



Inhibitory control in people who self-injure: Evidence for impairment and enhancement



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ABSTRACT

Self-injury is often motivated by the desire to reduce the intensity of negative affect. This suggests that people who self-injure may have difficulty suppressing negative emotions. We sought to determine whether self-injuring individuals exhibit impaired inhibitory control over behavioral expressions of negative emotions, when responding to images containing aversive emotional content. Self-injuring participants and healthy controls completed a Stop Signal Task in which they were asked to judge the valence (positive or negative) of images. Three types of images depicted emotional content (neutral/positive/negative). A fourth type depicted self-cutting. An unpredictable “stop signal” occurred on some trials, indicating that participants should inhibit their responses to images presented on those trials. Compared to controls, self-injuring participants showed poorer inhibition to images depicting negative emotional content. Additionally, they showed enhanced inhibition to self-injury images. In fact, self-injuring participants showed comparable response inhibition to cutting images and positive images, whereas controls showed worse inhibition to cutting images compared to all other types of images. Consistent with the emotion regulation hypothesis of self-injury, people who self-injure showed impaired negative emotional response inhibition. Self-injuring individuals also demonstrated superior control over responses to stimuli related to self-injury, which may have important clinical implications.

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1. Introduction

Non-suicidal self-injury (NSSI) refers to deliberate self-harm without the intent to die. In a recent cross-national study, almost a quarter of adolescents reported having engaged in NSSI within the last year (Giletta et al., 2012). Although these acts themselves are “non-suicidal”, NSSI is strongly associated with suicidality. In one large randomized controlled trial for treatment-resistant depression, compared to baseline suicide attempts, NSSI was a better predictor of future suicide attempts (Asarnow et al., 2011). The prevalence and prognostic implications of NSSI have contributed to its inclusion in the latest edition of the Diagnostic and Statistical Manual of Mental Disorders (5th ed., American Psychiatric Association, 2013) as a condition warranting further research. Together, self-injurious behaviors are among the leading causes of injury and death worldwide (Nock et al., 2008).

Although people report a variety of motivations for engaging in NSSI, one functional model of self-injurious behaviors that has received considerable empirical attention suggests that they serve to regulate affect by providing escape or distraction from certain

types of negative emotions (Nock and Prinstein, 2004; Jacobson and Gould, 2007; Nock, 2009). Aversive affective states (e.g., anger, anxiety, and sadness) are frequently reported antecedents to NSSI (Nock et al., 2009), and people who engage in self-injury often experience decreases in negative emotional and psychophysiological arousal after exposure to NSSI proxies in the laboratory (Haines et al., 1995; Welch et al., 2008; Franklin et al., 2010). The emotion regulation model thus suggests that an impaired ability to self-modulate or inhibit unpleasant emotions is a central feature of NSSI. That is, according to this model, people who self-injure may possess deficits in inhibitory control over negative affect. In the current study we examined this possibility in a laboratory setting.

Relatively few studies to date have examined neuropsychological functioning in NSSI. Some researchers have found no differences between individuals who harm themselves and controls on various measures of executive functioning (Ohmann et al., 2008) or on measures of behavioral impulsivity (Janis and Nock, 2009). However, there is some evidence that currently self-injuring individuals (i.e., those who had done so in the past 30 days) make more impulsive decisions on the Iowa Gambling Task than formerly self-injuring individuals (Oldershaw et al., 2009). Despite its conceptual relevance to impulsivity, inhibition – one of the core executive functions (Miyake and Friedman, 2012) – has not been well studied in this population.

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Inhibitory control (or response inhibition) refers to the ability to halt the execution of an already initiated action (Nigg, 2000). People who report high levels of trait impulsivity exhibit poor inhibitory control, suggesting that problems controlling behavior might reflect difficulty in “stopping” processes rather than overactive approach tendencies (Logan et al., 1997). Deficient inhibitory control is characteristic of several psychiatric disorders that involve impulsive behavior, including attention deficit hyperactivity disorder (ADHD; Lijffijt et al., 2005, but see also Alderson et al., 2007) bulimia nervosa (Wu et al., 2013), and substance use disorders (Rubio et al., 2008; de Wit, 2009). Given the relatively high prevalence of self-injury in these clinical populations relative to community samples (Nock et al., 2006; Peebles et al., 2011; Hinshaw et al., 2012), it is possible that impaired inhibitory control is associated with a variety of direct and indirect self-injurious behaviors.

Only two studies have examined inhibitory control specifically in people who self-injure (Glenn and Klonsky, 2010; Fikke et al., 2011), employing the Stop Signal Task (SST; Logan et al., 1984) to assess behavioral response inhibition. On each trial in this task, participants are presented with either a right- or left-facing arrow, and must quickly press the button that corresponds to the direction of the stimulus. However, on some trials, an auditory tone (or “stop signal”) rapidly follows the arrow, indicating that the prepotent response must be withheld. Glenn and Klonsky (2010) found no differences in response inhibition between participants who self-injured and those who did not. Fikke et al. (2011) reported that adolescents engaging in “low-severity” NSSI were poorer at inhibiting initiated responses compared to those engaging in “high-severity” NSSI, but both groups performed comparably to healthy controls. Notably, no previous research has directly assessed inhibitory control over emotional responses among people who self-injure, an omission that may partially explain mixed findings in this literature. Self-injury is an action that often occurs in response to a negative emotion. Therefore, a domain of executive functioning that may be particularly relevant to NSSI is motor inhibition to stimuli that evoke unpleasant emotional reactions. Accordingly, we modified the SST to include various affective images in place of the standard arrow stimuli.

We used a laboratory-based procedure to examine differences in inhibitory control between participants who self-injured and control participants who did not. We also sought to examine the role of several variables that we believed might contribute to an association between self-injury and inhibitory control. NSSI is often conceptualized as an impulsive behavior, and it has been suggested that certain people engage in NSSI because it requires little planning or additional materials (i.e., the Pragmatic Hypothesis, Nock, 2009). Consistent with this idea, people who engage in NSSI often self-report higher levels of impulsivity (Janis and Nock, 2009; Glenn and Klonsky, 2010; Di Pierro et al., 2012). Given the link between impulsivity and inhibitory control (Logan et al., 1997), it is plausible to suggest that higher levels of impulsivity may be related to poorer emotional inhibition in people who self-injure. Additionally, stimuli related to self-injury are commonly thought to trigger NSSI urges (Lewis et al., 2011). If NSSI is an impulsive behavior, and if NSSI stimuli trigger this behavioral impulse, we might expect that NSSI stimuli would also disrupt inhibitory control. Therefore in this study we also assessed the possibility that people who self-injure would show behavioral disinhibition when confronted with NSSI-related stimuli.

Self-injurious behavior is a symptom of borderline personality disorder (BPD). However, NSSI is also common in individuals with anxiety and mood disorders (Nock et al., 2006). Evidence suggests that deficits in inhibitory control over negative emotional processing are characteristic of each of these disorders (e.g., Korfine and Hooley, 2000; Joormann and Gotlib, 2010; Hopkins et al., 2013). Thus, we additionally sought to clarify the role of these factors in negative emotional response inhibition among self-injuring individuals.

The main goal of this study was to empirically test predictions made by the emotion regulation model of self-injury, as well as to reconcile the divergent state of the literature regarding self-report and behavioral measures of impulsivity among people who self-injure. Specifically, we hypothesized that self-injuring participants would show poorer inhibitory control over their behavioral responses to negative affective stimuli. Additionally, we predicted that they would show poorer inhibitory control over their responses to NSSI stimuli. Finally, we examined associations between cognitive task performance and self-reported impulsivity, as well as symptoms of anxiety, depression, and BPD.

2. Methods

2.1. Overview of procedure

Participants were recruited from the greater Boston area over approximately three months. Printed advertisements distributed on local university campuses and online postings on the website Craigslist directed interested individuals to an online survey that collected demographic information and information about self-injury. Eligible individuals were invited to a laboratory session. In the laboratory, participants completed several self-report measures and were administered an intelligence test. They then completed a battery of computerized cognitive tasks that included the SST. All participants were provided written informed consent to a protocol approved by the Harvard University Institutional Review Board.

2.2. Participants

Participants ($N=67$) included 34 healthy controls (22 females; 12 males) and 33 people who reported self-injury (25 females; 8 males) aged 18–53 (mean age 23; see Table 1). Healthy controls reported no history of mental illness or head injury on the online survey, indicating specifically that they (a) had never received a diagnosis of or treatment for any Axis I disorder or ADHD; (b) did not use psychiatric medication; and (c) had never experienced a concussion. One female and two males reported a past suicide attempt but no deliberate destruction of body tissue. These participants were excluded from all analyses.

Self-injuring participants were identified via the following item: “Have you ever intentionally harmed yourself (e.g., cut or burn)?” Of the 33 participants who endorsed this item, 17 (51.5%) reported engaging in self-injury within the past year. Eight participants (24.2%) also reported a past suicide attempt on the Schedule for Nonadaptive and Adaptive Personality (see below) in addition to endorsing intentional self-injury on the item mentioned above. 22 self-injuring participants

Table 1
Demographic & clinical characteristics.

	HC ($n=31$)	NSSI ($n=33$)	χ^2 or t , p , Cohen's d
Sex n (%)			0.51, 0.48
Female	21 (67.74)	25 (75.75)	
Male	10 (32.26)	8 (24.24)	
Ethnicity n (%)			1.20, 0.88
White	21 (67.74)	23 (69.70)	
African-American	3 (9.68)	3 (9.10)	
Asian	3 (9.68)	5 (15.15)	
Latino/a	2 (6.45)	1 (3.03)	
Biracial/Other	2 (6.45)	1 (3.03)	
Age, years	23.71 (7.19)	22.45 (4.36)	-0.85, 0.40
WAIS Vocabulary	12.48 (3.00)	13.00 (2.89)	0.70, 0.49
BAI ^a	7.67 (8.93)	12.64 (7.30)	2.43, 0.02, 0.61
BDI-II	8.81 (7.42)	18.30 (10.51)	4.15, < 0.001, 1.04
SNAP BPD ^b	8.55 (5.42)	13.94 (5.85)	3.78, 0.001, 0.91
SNAP Impulsivity ^c	5.55 (3.95)	6.88 (4.44)	1.25, 0.22

Note. HC=healthy control group; NSSI=self-injury group; BAI=Beck Anxiety Index; BDI-II=Beck Depression Inventory-II; SNAP Impulsivity=Schedule for Nonadaptive and Adaptive Personality Scale Impulsivity Subscale; and SNAP BPD=Schedule for Nonadaptive and Adaptive Personality Scale Borderline Personality Disorder Subscale. Values are given as mean (standard deviation) unless otherwise indicated.

^a $n=30$ healthy controls, $n=33$ self-injuring participants;

^b $n=29$ healthy controls, 31 self-injuring participants; and

^c $n=29$ healthy controls, 33 self-injuring participants.

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