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Research report

Extinction retention and fear renewal in a lifetime obsessive–compulsive disorder sample

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HIGHLIGHTS

- Obsessive–compulsive disorder (OCD) may involve impaired fear extinction retention (ER).
- Fear conditioning/extinction and ER was assessed in OCD patients.
- OCD patients, relative to controls, showed impaired ER.
- OCD symptom severity was not correlated with the magnitude of ER.
- There were no differences in fear renewal between OCD patients and controls.

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ABSTRACT

Obsessive–compulsive disorder (OCD), like other illnesses with prominent anxiety, may involve abnormal fear regulation and consolidation of safety memories. Impaired fear extinction memory (extinction recall, ER) has been shown in individuals with current symptoms of OCD [1]. However, contrary to expectations, the only previous study investigating this phenomenon showed a positive correlation between extinction recall abilities and OCD symptomology (i.e., as OCD symptoms worsened, extinction memory improved). The purpose of the current study was to determine if patients with a lifetime diagnosis of OCD (not necessarily currently symptomatic) also demonstrate impairments in extinction memory, and the relationship between OCD symptomology and extinction memory in this type of sample. In addition, we also examined fear renewal, which has never been investigated in an OCD sample. We enrolled 37 patients with OCD, the majority of whom were on serotonin reuptake inhibitors, and 18 healthy control participants in a 2-day paradigm assessing fear conditioning and extinction (Day 1) and extinction retention and renewal (Day 2). Skin conductance responses (SCRs) were the dependent measure. Results, as in the prior study, indicated that the only between-group difference was impaired ER in OCD patients relative to controls. Contrary to our prediction, OCD symptom severity was not correlated with the magnitude of extinction recall. There were no differences in fear renewal between OCD patients and controls.

1. Introduction

Fear conditioning and fear extinction are central to disorders of fear and anxiety [2], including obsessive–compulsive disorder (OCD) – a disorder characterized by the presence of intrusive thoughts and ritualistic compulsions aimed at reducing anxiety or discomfort. From a behavioral perspective, OCD is maintained through continued engagement in ritualistic compulsions in order

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to "prevent" a feared outcome from occurring, despite some degree of knowledge that this fear is unreasonable. The first-line psychosocial treatment for OCD – exposure and response prevention (ERP) – is based on principles of fear extinction. In order to improve OCD symptoms, therapists guide patients to place themselves in increasingly difficult, OCD-triggering situations while refraining from engaging in their compulsions. Over time, patient fears are extinguished.

The ability to retain a memory of fear extinction over time, also called extinction recall or retention (ER), appears to be impaired in individuals with anxiety disorders. Extinction retention has been found to be abnormal in post-traumatic stress disorder (PTSD) [3], and individuals with panic disorder appear to be resistant to extinction [4]. A recent study using Pavlovian conditioning to associate a shock with certain lights found that fear extinction retention is reduced in OCD, compared to healthy controls [1]. This study also found a direct correlation between OCD symptom severity and ER – that is, participants with greater OCD severity also had better recall of fear extinction. While the specific causal mechanism of these results remains unclear, together these findings suggest problems with ER as a potential mechanism in the development and/or maintenance of anxiety-related disorders.

In the current study, given the unexpected finding in Milad et al. [1] showing improved extinction memory with greater OCD severity, we tested the hypothesis that participants with a lifetime diagnosis of OCD would also have impaired extinction recall as compared to healthy controls, and assessed whether there continued to be a relationship between OCD severity and extinction memory. We also examined differences between participants with OCD and healthy control patients during an additional fear renewal phase, hypothesizing impairments in participants with OCD.

2. Materials and methods

2.1. Participants

We enrolled 37 participants with OCD and 18 healthy controls. OCD participants were recruited from the OCD clinic at Butler Hospital in Providence, RI, and met DSM-IV criteria for a lifetime diagnosis of obsessive–compulsive disorder [5]. Exclusion criteria for the OCD group included current or past psychotic disorder and a clinical history of post-traumatic stress disorder (PTSD; excluded because of the known ER deficits in this disorder). Controls, free of current psychiatric disorders or past anxiety or psychotic disorder, were recruited from the community through advertisements at local colleges and in local cafes and stores. Informed consent was obtained for this Butler Hospital IRB-approved study.

2.2. Procedures

2.2.1. Rating scales

Structured Clinical Interview for DSM-IV, SCID-IV [6]. The Structured Clinical Interview for DSM-IV is a semi-structured interview for making major Axis I diagnoses. It is administered by trained evaluators and includes an introductory overview, followed by specific diagnostic modules.

Yale–Brown Obsessive Compulsive Scale, Y-BOCS [7]. The Y-BOCS is an evaluator-administered questionnaire assessing severity of OCD symptoms, separated by obsessions and compulsions.

Yale–Brown Obsessive Compulsive Scale Symptom Checklist, Y-BOCS SC; [7]. The Y-BOCS SC is a questionnaire assessing the presence of current or past OCD symptoms.

2.2.2. Fear conditioning paradigm

The experimental protocol was administered over two separate days. On Day 1, participants underwent three different phases where they were presented with visual stimuli: the *habituation*, *conditioning*, and *extinction* phases (Fig. 1). This day was designed to condition participants to a stimulus and extinguish the conditioned stimulus. On Day 2, approximately 24 h after conditioning and extinction, participants underwent two additional blocks, *extinction retention* and *fear renewal*. The goal of these blocks was to show the conditioned and unconditioned stimuli again, to determine if the conditioned stimulus remained extinguished (i.e., extinction recall). During both days of the procedure, participants sat in a comfortable chair in front of a computer monitor. On Day 1, after the electrodes were attached, prior to task initiation, the intensity of the electric shock was set by each participant, and determined by each participant to be "highly annoying but not painful". The shock was generated by a Coulbourn Transcutaneous Aversive Finger Stimulator, which was isolated from line current and powered by a 9 V dry cell battery attached to an adjustable step-up transformer. Participants were then asked to passively view digital photographs of two rooms containing lamps that appeared on the computer screen (Fig. 1). Photographs of the two rooms (a conference room and an office) constituted the two virtual contexts (CX). During the procedure, one context was associated (CX+) and one was not associated (CX−) with receiving the unconditioned stimulus (US). Each room contained a lamp. Two colors of the lit lampshade (blue or red) constituted the conditioned stimuli (CS). One CS was paired (CS+) and one was not paired (CS−) with presentations of the US. The selection of the CS+ and CS− colors and the CX+ and CX− rooms was counterbalanced across participants. For each trial during the experiment, the CX was presented for 9 s: 3 s alone, followed by 6 s in combination with the CS+ or CS−. Skin conductance was recorded for 5 s before the presentation of the CX, during the 3 s presentation of the CX alone, and during the 6 s presentation of the CX plus the CS. The US occurred during the last 500 ms of the CS+. The US was a 500 ms electric shock delivered through electrodes attached to the second and third fingers of the dominant hand. The average inter-trial interval was 15 s.

2.2.3. Psychophysiological measures

See Milad et al. [1] for additional details. A Coulbourn Modular Instruments System (Allentown, PA) was used to record skin conductance levels via a Coulbourn Isolated Skin Conductance Coupler using a constant 0.5 V through 8 mm (sensor diameter) electrodes. Electrodes were filled with isotonic paste and placed on the palm of the participant's non-dominant hand. The skin conductance electrodes were separated by approximately 8 mm, as determined by the width of the adhesive collar. A Coulbourn analog-to-digital converter digitized the analog signals, which were then sampled and stored by a personal computer.

2.3. Day 1

2.3.1. Phase 1 – habituation phase

Prior to the *habituation phase*, participants were instructed that the purpose of this phase was to show them all of the possible pictures that they would see in the experiment, and that no shock would be delivered. In the *habituation phase*, four CS+ and four CS− were presented in a counterbalanced manner within the acquisition context (CX+) or the extinction context (CX−).

2.3.2. Phase 2 – conditioning phase

Prior to the *conditioning phase*, participants were instructed that they "may or may not be shocked" during that phase and the following phases of the experiment. One of the lights (e.g., red or a blue light) was depicted within a photograph and paired with the US (i.e., shock) at a 100% reinforcement rate, within the CX+. Each participant was administered five CS+ and five CS− trials. The US