# Emotional distress and pain tolerance in obsessive-compulsive disorder

Dianne M. Hezel [a,*], Bradley C. Riemann [b], Richard J. McNally [a]

[a] Department of Psychology, Harvard University, 33 Kirkland Street, Cambridge, MA 02138, USA
[b] The Obsessive-Compulsive Disorder Center, Rogers Memorial Hospital, USA

## ARTICLE INFO

## ABSTRACT

Background and objectives: Physical pain can reduce emotional distress, perhaps especially the psychic pain of guilt. This implies that people who continually experience guilt may exhibit greater tolerance for pain relative to people who do not.
Methods: To test this hypothesis, we administered a pressure algometer procedure to assess pain tolerance in patients with obsessive-compulsive disorder (OCD) plagued by moral obsessions (e.g., concerns about harming others, violating religious values), in patients with OCD with non-moral obsessions (e.g., regarding contamination and symmetry), and in healthy comparison subjects.
Results: The results indicated that the OCD groups did not differ in levels of guilt, emotional distress tolerance, or in pain endurance. However, when we collapsed across subtypes, OCD subjects endured pain significantly longer than did healthy subjects.
Limitations: Limitations included small sample size and use of a sample with complex OCD symptoms that were, in some instances, difficult to categorize.
Conclusions: The results suggest that individuals with severe OCD might be willing to endure physical pain as a distraction from emotional distress, an expression of negative self-worth, or as a means to gain control over some aspect of suffering.

## 1. Introduction

Obsessive-Compulsive Disorder (OCD) is a common and debilitating anxiety disorder characterized by recurrent, unwanted, and intrusive thoughts (obsessions) and repetitive behaviors (compulsions) performed to reduce anxiety (American Psychiatric Association, 2000). A heterogeneous disorder, OCD consists of symptoms that vary greatly from one individual to the next. Symptoms occur in four clusters (Leckman et al., 1997):

(1) aggressive, sexual, and religious obsessions (e.g., fear of killing one's child or having sex with one's child) and related checking compulsions (e.g., replaying events in one's head to make sure no one was harmed);
(2) symmetry obsessions (e.g., preoccupation with objects being aligned in a certain manner) and ordering/repeating/counting compulsions (e.g., repeating an action until it looks or feels "just right");
(3) contamination obsessions (e.g., fear of contracting a disease such as AIDS) and cleaning compulsions (e.g., frequent and excessive hand-washing or cleaning); and

(4) hoarding obsessions (e.g., reluctance to discard items, irrespective of their usefulness or functionality) and compulsions (e.g., accumulation of objects of questionable value).

Individuals with aggressive/sexual/religious obsessions frequently experience uncertainty about whether they might act on their intrusive thoughts. This pathological doubt often results in high levels of guilt, self-criticism, or even self-loathing (Abramowitz, Franklin, Schwartz, & Furr, 2003; Gordon, 2002; Osgood-Hynes, n.d.). Indeed, both guilt and shame have been identified as important factors in the etiology and maintenance of OCD. Some individuals who have intrusive thoughts of harming others or committing a sinful action believe that simply having a bad thought is equivalent to acting on it, a phenomenon known as "moral thought-action fusion" (TAF) (Rachman, 1993; Shafran & Rachman, 2004). People with moral TAF believe their thoughts reflect a flawed moral character, and thus it frequently leads to high levels of guilt, shame, and anxiety (Shafran & Rachman, 2004).

The experience of physical pain may ease the psychic pain of chronic guilt, at least for some people. For example, the Christian flagellant movement, erupting in Perugia in 1260 (Dickson, 1989), dramatically exemplifies how self-inflicted injury may serve penitential motives. Likewise, people who engage in deliberate non-suicidal self-injury may do so to alleviate intense psychological distress (Nock, 2009) and to punish themselves (Lloyd-Richardson,

 * Corresponding author. Tel.: +1 617 714 5974.
   E-mail address: dhezel@fas.harvard.edu (D.M. Hezel).

Perrine, Dierker, & Kelley, 2007). Many individuals diagnosed with OCD also suffer from Obsessive-Compulsive Spectrum Disorders, including compulsive self-injury (du Toit, van Kradenburg, Niehaus, & Stein, 2001). One study found the prevalence of self-harming behaviors to be as high as 22.4% in a sample of OCD patients (du Toit et al., 2001). However, the relationship between OCD and physical pain remains unstudied.

There are several methods that ascertain a person's subjective sensitivity to a pain-inducing stimulus, such as thermal stress (Leyro, Zvolensky, & Bernstein, 2010) or focal pressure (Hooley, Ho, Slater, & Lockshin, 2010). *Pain threshold* is the time it takes before a person first feels pain in response to an aversive stimulus, whereas *pain tolerance* is the time it takes before the pain becomes intolerable, prompting the person to demand termination of the stimulus (Burns, Bruehl, & Caceres, 2004; Hines & Brown, 1932; Leyro et al., 2010). Finally, *pain endurance* is the amount of time that a person continues to bear the stimulus after he or she first experiences it as painful (i.e., pain tolerance time minus pain threshold time; Hines & Brown, 1932; Leyro et al., 2010). In the present study, we measured pain threshold and pain endurance as our primary dependent variables.

Several studies suggest a connection between pain tolerance and sensitivity and emotional distress, including guilt (Bastian, Jetten, & Fasoli, 2011; Leyro et al., 2010). Research suggests that people who engage in self-harming behaviors have higher pain thresholds and greater pain endurance than do individuals who do not engage in such behaviors. In a population of individuals who practice nonsuicidal self-injury (NSSI), Hooley et al. (2010) found that increased pain endurance was predicted most strongly by negative beliefs about one's self-worth. The authors concluded that "the more people considered themselves to be worthless or inferior, the more willing they were to endure pain" (p. 176) and that "beliefs about the self as being bad and deserving of punishment" (p. 177) might be an important moderating variable for why some people choose NSSI to regulate their negative emotions while others do not. Similarly, a different study suggested that high rates of non-verbal shame behaviors predicted a higher incidence of self-injury in a study of women with Borderline Personality Disorder (Brown, Linehan, Comtois, Murray, & Chapman, 2009). These findings suggest that negative self-thoughts of low self-worth may motivate NSSI.

Likewise, Bastian et al. (2011) documented a link between feelings of guilt and pain endurance in college students. Study participants asked to recall instances of past immoral behavior (defined as excluding another person in a social situation) had higher rates of guilt and negative mood than did those asked to write about an "everyday interaction" they had with someone the day prior to the experiment. Furthermore, individuals in the former group not only kept their hands submerged in ice water longer than did those in the latter group, but also rated the pain they experienced as more severe. Yet after experiencing this pain, their feelings of guilt declined. Hence, guilt may motivate people to endure increased pain, which, in turn, may diminish guilt.

The relationship between psychopathology and the self-referential emotions of shame and guilt has been studied widely (Tangney & Dearing, 2003). The State Shame and Guilt Scale (SSGS) is one of several measures that assess the moral, self-referential emotions of shame, guilt, and pride (Marschall, Sanftner, & Tangney, 1994). Subjects are asked to rate the extent to which they agree or disagree with statements such as "I feel remorse, regret," "I feel like I am a bad person," and "I feel humiliated, disgraced." We used the SSGS to evaluate subjects' feelings of badness or worthlessness in our study. We hypothesized that individuals diagnosed with OCD should experience higher levels of guilt and shame and lower levels of pride than should those in the psychiatrically healthy comparison group. Furthermore, specifically within the OCD sample, we expected that people with moral obsessions should display higher levels of negative self-referential emotions than should those with non-moral obsessions.

In addition, we tested whether OCD patients whose obsessions had moral content involving aggressive, sexual, or religious themes exhibit greater pain tolerance relative to OCD patients whose obsessions do not involve moral content and healthy comparison participants. Exemplifying patients in the moral group are a mother who fears she will stab her infant; a man who experiences disturbing images of fondling a young child; and a teenager who fears she has offended God. These patients presumably have more feelings of negative self-worth and feel more deserving of punishment and hence will have a higher physical pain tolerance than will patients who do not have prominent moral obsessions (i.e., symptoms that are primarily concerned with contamination obsessions/ cleaning compulsions or symmetry/ordering obsessions and compulsions, etc.). Alternatively, if physical pain endurance is related to greater psychic relief of emotional distress in general, we would expect OCD subjects, irrespective of the symptom subtype, to endure pain for longer than do the healthy subjects. One might expect that people with OCD would have a lower pain tolerance than do healthy people, given the disorder's strong association with neuroticism, a trait associated with harm avoidance (Paulus, Rogalsky, Simmons, Feinstein, & Stein, 2003). However, we expect that OCD subjects' intolerance of emotional distress will be so strong as to override this effect, and instead cause them to endure the pain longer than do their healthy peers.

## 2. Materials and method

### 2.1. Subjects

OCD patients were recruited from the residential and intensive outpatient units of the Obsessive-Compulsive Disorder Center at Rogers Hospital in Oconomowoc, Wisconsin where they participated in the study. To qualify for the study, OCD patients had to be between the ages of 18 and 65, not to have taken any pain medication within 24 h, and had to have a chart diagnosis of OCD. Patients with Major Depressive Disorder (MDD) or other comorbid disorders still qualified.

Using the Yale-Brown Obsessive-Compulsive Scale (Y-BOCS) and Symptom Checklist, the first author classified OCD patients into one of two groups: (1) those with prominent obsessions concerning moral themes (e.g., harm to others, sexuality, religion), and (2) those with no prominent moral obsessions (e.g., contamination, symmetry). The third author independently classified these patients after reviewing the OC Checklist and related chart notes on each patient. The third author agreed with the first author's classification of 18 of 20 cases, yielding a Kappa of .80, $p < .001$. Following discussion between the authors, we reclassified one patient. Thus, eight patients (3 men, 5 women; mean age = 26.5 years [SD = 10.1]) were assigned to the moral group and 12 patients (6 men, 6 women; mean age = 24.8 years [SD = 7.5]) were assigned to the non-moral group. Comparison subjects were recruited in Cambridge, Massachusetts via an advertisement on craigslist.com. Participation as a healthy subject was limited to men and women between the ages of 18 and 65 who had never met criteria for OCD or MDD and who did not have a history of self-harming behavior. Subjects did not take any over-the-counter pain medication (ibuprofen, aspirin, etc.) within 24 h of their visit, nor were they taking any prescription pain medication. Comorbidity data were available for 19 of the 20 OCD subjects. Only one of these 19 did not have a comorbid psychiatric illness, with the remaining sample averaging 1.5 (SD = 1.07) comorbidities per person. The most

common comorbid illness was MDD ($n = 10$; 50%) followed by social anxiety disorder ($n = 3$; 15%), generalized anxiety disorder ($n = 3$; 15%) and eating disorders ($n = 3$; 15%). Other diagnoses included PTSD ($n = 2$; 10%), history of substance abuse ($n = 2$, 10%), mood disorder NOS ($n = 1$; 5%), bipolar disorder ($n = 1$; 5%) dysthymia ($n = 1$; 5%), borderline personality disorder ($n = 1$; 5%), and Tourette's Syndrome ($n = 1$; 5%). In addition, medication data were available for 17 OCD subjects. Upon admission to the OCD Center, only two subjects were not taking any medication and the rest of the patients were taking an average of 3.5 meds (SD = 2.4) per person. Subjects were on a wide range of medication, most typically selective serotonin reuptake inhibitors (SSRIs), tricyclic antidepressants, antipsychotics, serotonin-norepinephrine reuptake inhibitors (SNRIs), and benzodiazepines.

The first author conducted a brief phone screen to confirm that potential comparison subjects fell within the requisite age range and that they had no history of OCD, MDD, or self-harming behavior. Among the 30 potential healthy comparison subjects, 25 (14 men, 11 women) with a mean age of 30.6 years (SD = 10.0) qualified and participated in the study. The excluded five had histories of MDD or self-harming behavior. All subjects were compensated $20 for participating.

## 2.2. Materials and procedures

Subjects first read and signed an informed consent form approved by Harvard University's Committee on the Use of Human Subjects, which had approved the protocol as well. The first author then administered the MDD and OCD modules of the Mini International Neuropsychiatric Interview (MINI) to confirm that comparison subjects did not have a history of these disorders (Sheehan et al., 1998). All subjects then completed the SSGS, a 15-item questionnaire that measures the respondent's current feelings of guilt, shame, and pride (Marschall et al., 1994).

We used Hooley and Delgado's (2001) portable pressure algometer to measure subjects' physical pain tolerance and pain endurance. It consists of a base attached to a 35 cm-long hinge with attached weights. The hinge, which is approximately 1.5 cm long and 1 mm wide, exerts a constant pressure on the subject's finger, producing a sensation akin to a dull butter knife pressed against the skin. The pressure creates a dull pain that intensifies with time, but causes no tissue damage.

Subjects were asked to place the pressure algometer between the first and second knuckles on the back side of their index fingers and keep it there for as long as they could tolerate it. The subjects were in complete control of the algometer, and they were told that they could remove it from their finger at any time. All subjects were asked to tell the experimenter (1) when they first felt pain and (2) when the pressure became so uncomfortable that they wanted it off their finger, at which point they were told to remove it. During this procedure, the experimenter observed the subjects and recorded with a stopwatch when subjects said they first felt pain (pain threshold) and the point at which the subjects wished to terminate the experiment (pain tolerance). By subtracting the first time from the second one, we calculated each subject's pain endurance. If eight minutes elapsed and the subject had not asked for the algometer's removal, the experimenter asked the subject to remove it, and she recorded pain tolerance as eight minutes, in accordance with the typical maximum cutoff time (Hooley & Delgado, 2001; Hooley et al., 2010). The procedure was done twice: first on the nondominant hand, and then on the dominant one. Immediately after completing each trial, the subjects were asked to rate their pain on a scale of one to 100, with one being the least painful and 100 being the most painful (Huskisson, 1974). The same pressure algometer was used to test all subjects.

After completing the pain perception task, subjects completed the Y-BOCS and Symptom Checklist (given to OCD patients only) to assess OCD severity (Goodman, Price, Rasmussen, Mazure, Delgado, et al., 1989; Goodman, Price, Rasmussen, Mazure, Fleischmann, et al., 1989); the Beck Depression Inventory II (BDI-II; (Goodman, Price, Rasmussen, Mazure, Delgado, et al., 1989; Goodman, Price, Rasmussen, Mazure, Fleischmann, et al., 1989), the NEO Five-Factor Inventory (NEO-FFI) that measures neuroticism, extraversion, openness to experience, agreeableness, and conscientiousness; Costa & McCrae, 1992) and the Distress Tolerance Scale (DTS), a 15-item questionnaire that measures one's tolerance for negative affect (Simons & Gaher, 2005). Patients at the OCD Center in Oconomowoc complete the Y-BOCS and BDI-II regularly as a part of the treatment program. If subjects had completed these measures within one week of their study participation, we used these data rather than having them redo the questionnaires.

## 3. Results

### 3.1. Preliminary results

The groups did not significantly differ in age, $t(43) = 1.84$, $p = .07$, nor was there a significant correlation of pain endurance and age, $r = -.21$, $p = .16$. There were also no significant group differences in how subjects rated the pain (on the 1–100 scale) caused by the pressure algometer, $F(2,42) = .37$, $p = .69$. Finally, there was no effect of gender on endurance, $t(43) = 1.54$, $p = .13$.[1]

The moral and non-moral subtypes did not differ significantly in OCD or depression severity, level of distress tolerance, or personality factors as measured by the NEO-FFI (see Table 1). There were differences, however, between OCD subjects and healthy comparison subjects on all of the aforementioned measures. Specifically, OCD patients had lower distress tolerance, higher neuroticism, and lower extraversion, agreeableness, and conscientiousness. There was no difference between groups in the third scale of the NEO, openness to experience (see Table 1).

### 3.2. Self-referential emotions

Using the SSGS, we compared the groups on the scales of guilt, shame, and pride. There were no significant differences in ratings of guilt or pride between the OCD groups, but the OCD moral group reported higher levels of shame than did the OCD non-moral group $t(42) = 3.43$, $p = .001$, $r = .47$. As expected, individuals in both OCD groups combined scored significantly higher on shame $t(42) = 8.81$, $p < .001$, $r = .81$ and guilt $t(42) = 7.07$, $p < .001$, $r = .74$ and significantly lower on pride $t(42) = -8.01$, $p < .001$, $r = .78$ than did the comparison group (Table 2).

### 3.3. Pain data

Only one subject was left handed. Pain endurance did not differ between subjects' dominant and nondominant hands, $t(43) = 1.03$, $p = .31$, and the correlation between subjects' two scores was $r(44) = .76$, $p < .001$. Accordingly, we based the following analyses on the average of the two pain endurance scores. Because one healthy comparison subject reported not feeling any pain on his nondominant hand, only the scores from his dominant were used.

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[1] Two patients in the OCD group had eating disorders and histories of self-harming behavior. Because pain endurance is strongly correlated with self-harming behaviors (Hooley et al., 2010), we repeated the analysis after excluding these subjects. The OCD group still had greater pain endurance than did the healthy comparison group, $t(40) = 2.74$, $p = .009$, $r = .39$.

**Table 1**
Group Characteristics.

| Measure | OCD: moral vs. non-moral | | | | OCD vs. healthy comparison group | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Moral M (SD) | Non-moral M (SD) | $t(42)$ | $p$ | OCD M (SD) | Healthy M (SD) | $t(42)$ | $p$ | $r$ |
| Y-BOCS | 20.25 (4.71) | 20.33 (5.16) | −.06 | .96 | 20.30 (4.86) | n/a** | n/a | n/a | n/a |
| BDI-II | 22.63 (12.63) | 20.67 (12.77) | .50 | .62 | 21.45 (12.41) | 1.80 (2.52) | 7.66 | <.001* | .76 |
| Distress Tolerance | 34.00 (6.63) | 40.33 (12.88) | −1.22 | .23 | 37.80 (11.06) | 57.80 (11.75) | −5.97 | <.001* | .67 |
| NEO 1: neuroticism | 36.88 (5.38) | 31.75 (8.42) | 1.54 | .13 | 33.80 (7.64) | 13.16 (7.19) | 9.58 | <.001* | .83 |
| NEO 2: extraversion | 21.75 (4.65) | 23.58 (5.02) | −.50 | .62 | 22.85 (4.84) | 32.28 (9.83) | −3.92 | <.001* | .52 |
| NEO 3: openness to experience | 34.25 (7.82) | 32.25 (6.90) | .68 | .50 | 33.05 (7.15) | 35.84 (5.81) | −1.32 | .20 | n/a |
| NEO 4: agreeableness | 31.88 (6.69) | 30.00 (4.71) | .67 | .51 | 30.75 (5.50) | 36.20 (6.50) | −2.84 | .007* | .40 |
| NEO 5: conscientiousness | 22.13 (3.52) | 25.17 (6.49) | −1.04 | .30 | 23.95 (5.60) | 36.84 (7.00) | −6.78 | <.001* | .73 |

*Note.* * = $p < .05$ criteria; ** Only the OCD subjects completed the Y-BOCS.

Similarly, the degree to which subjects rated the stimulus as painful on their dominant hands was significantly correlated with the rating on their nondominant hands, $r(45) = .93$, $p < .001$.

Using contrast weights of 2, 1, and −1, we tested the hypothesis that the OCD moral group would endure pain significantly longer than would both the OCD non-moral group and the healthy comparison group. The results failed to support our hypothesis, $t(42) = .83$, $p = .41$, $r = .13$. However, OCD subjects (moral and non-moral combined) endured pain an average of 96.8 s longer than did healthy subjects, $t(42) = 3.21$, $p = .003$, $r = .44$ (Fig. 1). The groups did not differ in how painful they rated the algometer, $F(2,42) = .37$, $p = .69$, or pain threshold, $F(2,42) = .67$, $p = .52$, suggesting there was no difference in subjects' perception of pain, but rather in their willingness to tolerate it.

We combined the data of all our subjects to test hypotheses about the relation between guilt, shame, and pride and pain tolerance. We conducted a simultaneous multiple regression analysis, regressing pain endurance on each of the pride, shame, and guilt scales of the SSGS while controlling for presence of OCD. Despite differences between the OCD and healthy subjects, the only measure that significantly predicted the amount of time that subjects endured pain was the pride scale of the SSGS. That is, the less pride subjects expressed, the longer they endured pain from the pressure algometer, $\beta = -12.26$, $t(42) = -2.74$, $p = .009$, $r = .40$. Pride remained the only statistically significant predictor even with the inclusion of other factors in the regression, such as OCD and depression severity and distress tolerance, $\beta = -13.12$, $t(39) = -2.74$, $p = .009$, $r = .40$.

Finally, there was a significant correlation between OCD patients' length of stay at the hospital, measured in days, and pain endurance, $r = .45$, $p = .05$. However, length of stay was not significantly associated with OCD or depression severity, distress tolerance, or levels of shame, guilt, or pride.

## 4. Discussion

Despite OCD patients with moral obsessions expressing more shame than did OCD patients with non-moral obsessions, they did not exhibit greater endurance for pain, contrary to our hypothesis. Although the number of subjects in our OCD subgroups was modest, hence limiting statistical power, the direction of the means

was *opposite* to prediction: subjects with non-moral obsessions tended to exhibit greater endurance than did those with moral obsessions. However, when we combined the OCD groups, we found that they expressed higher levels of shame and guilt and a lower level of pride, and endured pain for over 90 s longer than did a healthy comparison group. This finding suggests that patients suffering from OCD, irrespective of the content of their obsessions, are especially tolerant of physical pain.

The similarly elevated levels of guilt in the moral and non-moral OCD groups may be due to the severity of their illness. Prior to their hospitalization, these patients had OCD that caused repeated failures in their personal, academic, and occupational lives. A study by Stewart et al. (2011) highlights the subsequent impairment families of OCD patients suffer as a result. Such experiences are likely to increase feelings of guilt. Because this level of dysfunction is not limited to people with moral obsessions, it may explain why those with non-moral obsessions experience comparable levels of guilt. Alternatively, shame is a more self-referential emotion than is guilt. It is characterized by negative self-evaluation, whereas guilt focuses more on the outcome of the action (Lewis, 1971; Tangney, Miller, Flicker, & Barlow, 1996). Although both emotions can arise from similar situations, shame results in global feelings of unworthiness, badness, and a defective self. Guilt, on the other hand, is "generally less painful and devastating… because it does not directly affect one's core self concept" (p. 1257) (Tangney et al., 1996). It is possible that, consistent with our hypothesis, the moral OCD group reported higher levels of shame due to the especially disturbing content of their obsessions (e.g., having sex with a child, killing a loved one, etc.).

The self-referential emotions evaluated with the SSGS were associated with pain endurance. A regression analysis revealed that only the pride scale of the SSGS predicted significant variance in endurance for pain beyond depression symptoms, severity of OCD symptoms, and emotional distress tolerance. The *lower* subjects' pride, the more they tolerated pain. Although Fernandez (1986) found that images of pride can be "incompatible with pain" (p. 145) and serve as a cognitive strategy for coping with pain, aspects of the SSGS pride scale suggest that it taps a different sense of pride than what other researchers have assessed. The scale includes statements such as, "I feel good about myself," "I feel worthwhile,

**Table 2**
Group differences in self-referential emotions.

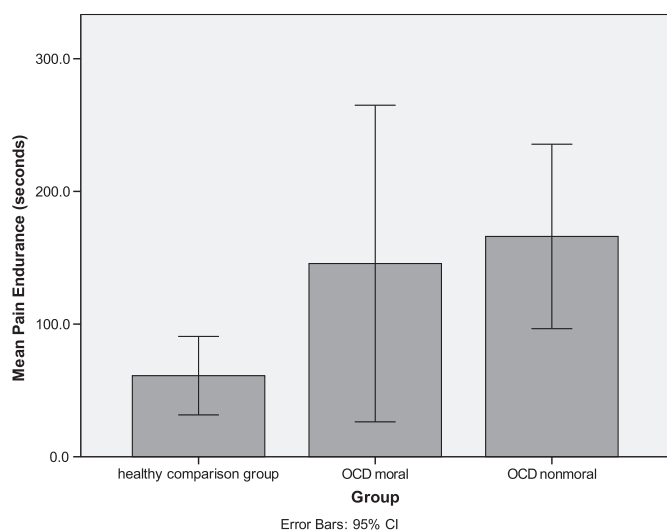| SSGS scale | OCD: Moral vs. non-moral | | | | | OCD vs. healthy comparison group | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Moral M (SD) | Non-moral M (SD) | $t(42)$ | $p$ | $r$ | OCD M (SD) | Healthy M (SD) | $t(42)$ | $p$ | $r$ |
| Guilt | 13.00 (5.26) | 11.33 (4.23) | 1.17 | .25 | n/a | 12.00 (4.61) | 5.44 (.96) | 7.07 | <.001* | .74 |
| Shame | 13.88 (3.98) | 9.83 (3.90) | 3.43 | .001* | .47 | 11.45 (4.33) | 4.96 (.20) | 8.81 | <.001* | .81 |
| Pride | 11.88 (3.44) | 13.25 (1.60) | −.99 | .33 | n/a | 12.70 (2.52) | 20.00 (3.43) | −8.01 | <.001* | .78 |

*Note.* * = $p < .05$.

**Fig. 1.** Mean values (seconds) representing physical pain endurance for each test group. Although no significant difference existed between OCD moral and non-moral groups, OCD subjects endured pain for over 90 s longer than did healthy subjects.

valuable," and "I feel capable, useful." Hence, the scale may measure self-esteem rather than a stoic pride. If so, then our findings are consistent with Hooley et al. (2010), who found that feelings of negative self-worth are predictive of higher pain endurance.

The OCD subjects had low scores on the Distress Tolerance Scale (DTS), yet displayed significantly higher pain tolerance and endurance than did the comparison group. This finding suggests that people who have difficulty experiencing emotional distress may have little difficulty enduring physical pain. Indeed, the experience of focal physical pain may distract them from emotional pain. Nock (2009) asserts that a functional explanation for the development and maintenance of self-injurious behavior is that it "decreases or distracts from aversive thoughts or feelings" (p. 2). The pain caused by the algometer may function similarly, thus motivating OCD patients to endure it longer than did comparison subjects who reported significantly lower levels of emotional distress. Research on the DTS suggests that low tolerance for negative emotional states may be a risk marker for psychopathological symptoms, including substance abuse and eating disorders (Leyro et al., 2010). A recent study found that poorer distress tolerance was predictive of OCD symptoms, potentially because of maladaptive coping mechanisms in response to these negative emotions (Cougle, Timpano, Fitch, & Hawkins, 2011). These maladaptive coping mechanisms may include using pain as a distraction from emotional distress.

Two of the subjects in the OCD group commented on the pain they experienced from the pressure algometer. One patient stated that the pain "felt good," whereas another stated that he liked the sensation because, "In all the craziness of my OCD, pain is a constant. It's one thing that you can count on." Prior research has shown that perceived control does affect people's reaction to pain (Bandura, O'Leary, Taylor, Gauthier, & Gossard, 1987; Bowers, 1968). Specifically, a sense of control over the pain lowers its severity and results in increased pain endurance (Haythornthwaite, Menefee, Heinberg, & Clark, 1998; Lorig, Chastain, Ung, Shoor, & Holman, 1989; Rejeski, Craven, Ettinger, McFarlane, & Shumaker, 1996). Although OCD patients experience lack of control over their obsessive thoughts, the algometer task affords complete control over an external aversive stimulus. Patients may have found it comforting to control some aspect of their distress, which, in turn, caused them to endure physical pain longer than did the healthy

comparison group. Research suggests that control may play an important role in the development and maintenance of OCD. Compared to healthy individuals, people with OCD report a higher desire to control not only their thoughts, but also external events, particularly those with negative outcomes (Moulding, Doron, Kyrios, & Nedeljkovic, 2008; Moulding & Kyrios, 2007). In an attempt to gain control over their thoughts, individuals with OCD perform rituals, which temporarily alleviate anxiety (Rachman & Hodgson, 1980). Some postulate that this high desire for control and temporary relief from compulsions may result in an illusion of control (Reuven-Magril, Dar, & Liberman, 2008). That is, OCD patients may assume they have more control over negative outcomes than they do in reality. Reuven-Magril et al. (2008) found that OC tendencies, but not depression, were positively associated with illusion of control, and that this effect was more pronounced when individuals were presented with negative stimuli. Thus, an illusory sense of control over the pain stimulus in the present study may have contributed to increased pain endurance in OCD subjects.

Alternatively, OCD subjects may experience such persistently high levels of emotional pain on a daily basis, that by comparison, the physical pain caused by the algometer is insignificant. If this were the case, we would expect OCD subjects to have a higher pain threshold and rate the pressure algometer as less painful than did the healthy comparison group. However, there were no group differences in threshold or mean pain rating, suggesting that all subjects perceived the pain to an equal extent. The absence of difference implies that medications did not affect our results even though some studies show that SSRIs and other antidepressants can increase pain tolerance (Coluzzi & Mattia, 2005).

A recent study by Lazarov, Dar, Liberman, and Oded (2012) suggests that individuals with OCD lack conviction about internal states such as feelings, beliefs, and basic sensations, and thus may rely on external indicators (proxies) of internal states to guide their behavior. The authors found that people with OCD symptoms were more likely than people with few OCD symptoms to rely on biofeedback to gauge their own muscle tension and relaxation. In our study, it is possible that OCD subjects simply did not "trust" their perception of pain, and therefore took longer to remove the painful stimulus to ensure they felt it. This alternative explanation seems unlikely, however, because subjects did not differ from healthy individuals on pain threshold or subjective ratings of pain. If the OCD subjects doubted their perception of pain, one would expect them to have had higher pain thresholds, on average, than did the non-OCD subjects. Likewise, subjects were asked to rate the intensity of the pain they felt on a scale of 1–100. Given such a large scale, one might expect differences in pain ratings if OCD subjects were less certain of how painful the algometer was. The absence of significant differences between their ratings and those of healthy participants seems inconsistent with this alternative interpretation.

As expected, patients with OCD endorsed more depressive symptoms than did people in the comparison group, but there was no difference in depression severity between OCD moral and non-moral groups. Some data suggest that depression may lower physical pain tolerance (Chiu et al., 2005; Tang et al., 2008). Indeed, associations between depression and pain have been identified in people who suffer from chronic pain disorders, such as fibromyalgia or neuropathic pain (Maletic & Raison, 2009). Accordingly, higher levels of depression are unlikely to have contributed to higher pain tolerance and endurance in OCD subjects in our study. Furthermore, even though significantly correlated with pain endurance, BDI-II scores were not predictive of how long a person kept his or her hand under the pressure algometer. Likewise, differences emerged between groups on the personality factors of the NEO-FFI. As expected, OCD subjects showed higher neuroticism and lower

extraversion, agreeableness, and conscientiousness compared to the comparison group, though there was no significant difference in openness to experience. Prior research on OCD subjects has shown similar elevated neuroticism scores, a factor that may contribute to the development of anxiety, depression, guilt, anger, and disgust (Rector, Hood, Richter, & Bagby, 2002). Indeed, this attribute may contribute to our sample's high levels of shame and guilt. Although high neuroticism is sometimes associated with pain aversion, other studies have found the same association between high neuroticism and increased pain endurance. Hooley et al. (2010) found that subjects who engage in NSSI not only endure pain for longer than do healthy subjects, but also were higher on neuroticism and introversion. Likewise, Brown (2009) observed a similar pattern of high neuroticism in college students with a history of NSSI.

The few studies on anxiety disorders and physical pain tolerance and endurance have yielded mixed findings. Using a pressure algometer, Merskey (1965) found that anxious subjects did not endure pain as long as a healthy comparison group did. Because the author did not specify the anxiety disorders from which his study subjects suffered, it is unclear whether any of the subjects had OCD. Other research indicates that people with panic disorder are less tolerant of physical discomfort, and may avoid adverse physical states to a greater extent than do other anxious clinical and healthy comparison groups (Schmidt & Cook, 1999; Schmidt, Richey, & Fitzpatrick, 2006). Other studies have failed to identify any differences in people with and without anxiety disorders such as generalized anxiety disorder, agoraphobia, and panic disorder (Kopp & Gruzelier, 1989). These results imply that endurance of physical pain may be greater in OCD than in other anxiety disorders. Direct comparison of OCD patients and patients with other anxiety disorders are needed.

Perhaps people with OCD are especially keen to be compliant research subjects, thus motivating them to endure pain for longer than healthy subjects do. However, the first author explicitly instructed all subjects to remove the pressure algometer from their fingers as soon as the pain became intolerable, and emphasized that enduring the pressure beyond that point would not benefit the study. Therefore, if subjects did comply with the instructions, they presumably did not endure pain beyond what they experienced as tolerable. It is also possible that length of hospital stay affected patients' pain endurance. All OCD subjects engaged in exposure and response prevention (ERP), which entails confronting objects, situations, and thoughts that trigger anxiety while refraining from engaging in rituals or other avoidance behaviors (Huppert & Roth, 2003). During ERP, patients regularly experience high levels of anxiety and emotional discomfort, which tend to decrease with repeated exposures (Huppert & Roth, 2003; Rachman & Hodgson, 1980). The longer subjects are in treatment, the greater their experience with this type of therapy. It is possible that patients viewed the pressure algometer as an exposure and thus attempted to endure the pain for as long as possible. It is also possible that the more experience patients had with ERP, the more likely they were to treat the algometer as an exposure. However, if longer hospital stay caused patients to become more willing to endure distress, one would expect an inverse relationship between length of treatment and emotional distress tolerance, but this was not the case. The lack of association between these two variables suggests that length of stay alone did not predict subjects' willingness to endure emotional distress. Moreover, because ERP does not inflict physical pain on patients, it seems unlikely that subjects' would view the pressure algometer as an exposure even if they were more accustomed to enduring anxiety triggered by ERP. Finally, our calculation of days spent at Rogers Memorial Hospital does not take into account subjects' prior hospitalizations or hours of therapy, and therefore is a crude estimate of the amount of treatment they have received.

One limitation of our study was the relatively small number of subjects in each of the OCD subgroups. In addition, because the subjects came from an intensive residential treatment center, many patients had very complex cases of OCD with a myriad of symptoms and overlapping subtypes. Consequently, trying to classify their OCD as "moral" versus "non-moral" was both challenging and imprecise in some cases. Although the first and third authors nearly always agreed in their classification decisions, some cases were nevertheless challenging to classify. Finally, because of the severity of their illness, they might not be representative of most people suffering from OCD. These patients are likely much more impaired than the average patient, which may account for the high levels of guilt and shame across both subtypes of OCD.

Our results suggest a connection between emotional distress and physical pain endurance in patients with severe OCD. Although less tolerant of emotional distress, OCD patients exhibited significantly greater pain endurance than did a healthy comparison group. Potential explanations of this willingness to endure pain for longer include using physical pain as a distraction from emotional distress, expressing negative self-worth, and as a means to gain control over some aspect of suffering.

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