Effects of emotion regulation strategies on smoking craving, attentional bias, and task persistence

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ABSTRACT

The goal of this study was to investigate the effects of different strategies for regulating emotions associated with smoking on subjective, cognitive, and behavioral correlates of smoking. Emotion regulation was manipulated by instructing participants to reappraise ($n = 32$), accept ($n = 31$), or suppress ($n = 31$) their emotions associated with smoking. The dependent measures included subjective reports of craving, negative affect, and attentional biases, as measured by a modified dot-probe task, and persistence during a task to measure distress tolerance. Individuals who were encouraged to reappraise the consequences of smoking showed diminished craving, lower negative affect, had reduced attentional biases for smoking-related cues, and exhibited greater task persistence than those who were instructed to accept and suppress their urge to smoke. These findings suggest that reappraisal techniques are more effective than acceptance or suppression strategies for targeting smoking-related problems.

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Cigarette smoking is a common and serious health problem, with craving being an important reason for the maintenance of this problem. In fact, between 85% and 95% of people resume smoking within 12 months without a formal intervention (Garvey, Bliss, Hitchcock, Heinold, & Rosner, 1992). Of those who did receive treatment, more than 75% resume smoking within 6 months (Ferguson, Bauld, Chesterman, & Judge, 2005), possibly due to an inability to tolerate the distress of nicotine withdrawal and associated negative affect and craving (Brown, Lejuez, Kahler, Strong, & Zvolensky, 2005; see also Hajek, Stead, West, Jarvis, & Lancester, 2009, pp. 1–91). At the same time, treatments that specifically target craving are more effective than those that do not (McDonald, Colwell, Husten, & Maule, 2003; Piasecki & Baker, 2001; Shiffman, 1993).

Craving is an affective state that reflects the activation of motivational and drug-acquisitive systems that are associated with specific subjective, behavioral, physiological and cognitive correlates (Baker, Morse, & Sherman, 1987; Sayette, Martin, Hull, Wertz, & Perrot, 2003). Craving is likely to arise when substance users are exposed to substance-related cues (Baker et al., 1987; Carter & Tiffany, 1999; Perkins, Epstein, Grobe, & Fonte, 1994). Furthermore, craving and the negative affect associated with nicotine

withdrawal have been shown to predict future relapse (DiFranza & Wellman, 2005; Doherty, Kinnunen, Militello, & Garvey, 1995; Orleans, Rimer, Cristinzio, Keintz, & Fleisher, 1991). These motivational and cognitive aspects of drug use are strongly coupled in active smokers, but become uncoupled in individuals who are trying to quit (Tiffany, 1990).

Closely associated with craving are attentional biases toward drug cues (Bradley, Field, Mogg, & De Houwer, 2004; Chanon, Sours, & Boettiger, 2010; Ehrman et al., 2002; Field & Cox, 2008; Franken, Kroon, Wiers, & Jansen, 2000; Mogg, Bradley, Field, & De Houwer, 2003). It has been suggested that craving can enhance these attentional biases toward substance-related cues, which may then further increase craving (Field & Cox, 2008) and the likelihood of relapse (Cox & Klinger, 1988, 2004; Field & Cox, 2008; Franken, 2003; Kavangh, Andrade, & May, 2005). Other studies, however, suggest that attentional biases for substance-related cues are only weakly associated with current substance craving level (Field, Munafo, & Franken, 2009).

Reducing craving and cigarette smoking can be effectively approached by employing cognitive regulation strategies, suggesting that cognitive down-regulation of craving involves neural dynamics parallel to those involved in emotion regulation in particular and cognitive control in general (Delgado, Gillis, & Phelps, 2008; Kober, Mende-Siedlecki, Kross, Weber, Mischel, Hart, & Ochsner, 2010). For example, it has been shown that cigarette craving can be significantly reduced when participants were asked

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to focus on the long-term negative consequences associated with smoking (Kober, Kross, Mischel, Hart, & Ochsner, 2010).

When trying to quit, smokers typically experience several nicotine withdrawal symptoms associated with significant physical and psychological discomfort (Hughes, Higgins, & Hatsukami, 1990). This often increases the likelihood of early relapse in an attempt to avoid or escape these distressing symptoms (Baker, Piper, McCarthy, Majeskie, & Fiore, 2004; Brown, Lejuez, Kahler, & Strong, 2002; Brown et al., 2005). Therefore, successful smoking cessation will require distress tolerance and persistence (Brown et al., 2005). This is also evident in smoking-unrelated tasks, because persistence across various behavioral tasks (e.g., mirror tracing, paced auditory serial addition) is related to length of abstinence from cigarette smoking (Brandon et al., 2003; Brown, et al., 2002). For example, a study by Brown et al. (2002) showed that smokers who were abstinent for 3 months were more persistent on these tasks than those who had never quit.

There is further evidence to suggest that cognitions can influence the task persistence that is necessary for successful cessation. Consistent with the general emotion regulation literature (e.g., Bargh & Williams, 2007; Gross, 1998, 2002; Gross & John, 2003; Gross & Thompson, 2007; Hofmann, Sawyer, Fang, & Asnaani, in press; Hofmann, Sawyer, Witt & Oh, 2010; Ochsner & Gross, 2008) and recent literature on emotion regulation in other addictive behaviors (Berking et al., 2011), the experience of craving and negative affect following withdrawal can be down-regulated through cognitive strategies. According to the emotion-generative process model by Gross et al. (Gross, 1998, 2002; Gross & John, 2003), emotions can be regulated by either manipulating the input to the system (antecedent-focused emotion regulation) or by manipulating the output of the regulation process (response-focused emotion regulation). Cognitive reappraisal techniques are in line with antecedent-focused strategies and are routinely applied in cognitive-behavioral therapy (CBT), whereas suppression or acceptance strategies may be conceived as response-focused strategies (Hofmann & Asmundson, 2008; Hofmann, Asmundson, & Beck, in press).

Acceptance techniques are a feature of Acceptance and Commitment Therapy (ACT; Hayes, Strohsahl, & Wilson, 1999) and involve active acceptance of private events without attempts to change them. Based on this model, maladaptive behaviors associated with substance use disorders are maintained through negative reinforcement by the temporary relief they provide from uncomfortable sensations, thoughts, or emotions (Hayes, Wilson, Gifford, Follette, & Strosahl, 1996). Consistent with this approach, Bowen and Marlatt (2009) compared the effect of mindfulness-based "urge-surfing" instructions to naturally-used coping techniques on negative affect, smoking-related urges and behavior in undergraduate smokers. No significant differences in smoking urges were found, but results indicated that frequency of smoking cigarettes decreased over a 7-day follow-up period in the mindfulness group compared to the control group (Bowen & Marlatt, 2009).

Another study expanded these findings by including a suppression-instructed group (Rogojanski, Vettese, & Antony, 2011). Participants in both the mindfulness-based and suppression conditions reported significant reductions in amount of smoking and increased self-efficacy in coping with smoking urges, but only participants in the mindfulness group reported beneficial effects on nicotine dependence and emotional functioning at the 7-day follow-up. Frequent use of suppression was also found to be associated with longer smoking history and greater attentional bias to smoking cues on an Emotional Stroop Task, compared to frequent use of reappraisal, which was found to be associated with lower expectancies that smoking alleviates unpleasant feelings, greater positive mood, and fewer depressive symptoms (Fucito, Juliano, & Toll, 2010).

Several laboratory experiments have compared reappraisal techniques and suppression strategies in regulating negative emotions (Gross, 2002; Gross & John, 2003; Hofmann, Heering, Sawyer, & Asnaani, 2009; Szasz, Szentagotai, & Hofmann, 2011). These studies have shown that suppression is typically associated with greater physiological arousal and negative affective consequences than reappraisal strategies. Several studies have also shown acceptance strategies are more effective at moderating distress in patients with panic attacks (Eifert & Heffner, 2003) and other individuals with clinical anxiety or depression (Campbell-Sills, Barlow, Brown, & Hofmann, 2006a,b) than attempts to suppress emotions.

The goal of this study was to examine the comparative effects of reappraisal, acceptance, and suppression strategies for regulating emotions associated with smoking on the subjective, cognitive, and behavioral correlates of smoking. Based on the existing literature, we predicted that suppression will be associated with the most craving, higher levels of negative affect, greater attentional bias to smoking cues in a dot-probe task, and diminished persistence during a mentally challenging task. The cognitive model further predicts that reappraising the consequences of smoking is associated with the least craving, negative affect, attentional biases to smoking cues, and the longest task persistence of a distressing task. In contrast, an acceptance-based model predicts that acceptance is associated with the least craving, negative affect, attentional biases to smoking cues, and longest task persistence.

Method

Participants

Participants were 94 undergraduate students (88.3% female) from Babeş-Bolyai University recruited through an online announcement that sought volunteers "who want to quit, but still smoke" and who smoked more than 10 cigarettes per day. We recruited smokers who were trying to quit because we assumed that these individuals are in a vulnerable stage that makes them particularly responsive to experimental inductions of different emotion regulation strategies. Participants' ages ranged from 19 to 49 (mean age = 23.02, SD = 5.71). On average they smoked 18.62 cigarettes per day (SD = 7.13, range = 10–25) and had been smoking for 5.88 years (SD = 4.93, range = 1–30 years). They reported having attempted to quit smoking on average 2.47 times (SD = 1.71, range = 1–8 quit attempts) and the range of time elapsed since smoking their last cigarette was between 50 and 175 min. Participants received course credit for participating in this study. Informed consent was obtained from each participant.

Measures

Fagerström Test of Nicotine Dependence (FTND)
The FTND is a widely used self-report questionnaire on nicotine dependence (Heatherton, Kozlowski, Frecker, & Fagerström, 1991). Participants rate their smoking behavior on six questions (e.g., "Do you find it difficult to refrain from smoking in places where it is forbidden?").

Questionnaire on Smoking Urges-Brief (QSU-Brief; Cox, Tiffany, & Christen, 2001)
The 10-item QSU-Brief is a self-report measure designed to assess urges and cravings to smoke, with higher scores indicating stronger urges. The scale consists of two clearly distinguishable underlying factors, which can be described as "the desire and intention to smoke with an anticipation of pleasure from smoking" and "the relief from nicotine withdrawal or negative affect with an urgent and overwhelming desire to smoke". The scale showed good