper side. The location of the words was reversed on the second session. Answers were considered correct when OCD-related pictures were matched with the word nervous and non–OCD-related (ie, geometric) figures were matched with the word neutral. The software provided feedback after a wrong answer and recorded the period between the stimulus exhibition and the moment that subjects pressed letters “e” or “i” in milliseconds. The first part of the attentional bias task was considered a training session. Only the data from second session were considered for the final analysis.

The ability of the task to identify differences between early detection and delayed dismissal lied on RT being lower or higher than those exhibited by healthy controls (respectively) and on the direction of the correlations (negative, absent, or positive) between RT to different figures and severity of OCD symptoms. Because RT was measured on a unidimensional level, that is, low or high, we were unable to identify if circumstances where both early detection (low RTs) and delayed dismissal (higher RTs) were present at the same time.

2.4. Cue stimuli

Eight stimulus pictures were compiled, representing 2 groups of stimulus classes: 4 OCD-related and 4 non–OCD-related (neutral geometric figures) stimuli. Each OCD-related stimuli illustrated a particular OCD symptom dimension according to factor-analytic studies [31,32]. Neutral geometric figures included a hexagon, a rhombus, a square, and a rectangle, each one with its own name written below.

The final set of OCD-related pictures was developed and chosen by consensus among clinical experts to reflect typical OCD dimensions [31,32]. Although the chosen checking-, ordering-, and hoarding-related pictures were previously rated by patients with OCD as significantly more aversive and/or impacting than by controls [28], the washing-related picture represented an improvement of a picture that was not otherwise visible. For instance, we used the word lost below the picture of several bills to better represent hoarding, and not ordering.

2.5. Statistical analysis

Attentional bias was assessed using 3 different comparisons. First, separate repeated-measures analyses of variance were performed, with RT toward OCD-related pictures and non–OCD-related pictures as the within-subject variables (with 4 levels each), group (OCD vs healthy controls) as between-factor variables, and age and education as covariates. To do so, log 10 transformations were performed, and data were normalized because results from the attentional bias task showed not to be normal, according to Shapiro-Wilk test. Second, to control for general slowness, we compared patients with OCD and healthy controls regarding mean log-transformed RT toward OCD-related figures minus mean log-transformed RT toward neutral figures using Student t test. Finally, we assessed the Spearman correlations between RT toward OCD-stimuli and severity of each OCD (OCI-R) dimension among patients with OCD, controlling for age and levels of depression (BDI).

3. Results

3.1. The OCD-related pictures attentional bias task

In regard to OCD-related pictures, Mauchly test indicated that the assumption of sphericity was not violated (χ² = 6.7, P = .24). On the tests of within-subject effects, interactions of RT toward OCD-related pictures with age (F [3.0–66.0] = 0.92, P = .43) and education (F [3.0–66.0] = 0.80, P = .49)

| Table 1 | Comparison of sociodemographic and RTs between patients with OCD and healthy controls |
|-----------------|---------------------------------|-----------------|-----------------|
|                | Patients with OCD (n = 48) | Healthy controls (n = 24) | P       |
| Sociodemographic features |                      |                      |       |
| % Female | 52.9 | 49.5 | .44 |
| Age (y), mean (SD) | 37.78 (12.75) | 37.81 (9.63) | .83 |
| Education, mean (SD) | 11.96 (2.47) | 11.67 (2.54) | .65 |
| Attentional bias task RTs (ms) | Mean (SD) | Mean (SD) | Student t test using base 10 logarithm transformation |
| OCD-related stimuli |                      |                      |       |
| Checking picture | 867.0 (480.7) | 754.9 (270.7) | 0.33 |
| Ordering picture | 901.5 (380.0) | 796.9 (334.7) | 0.20 |
| Hoarding picture | 1003.6 (491.4) | 712.8 (215.1) | 0.002 |
| Washing picture | 963.7 (461.9) | 912.0 (503.4) | 0.53 |
| Non–OCD-related stimuli |                      |                      |       |
| Hexagon picture | 921.9 (531.1) | 739.8 (229.6) | 0.14 |
| Rhombus picture | 1001.85 (541.2) | 786.8 (165.9) | 0.11 |
| Square picture | 911.9 (465.0) | 742.5 (221.8) | 0.12 |
| Rectangle picture | 923.2 (424.5) | 814.5 (366.9) | 0.30 |

were not significant. On the tests of between-subject effects, age (F [1.0-68] = 1.25, P = .26) and education (F [1.0-68.0] = 0.71, P = .79) were not significant as well. However, there was a clear group effect on the RT toward OCD-related figures (F [1.0-68.0] = 4.89, P = .03), with patients with OCD showing increased RT (see Table 1). Simple comparisons of RT toward specific stimuli showed that, compared with healthy controls, patients with OCD displayed increased RT toward the hoarding-related picture (t = 3.30, P = .002).

3.2. Neutral pictures attentional bias task

Using the neutral pictures data, Mauchly test indicated that the assumption of sphericity was not violated (χ² = 2.8, P = .72). Here, the tests of within-subject effects showed that there was no significant interaction of RT toward neutral (ie, non-OCD-related) pictures with age (F [3.0-66-66.0] = 0.62, P = .60) and education (F [3.0-66-66.0] = 0.67, P = .57). On the tests of between-subject effects, although education (F [1.0-68.0] = 0.59, P = .44) and group (F [1.0-68.0] = 3.57, P = .06) were not significant, age (F [1.0-68.0] = 5.26, P = .02) was significant.

3.3. Differences between mean log-transformed RT toward OCD-related figures and neutral figures

To control for baseline general slowness, we compared patients with OCD and healthy controls regarding mean log-transformed RT toward OCD-related pictures minus mean log-transformed RT toward neutral pictures. No significant difference between the groups was found (t = −0.14, P = .88), thus suggesting that the former group effect could simply reflect general slowness among the group of patients with OCD.

3.4. Correlations between OCD-related pictures attentional bias task and OCD symptoms

Within the OCD group, the correlation analyses between severity of different dimensions and RT toward different OCD-related stimuli generated some significant results (Table 2), that is, (1) severity of obsessional and checking symptoms correlated positively with the RT toward the checking-related picture (0.38 and 0.30, respectively) and (2) severity of ordering symptoms correlated positively with RT toward ordering-related pictures (0.36). However, after controlling for current age and the severity of concurrent depressive symptoms, only correlations between severity of obsessions and RT toward the checking-related picture and between severity of ordering and RT toward ordering-related picture remained significant (0.40 and 0.32, respectively).

4. Discussion

In this study, although we found that patients with OCD, as compared with healthy controls, displayed greater RT toward OCD-related pictures, they also exhibited a trend for showing great RT toward neutral pictures. Furthermore, no significant difference between patients with OCD and controls was found when general slowness was taken into account, that is, the groups did not differ in terms of mean RT toward OCD-related pictures minus mean RT toward neutral pictures. Although a superficial examination of our findings suggests that no attentional bias exists in OCD, significant findings emerged when correlation analyses were restricted to patients with OCD. Consistently, (1) the severity of obsessional symptoms correlated positively with RT toward the checking-related picture (opened door) and (2) the severity of ordering symptoms correlated positively with RT toward the ordering-related picture (disorganized shoes). Of note, these latter results were independent from age and severity of depression, which are known to affect RT.

We believe that the positive correlations between RT to some content-specific stimuli and severity of corresponding obsessive-compulsive symptoms are consistent with the presence of a series of specific attentional bias in OCD, that is, difficulty in disengaging attention to personally salient stimuli. In other words, although patients with OCD do not seem to spot specific OCD-related stimuli more easily, they might be alarmed and unable to redirect attention once they spot OCD personally significant stimuli, thus slowing their RT. These findings dovetail with results from previous studies reporting dysfunctional attentional disengagement in OCD using an emotional variant of the inhibition of return paradigm and a spatial cueing task. They also add to the literature by showing that attentional bias in OCD might be also content-specific rather than just global, as previously suggested by Moritz et al. Lastly, they are broadly coherent with current cognitive models of OCD suggesting that negative interpretation of intrusive cognitions results in anxiety and counter-productive strategies that impair the individuals’ ability to attend to competing stimuli.

Table 2

<table>
<thead>
<tr>
<th>OCI-R checking</th>
<th>OCI-R obsession</th>
<th>OCI-R ordering</th>
<th>OCI-R hoarding</th>
<th>OCI-R washing</th>
<th>OCI-R neutralization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Checking picture</td>
<td>0.30*</td>
<td>0.38**</td>
<td>0.14</td>
<td>0.12</td>
<td>0.15</td>
</tr>
<tr>
<td>Ordering picture</td>
<td>0.07</td>
<td>0.16</td>
<td>0.36**</td>
<td>0.16</td>
<td>0.02</td>
</tr>
<tr>
<td>Hoarding picture</td>
<td>0.05</td>
<td>0.23</td>
<td>0.04</td>
<td>0.07</td>
<td>0.25</td>
</tr>
<tr>
<td>Washing picture</td>
<td>–0.02</td>
<td>–0.15</td>
<td>0.11</td>
<td>–0.02</td>
<td>–0.13</td>
</tr>
</tbody>
</table>

* P < .05.
** P < .01.
in the environment, skewing attention and keeping up OCD’s negative beliefs [34].

There are at least 2 explanations for the difficulty patients with OCD may exhibit while disengaging attention from threat (as suggested by Cisler and Olatunji [14]). First, it could reflect poor inhibitory control, a hypothesis that is consistent with theories positing that frontoparietal dys-function is an important feature of OCD [35]. Second, it could result from purposeful or strategic maintenance of attention onto threat because of exaggerated appraisals of the stimuli as harmful or dangerous. These theoretical distinctions have treatment implications. For example, while antidepressants may modulate inhibitory control abilities [36], training patients to disengage attention from threat stimuli using a modified version of the dot-probe task (which includes a greater number of targets at the location of the intended modified bias, thus inducing an implicitly learned bias away from the threatening stimuli) has been found to be an efficacious treatment for non-OCD anxiety disorders [23].

Although some of our findings dovetail with our initial predictions, we were unable to find correlations between the severity of washing and hoarding symptoms with the RT toward their corresponding pictures. Although this lack of correlations may signify absent attentional bias related to these OCD dimensions, it may also reflect problems associated with our OCD-related stimuli. In fact, our washing picture may be excessively “disgusting” to differentiate individuals with different severities of washing symptoms (as previously suggested by Moritz et al [13]). In addition, we feel that our hoarding-related picture might not have been able to grab the attentional bias of OCD hoarders because they might feel specifically distressed by the idea of losing personal belongings and not just items lacking a personal element [37], such as the ones shown in our computer screen.

Admittedly, our study has additional drawbacks. First, each dimension (checking, ordering, hoarding, and contamination) was portrayed by just 1 picture, which was presented 3 times along the test. Although both a larger picture set and more trials would enhance the statistical power of our study, it is also interesting to note that the adopted strategy was able to unveil significant correlations between OCD symptom dimensions and specific RTs. Second, although one could argue that the RT of patients with OCD might be increased by the use of serotonin reuptake inhibitors and other drugs, we believe that medication use could not explain the specificity of correlations reported in our study. Third, because RT was measured on a unidimensional time level, we were unable to identify circumstances where both prompt detection (low RTs) and dysfunctional dismissal (higher RTs) were present simultaneously. Finally, some authors suggest that decreased RT is a heterogeneous phenomenon that can indicate not only dysfunctional attentional disengagement but also attentional avoidance and even motor freezing [1].

Despite these problems, our study also have several advantages over previous ones, including a significant number of clinically heterogeneous patients assessed for the presence and severity of different obsessive-compulsive symptoms, comorbid depression, and a series of OCD-related pictures that were previously validated. They are of special interest in a field that has been characterized by small OCD samples, nonclinical samples, unidimensional assessments of obsessive-compulsive symptoms, and lack of control for the effects of comorbid depressive symptoms.

Acknowledgment

The authors are indebted to Dr Murat Yücel, Dr Luca Cocchi, and Dr Ben J Harrison for their careful review of the manuscript.

References


