The affect regulation function of nonsuicidal self-injury: An experimental examination using the cold pressor test

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Nonsuicidal Self-Injury (NSSI)
- Behaviors involving the direct, deliberate destruction of one’s own body tissue in which there is no intention of death (Nock & Favazza, 2009)
  - Although distinct from suicide, individuals with a history of NSSI are seven times more likely to report making at least one suicidal gesture and six times more likely to report having a past suicide plan (Whitlock & Knox, 2007)

NSSI: Numerous behaviors
- Cutting
- Scratching
- Burning
- Biting
- Punching
- Bruising
- Applying bleach or acid
- Embedding objects
- Breaking one’s bones

Prevalence of NSSI
- Average onset occurs between 12 and 16 years of age (e.g., Heath et al., 2008; Skegg, 2005)
- Studies using a college student sample have shown that a sizeable number of participants reported first engaging in NSSI between the ages of 17 and 20 years (e.g., Whitlock et al., 2006)
- Repeated episodes of NSSI are likely to follow the initial episode (e.g., Klonsky, 2007)
Lifetime Prevalence of NSSI

Adolescents
- 40% among inpatients (Darche, 1990; Hurry, 2000)
- 13 to 23% nonclinical (Jacobsen & Gould, 2007)

Adults
- 21% inpatients (Brier & Gil, 1998)
- 4% nonclinical (Klonsky, Oltmanns, & Turkheimer, 2003)
- 11% to 38% college students (e.g., Favazza, DeRosear, & Conterio, 1989; Gratz, Conrad, & Roemer, 2002; Heath et al., 2008)

Correlates of NSSI
- Gender?
- Race and ethnicity
- Sexual orientation
- Childhood sexual abuse

Comorbidity
- Axis II
  - Borderline PD
  - Avoidant PD
  - Paranoid PD
- Axis I
  - MDD
  - Anxiety disorders
  - Substance abuse
  - Eating disorders
  - PTSD
  - V 01 Non-suicidal Self Injury in the DSM-V

Proposed functions of NSSI
- Differing theories have been used to conceptualize the potential functions of NSSI
- Overlap among proposed functions
  - NSSI behaviors may serve several purposes simultaneously (e.g., Nock & Cha, 2009; Suyemoto, 1998)
- Majority of research examining the functions of NSSI has utilized a retrospective self-report design
Affect Regulation Hypothesis
- NSSI allows individuals to express, alleviate, or control intense emotional experiences (Favazza, 1992; Gratz, 2003; Haines, Williams, Brain, & Wilson, 1995)
  - Identified as the primary function of NSSI (e.g., Brier & Gil, 1998; Klonsky, 2007)
  - Supported via retrospective self-report among a variety of populations (e.g., BPD, inpatients, college students)

Experiential Avoidance Model
- Experiential avoidance is responsible for the initiation and maintenance of NSSI behaviors (Chapman et al., 2006)
  - Experiential avoidance represents a broad class of behaviors that function to avoid or escape from unwanted internal experiences (Hayes, Wilson, Gifford, Follette, and Strosahl, 1996)
  - Decreased emotional distress tolerance is one factor believed to be associated with heightened experiential avoidance (Chapman et al., 2006)

Present Study
- Utilized a proxy for NSSI to experimentally examine the affect regulation function of these behaviors
  - Relationship between distress tolerance and NSSI
    - Examination of the relationship between these variables may allow for a better understanding of why some individuals, but not all, engage in NSSI
    - Clinical implications that may assist in the development of specific treatments for NSSI

Participants
- N = 63
  - NSSI history
    - Participants reporting engagement in NSSI at least three times in past year
      - n = 30
  - No NSSI history
    - Participants reporting no history of NSSI
      - n = 33
  - Participants randomly assigned to receive either a neutral or negative mood induction
NSSI among PSYC 102 students

- Spring 2011
  - 9.3% (n = 75) reported at least 3 NSSI episodes in past year
  - 70.2% (n = 568) reported no history of NSSI
- Fall 2011
  - 7.9% (n = 66) reported at least 3 NSSI episodes in past year
  - 71.4% (n = 597) reported no history of NSSI
- Spring 2012
  - 4.8% (n = 34) reported at least 3 NSSI episodes in past year
  - 78.6% (n = 562) reported no history of NSSI

Participants

- Undergraduate students
- Primarily female (57.1%)
- Average age of 19.21 years (SD = 1.12)
- Race/ethnicity
  - Caucasian (61.9%)
  - African American (23.8%)
  - Latino (6.3%)
  - Asian (4.8%)
  - "other" (3.2%)

NSSI History Participants

- Average number of reported episodes of NSSI in the last year was 8.13 (SD = 5.68)
- Cutting was the type of NSSI most endorsed (76%)
  - 63.3% reported severely scratching/sticking sharp objects into the skin
  - 60% reported rubbing sandpaper/dripping acid, bleach, or oven cleaner/breaking one’s bones/hitting or punching oneself so that bruises appear
  - 50% reported carving words, pictures, designs, or other marks in the skin
  - 33.3% reported biting oneself so that skin is broken

Measures

- Demographic Questionnaire (DQ)
  - Respondents asked to indicate age, gender, ethnicity, year in school
- Deliberate Self-Harm Inventory-Short form (DSHI-S; Gratz, 2001)
  - Self-report questionnaire designed to measure NSSI during lifetime and within past year
- Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988)
  - Self-report measure will ask participants to indicate how they feel during the current moment on scales of negative affect and positive affect
  - Sensitive to state mood fluctuations (Watson et al., 1988)
Measures

- Distress Tolerance Scale (DTS; Simons & Gaher, 2005)
  - Self-report questionnaire designed to measure tolerance of negative emotional states
  - Higher scores equal higher distress tolerance
- Pain threshold
  - Measured as the amount of time that participants are able to keep their hand immersed in the cold water bath
- Pain intensity
  - Measured by asking participants to provide a verbal pain rating while hand is immersed in the cold water bath
- Pain Catastrophizing Scale (PCS; Sullivan, Bishop, & Pivik, 1995)
  - Measures catastrophic thinking related to physical pain

Anagram Task

- Three minutes to solve as many anagrams as possible
  - Told that performance on this task reliable indicator of future academic and career success
- Two versions of the anagram task
  - Negative mood
  - Neutral mood
  - Three- or four-letter anagrams of high-frequency words

Cold Pressor Test (CPT)

- CPT utilizes a cold water bath and is considered an ethical, low risk technique for the induction of physical pain (e.g., Mitchell, MacDonald, & Brodie, 2004)
- Participants asked to immerse nondominant hand up to the wrist in cold water
  - Instructed to keep hand immersed in water until too much discomfort to continue
  - Asked to provide a pain intensity rating every 15 seconds and immediately following removal of the hand from water
  - Temperature ranged between 1 and 2 °Celsius

Procedure

- Informed consent
- Fixed-order packet with DQ, DTS, and PANAS (i.e., baseline NA)
- Anagram task
- PANAS (i.e., Pre-CPT NA)
- CPT
- PANAS (i.e., Post-CPT NA)
- Open-ended questions
- Debriefing
What do you think was the purpose of the study?

- No clue
- I believe the purpose of this experiment was to identify stress levels of college students when placed under different tasks.
- You first took my distress/alertness level, then put me through the word test emphasizing that if I did good I would do good in life (to see if I felt proud on the next feeling test). For the ice water part you were testing to see if people will put themselves through discomfort just because the authority told you to.

Please summarize the thoughts that occurred while your hand was in the cold water

- Thought process: 1) She wasn’t joking when she said this water was cold. 2) How long should I keep it in for? 3) I wonder if Myth Buster’s was right. 4) This is really, really cold. 5) My hand is turning red…not good. 6) Okay, it hurts really bad. 7) Tingling. 8) Glad that’s over with.
- 110 seconds
- I was thinking that the water made my hand hurt, but that it started to feel good. I was wondering how long I could keep my hand in the water and I was singing a song in my head.
- 300 seconds

Please summarize the thoughts that occurred while your hand was in the cold water

- "This is colder than I thought it would be." "This does kind of hurt." "I have to go to the bathroom." "I wish I had more sleep." "I don’t know how much longer I can hold my hand in here." "My hand went numb."
- 64 seconds
- This water is cold. And DeKalb water is very yellow. Also the 5 minute maximum was such a competitive tease.
- 47 seconds

Please summarize the thoughts that occurred while your hand was in the cold water

- "How much longer is this going to be? My hand is getting tingly and feelings like there is needles!"
- 300 seconds
- I was thinking about trying to ignore or lessen the pain and giving an accurate pain rating. I was also thinking about how the water felt like knives cutting my skin, which led me to think about horror movies (like Hostel) where stuff like that happens. Ew.
- 300 seconds
- Piano jury in an hour crap, crap, crap, crap!!! Ok go over the piece in 4/4 time [music notes]…yeah
- 300 seconds
Preliminary Analyses

- Mood induction condition
  - No group differences of gender, ethnicity, age, distress tolerance, or number of NSSI episodes in past year

- History condition
  - No group differences of gender, ethnicity, age
  - Distress tolerance differed between participants with a history of NSSI ($M = 3.09, SD = 0.67$) and those without ($M = 3.51, SD = 0.61$), $t(60) = 2.60, p < .05, d = 0.67$

Manipulation Check

- Baseline NA did not differ between mood induction groups, $F(1, 56) = 3.93, ns, d = 0.55$
- Significant difference in pre-CPT NA between participants in neutral ($M = 12.81, SD = 2.85$) and negative ($M = 17.59, SD = 5.84$) mood conditions, $F(1, 61) = 16.93, p < .01, d = 1.06$

Differential function hypothesis

- Participants with a history of NSSI who receive negative mood induction will reported a greater decrease in negative affect following the CPT compared to other participants
  - $2$ (NSSI history) x $2$ (Mood condition) x $2$ (NA Change from pre- to post-CPT) repeated measures ANOVA

- NA Change main effect
  - $F(1, 57) = 0.09, ns, d = 0.09$

- NSSI History main effect
  - $F(1, 57) = 3.24, ns, d = 0.46$

- Mood main effect
  - $F(1, 57) = 4.56, p < .05, d = 0.55$

- NA Change x History interaction
  - $F(1, 57) = 1.05, ns, d = 0.29$
Differential function hypothesis

- Mood X History interaction
  - $F(1, 57) = 0.34, \text{ ns, } d = 0.20$
- NA Change x Mood interaction
  - $F(1, 57) = 11.79, p < .01, d = 0.9$
  - LSD post hoc analyses
    - Negative affect significantly decreased from pre-CPT to post-CPT among participants in the negative mood induction group
    - Negative affect significantly increased among participants in the neutral mood induction group
- NA change x Mood x History interaction
  - $F(1, 57) = 0.11, \text{ ns, } d = 0.09$

Mood activation hypothesis (a)

- Participants with a history of NSSI who receive negative mood induction will exhibit longer CPT immersion time compared to other participants
  - 2 (NSSI History) x 2 (Mood condition) ANOVA
Mood activation hypothesis (a)

- Possible artificial ceiling for immersion time
- Reanalyzed using logistic regression with immersion time dichotomized as either 0 (less than 300 seconds) or 1 (300 seconds)
  - Overall model was significant, $\chi^2(3) = 12.88, p < .01$
  - History main effect
    - Odds ratio = 12.83, Wald = 8.73, $p < .01$
  - Mood main effect
    - Odds ratio = 1.56, Wald = 0.26, ns
  - History x Mood interaction
    - Odds ratio = 0.09, Wald = 4.28, $p < .05$

Mood activation hypothesis (b)

- Participants with a history of NSSI who receive negative mood induction will report lower average pain ratings during the CPT compared to other participants
  - 2 (NSSI History) x 2 (Mood condition) ANOVA
Mood activation hypothesis (b)

- Mood main effect
  - $F(1, 59) = 0.13, \text{ns}, d = 0.09$
- History main effect
  - $F(1, 59) = 1.18, \text{ns}, d = 0.29$
- Mood x History interaction
  - $F(1, 59) = 0.44, \text{ns}, d = 0.17$

Distress motivated immersion time hypothesis

- Relationship between CPT immersion time and pre-CPT negative affect will differ as a function of emotional distress tolerance among participants with a history of NSSI
  - Hierarchical multiple linear regression
    - Main effects simultaneously entered in Step 1
      - The two continuous variables (pre-CPT negative affect and distress tolerance) mean centered
    - Pre-CPT NA x distress tolerance interaction entered in Step 2

Hierarchical Regression Predicting Cold Pressor Test Immersion Time among NSSI History Participants

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<th>Variable</th>
<th>Δ$R^2$</th>
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<th>Step 2 Partial $r$</th>
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Note: $N = 30$. DT = Distress Tolerance Scale; Pre-CPT NA = Negative affect scale of the Positive and Negative Affect Schedule at Pre-CPT; PT = Pain Tolerance.

Distress activated analgesia hypothesis

- Relationship between average pain ratings and pre-CPT negative affect will differ as a function of emotional distress tolerance among participants with a history of NSSI
  - Hierarchical multiple linear regression
    - Main effects simultaneously entered in Step 1
      - The two continuous variables (pre-CPT negative affect and distress tolerance) mean centered
    - Pre-CPT NA x distress tolerance interaction entered in Step 2
### Hierarchical Regression Predicting Average Physical Pain Ratings among NSSI History Participants

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Note. N = 30. DT = Distress Tolerance Scale; Pre-CPT NA = Negative affect scale of the Positive and Negative Affect Schedule at Pre-CPT; PT = Pain Tolerance.

### Discussion

- **Support for the affect regulation function of NSSI**
  - Decreased negative affect following the CPT among participants who received the negative mood induction
  - Regardless of NSSI history
    - Affect regulation properties of NSSI widely applicable
    - Coping strategy differences?
  - Decreased negative affect following the CPT occurred only among participants who received the negative mood induction
  - Participants who received the neutral mood induction reported a significant increase in negative affect after the CPT

- **Among participants who received the negative mood induction, degree of change in negative affect was unrelated to NSSI history**
  - Inconsistent with the theory that repeated engagement in NSSI leads to an automatic, conditioned response to emotional arousal

- **CPT immersion time differed between groups**
  - Participants in the negative mood condition with a history of NSSI exhibited longer immersion time
  - Combination of NSSI history and high negative affect

- **Average physical pain ratings did not differ between groups**
  - A moderate degree of physical pain reported across groups
  - Inconsistent with other studies reporting that individuals endorse low or minimal levels of physical pain during NSSI (e.g., Bohus et al., 2000; Nock & Prinstein, 2005; Russ et al., 1992; Russ et al., 1999)
Discussion

- Emotional Cascade Model (Selby & Joiner, 2009) may explain findings pertaining to negative affect, immersion time, and physical pain ratings
  - Those with emotion regulation difficulties have a tendency to experience an "emotional cascade"
    - Behavioral dysregulation induced by rumination on negative affect, which leads to increased emotional intensity
  - Individuals prone to emotional cascades may be likely to rely on intense methods of distraction to reduce negative affect
    - NSSI = intense method of distraction

- Emotional distress tolerance did not moderate the relationship between negative affect and indicators of emotional distress-induced analgesia
  - Emotional distress tolerance did not moderate negative affect and immersion time
  - NSSI participants in the negative mood condition exhibited the longest CPT immersion time
  - Emotional distress tolerance did not moderate negative affect and physical pain
    - Physical pain did not differ among participant groups

Clinical implications

- Emotion regulation skills could be a component of therapeutic interventions for NSSI
  - Dialectical Behavior Therapy (Linehan, 1993)
    - Emotion Regulation module
    - Distress Tolerance module
  - Problem-solving therapy (D'Zurilla & Nezu, 2001)
    - Identification and utilization of adaptive coping and problem-solving skills
  - Attention Training Technique (Wells, 1990)
    - Strengthening of executive control

Limitations and future directions

- Generalizeability to individuals exhibiting more extreme levels of dysfunction (e.g., inpatients)
- Analogue laboratory study
- Single measure of emotional distress tolerance
- Emotional distress tolerance only one component of EAM of NSSI
  - Use measures specific to experiential avoidance
- Further investigation of physical pain during NSSI
Conclusions

• Affect regulation function of NSSI supported
• NSSI alleviates high negative affect, even among individuals with no prior NSSI history
• Findings of CPT immersion time suggest the combined importance of NSSI history and high negative affect
• Differences in immersion time, none in physical pain
  • Emotional cascade theory
    • Some individuals require physically intense methods to disengage from strong emotional distress
• Emotional distress tolerance did not moderate the relationship between negative affect and emotional distress-induced analgesia