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Brief Report

Cognitive Reappraisal and Expressive Suppression Emotion Regulation Strategies in Cigarette Smokers

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Abstract

Introduction: Negative affect is an important psychological factor in the promotion and maintenance of cigarette smoking, though the underlying factors that account for this relationship remain to be determined. One possible mechanism may be smokers' emotion regulation strategies. Preliminary research among adolescents and young adults suggests that greater utilization of expressive suppression versus cognitive reappraisal is associated with higher rates of smoking initiation. There is limited research, however, on the role of emotion regulation strategies in smoking maintenance in adult smokers.

Methods: Data from participants in a laboratory study (N = 121) were used to examine whether utilization of cognitive reappraisal and/or expressive suppression were related to smoking characteristics and subjective (i.e., mood, urge to smoke ratings) and behavioral reactions (i.e., Emotional Stroop Task performance, smoking behavior) to a mood induction procedure. Data were evaluated for the full sample and subsample who endorsed current depressive symptoms (n = 46).

Results: Frequent reappraisal was associated with weaker expectancies that smoking alleviates unpleasant feelings, greater positive mood, and fewer depressive symptoms. In contrast, frequent suppression was related to longer smoking history and greater attentional bias to smoking cues on an Emotional Stroop Task. Among the depressed subsample, reappraisal moderated the effect of mood condition on smoking duration, number of cigarette puffs, and carbon monoxide boost.

Conclusions: These results provide preliminary support that emotion regulation strategies may be associated with motivational correlates of smoking as well as actual smoking behavior among depressed smokers.

Introduction

The escape and avoidance of negative emotional states is theorized as a primary motive for cigarette smoking (Brandon, 1994). Smoking rates and nicotine dependence levels are elevated among individuals with a history of depression or anxiety (Lasser et al., 2000). Negative affect has been shown to increase smoking urge, latency to smoke, and cigarette puffs in laboratory studies (Conklin & Perkins, 2005; Fucito & Juliano, 2009; Juliano & Brandon, 2002). Smokers often report strong expectancies that smoking alleviates unpleasant emotions and greater smoking motivation in response to negative mood (Copeland, Brandon, & Quinn, 1995; Spielberger, 1986). Moreover, increased negative affect upon cessation is a common relapse precipitant (Brandon, Tiffany, Obremski, & Baker, 1990; Shiffman & Waters, 2004).

Though negative affect and smoking are associated, the mechanisms of this relationship remain to be determined. Cognitive factors such as information processing and expectancies may play a role. Negative mood enhances smokers' attentional bias to smoking cues compared with neutral cues (Bradley, Garner, Hudson, & Mogg, 2007) and nicotine, relative to placebo, and has been shown to reduce smokers' attentional bias to negative affect–related stimuli on a modified Stroop Task (Rzetelny et al., 2008). Likewise, smokers who maintain strong negative affect reduction expectancies may exhibit greater motivation to smoke in response to negative mood and greater affective relief from smoking (Juliano & Brandon, 2002; Schleicher, Harris, Catley, & Nazir, 2009).

Difficulty managing negative emotions may also contribute to this relationship. Individuals differ in their general emotion regulation abilities and use of specific strategies, and these differences have implications for adaptation and well-being (Gross, 2002; Gross & John, 2003; Lopes, Salovey, & Straus, 2003). Emotion regulation can be broadly categorized into antecedent-focused strategies that occur before emotions have been generated or response-focused strategies that occur afterward (Gross, 2002). Cognitive reappraisal, an antecedent-focused strategy, involves reevaluating a situation to influence its emotional impact and may reduce both the experience and the consequences of negative emotions (Gross & John). Expressive suppression, a response-focused strategy, entails inhibiting the expression of ongoing emotions once they have been generated

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(Gross & John). It also reduces the experience of negative emotions, but at greater costs, by limiting cognitive resources to systematically evaluate decisions (e.g., to smoke or not). Frequent suppression is associated with memory decrements (Richards & Gross, 2000) and poor psychological and physical health (Gross & John; John & Gross, 2004) and thus is considered a poor regulatory style. The two strategies appear to be independent in that habitual use of reappraisal is unrelated to suppression utilization (Gross & John).

Smokers may be less effective modulating the intensity of negative emotional states (e.g., infrequent reappraisal) or may utilize strategies that reduce resources to resist smoking (e.g., frequent suppression). Research on smoking initiation among adolescents and young adults supports this notion. Frequent suppression is predictive of both being a smoker and earlier smoking initiation (Magar, Phillips, & Hosie, 2008). The results of one study among adults suggest that smokers can competently regulate their emotions in response to a brief stressor when instructed (Piper & Curtin, 2006). Nevertheless, it remains to be determined whether different emotion regulation strategies are related to smoking maintenance in adults.

The current investigation examined adult smokers' use of reappraisal and suppression as assessed by the Emotion Regulation Questionnaire (ERQ; Gross & John, 2003), which was administered during a previously reported smoking laboratory study (Fucito & Juliano, 2009). The original study compared the effects of a *sad* versus *neutral* mood induction on smoking behavior. No mood induction effect was found for the entire sample; however, among depressed participants, sad mood resulted in greater smoking behavior than neutral mood. Therefore, smokers' emotion regulation strategies were examined as potential moderators of mood induction effects among the full sample and depressed subsample. It was hypothesized that infrequent reappraisers and/or frequent suppressors would demonstrate greater decreases in positive mood as well as greater attentional bias to smoking cues and smoking behavior in response to sad mood than neutral mood compared with frequent reappraisers and/or infrequent suppressors.

Methods

Participants

This is a secondary analysis of data from a laboratory study comparing the effects of sad versus neutral induced moods in adult smokers (Fucito & Juliano, 2009). Eligibility requirements included being ≥18 years old and smoking ≥10 cigarettes/day for ≥1 year. One hundred and twenty-one participants (61 men and 60 women) were mostly Caucasian (45%) and Black (44%), had a mean age of 33.78 (SD = 14.84) years, smoked an average of 15.10 (SD = 5.98) cigarettes/day for a mean of 14.51 (SD = 13.54) years, and had a mean score of 12.93 (SD = 9.28) on the Beck Depression Inventory (BDI)-II (38% [n = 46] met the cutoff score of ≥14, indicative of mild or greater depressive symptoms).

Measures

Breath carbon monoxide (CO) samples, collected before and after smoking, measured smoke inhalation during the experiment. All measures and tasks were administered via computer. Baseline measures included a demographic and smoking history questionnaire; the Fagerström Test for Nicotine Dependence (FTND; Heatherton, Kozlowski, Frecker, & Fagerström, 1991); the Smoking Consequences Questionnaire—Adult (Copeland et al., 1995); the BDI-II (Beck, Steer, & Brown, 1996); and the ERQ (Gross & John, 2003). Measures administered at baseline, postfilm, and postsmoking included the Urge Rating Scale (Kozlowski, Pillitteri, Sweeney, Whitfield, & Graham, 1996) and the Mood Scale (Dierner & Emmons, 1984). The negative affect subscale of the Mood Scale had poor internal consistency in this study (alpha coefficients ranged from .31 to .59 across the three timepoints), so analyses are limited to the 5-item positive affect subscale.

ERQ (Gross & John, 2003) is a 10-item measure of emotion regulation strategies on a 7-point scale (1 = *strongly disagree* and 7 = *strongly agree*), yielding two independent subscales for cognitive reappraisal and expressive suppression with adequate reliability. Frequent reappraisal, compared with frequent suppression, is associated with greater positive mood, social functioning, and psychological well-being and lower negative mood (including depressive symptoms) compared with frequent suppression. Alpha coefficients for reappraisal and suppression were .83 and .79, respectively. The two factors had a small to moderate correlation, $r(121) = .20$, $p = .03$.

An Emotional Stroop Task, administered postfilm, assessed attentional bias to smoking cues. Participants viewed smoking-related (e.g., ashtray) or neutral words (e.g., clock) presented one at a time on a computer screen in one of four colors and immediately pressed a color-coded key to identify the word ink color. Smoking-related and neutral words were presented in counterbalanced blocks (Waters & Sayette, 2006; Waters, Sayette, & Wertz, 2003). Reaction time (RT) to key press was recorded in milliseconds. Incorrect RTs and RTs <100 or >1,500 ms were discarded. Standard interference scores were derived based on the difference between the average RT for smoking-related words and neutral words (Waters et al.).

Procedure

Participants attended one laboratory visit. They were instructed to smoke their last cigarette 1 hr prior to their appointment and to bring one of their cigarettes with them. As described in the original report (Fucito & Juliano, 2009), we were interested in whether exposure to an acute external stressor under minimal smoking deprivation conditions would affect immediate smoking motivation postexposure. A 1-hr deprivation requirement was selected to enhance ecological validity of the scenario as well as the effectiveness of the mood induction procedure, given that prior smoking laboratory studies have shown that smoking prior to a stressor (Fleming & Lombardo, 1987; Hatch, Bierner, & Fisher, 1983; Willner & Jones, 1996) has different effects on stress/negative affect than that after stress induction (Conklin & Perkins, 2005).

Participants first completed baseline measures and provided a breath CO sample. Participants were then randomly assigned to view one of two standardized film clips in order to elicit sad (n = 61) and neutral moods (n = 60; Rottenberg, Ray, & Gross, 2007). They then completed postfilm measures followed by the Emotional Stroop Task. Participants were next instructed by the computer to smoke one of their own cigarettes

ad libitum. Experimenters observed participants through a one-way mirror and recorded latency to smoke, smoking duration, and the number of cigarette puffs. Naturalistic observation was used so as not to interfere with smoking reinforcement (Conklin & Perkins, 2005). After smoking, participants completed postsmoking measures and provided a final breath CO sample.

The mood manipulation was successful. Participants exposed to the sad condition reported a greater decrease in positive mood ratings from baseline to postfilm on the Mood Scale compared with those exposed to the neutral condition ($p < .001$). At the end of the study, participants completed a standardized film questionnaire. Participants in the sad condition reported feeling more unhappiness and sadness as well as less happiness and joy in response to the film than those in the neutral condition (p's < .001). The primary results demonstrated that smoking duration and number of cigarette puffs was greater in response to the sad condition than to the neutral condition among participants with higher baseline depression scores and that changes in positive mood partially mediated this effect (p's < .05).

More detailed information regarding procedures and findings are reported in the original paper (Fucito & Juliano, 2009).

Statistical Analysis

Analyses were conducted using SPSS 16 for Windows. Pearson correlations were used to evaluate associations among reappraisal, suppression, and baseline mood, depression, expectancies, nicotine dependence, and smoking characteristics. Reappraisal and suppression were also evaluated as potential moderators of the mood induction among the full sample ($N = 121$) and depressed subsample ($n = 46$). Linear mixed models examined the effects of reappraisal, suppression, and mood condition on positive mood and smoking urge over time (i.e., baseline, postfilm, and postsmoking). Linear regression analyses examined the effects of reappraisal, suppression, and mood condition on Stroop interference scores, smoking latency and duration, cigarette puffs, and baseline to postsmoking changes in CO. Smoking analyses were conducted with and without controlling for baseline FTND scores. The results were similar, so we report results without controlling for dependence. Mixed and regression models were fitted in steps. In Step 1, mood condition and reappraisal or suppression scores were entered. In Step 2, the two-way interaction of condition and reappraisal or condition and suppression was entered. Simple slope analyses were conducted for significant moderator effects (Holmbeck, 2002).

Results

There were no baseline differences between mood conditions on key study variables, including ERQ factor scores.

Correlations Among ERQ Factors and Smoking and Mood Constructs

At baseline, frequent reappraisal was associated with smoking fewer cigarettes, $r(121) = -.18$, $p = .045$; weaker expectancies that smoking reduces negative affect, $r(121) = -.28$, $p = .002$ and boredom, $r(121) = -.20$, $p = .03$, less depression, $r(121) = -.41$, $p < .001$; and greater positive mood, $r(121) = .36$, $p < .001$. In contrast, frequent suppression was positively correlated with number of years smoking, $r(121) = .25$, $p = .006$. Reappraisal and suppression were not associated with nicotine dependence or CO; suppression was unrelated to depression and positive mood.

ERQ Factors as Moderators of Reactions to Mood Induction

Positive Mood and Smoking Urge

Reappraisal scores and mood condition had a significant interaction on positive mood among all smokers and the depressed subsample, $F(2, 117) = 4.68$, $p = .03$; $F(2, 42) = 7.40$, $p = .009$. Frequent reappraisers in the neutral condition reported greater positive mood than frequent reappraisers in the sad condition ($\beta = .06$; $\beta = .09$). Suppression was unrelated to positive mood; reappraisal and suppression were not associated with smoking urge.

Attentional Bias to Smoking Cues

Among all smokers and the depressed subsample, frequent suppressors exhibited greater interference to smoking-related words relative to neutral words ($\beta = .19$; $t = 2.04$, $p = .04$; $R^2 = .05$; $\beta = .32$; $t = 2.24$, $p = .03$; $R^2 = .13$). Suppression and mood condition did not interact; reappraisal was not associated with interference scores among both samples.

Smoking Behavior

Among all participants, reappraisal and suppression scores were not associated with latency to smoke, total time smoked, number of cigarette puffs, or changes in CO. However, among depressed smokers, reappraisal and mood condition had a significant interaction on total time smoked ($\beta = .55$; $t = 3.36$, $p = .002$; $R^2 = .39$), number of cigarette puffs ($\beta = .40$; $t = 2.15$, $p = .04$; $R^2 = .22$), and CO changes ($\beta = -.48$; $t = -2.04$, $p = .047$; $R^2 = .10$). Simple slope analyses demonstrated that the effect of reappraisal scores on smoking outcomes was observed in the sad condition but not in the neutral condition. Specifically, in response to sad mood, frequent reappraisers smoked significantly longer ($\beta = .59$, $p = .004$) and took nonsignificantly more cigarette puffs ($\beta = .38$, $p = .089$), whereas infrequent reappraisers experienced a nonsignificant greater boost in CO from smoking ($\beta = -.40$, $p = .096$) (see Figure 1).

Discussion

Consistent with prior investigations in nonsmoking samples (Gross & John, 2003), ERQ factors were associated with ratings of mood and depression. Across all smokers and the depressed subsample, frequent reappraisers exhibited greater positive mood overall and in response to the neutral condition relative to the sad condition. These results correspond with prior research in nonsmokers in which high reappraisers tend to exhibit greater positive affect and psychosocial functioning than low reappraisers (Gross, 2001; Gross & John; Mauss, Cook, Cheng, & Gross, 2007).

Nevertheless, frequent and infrequent reappraisers in both samples experienced similar positive affect reductions in response to the sad condition. Though a causal explanation is outside the scope of this investigation, the results suggest several hypotheses for further study. Smokers may be less effective modulating the intensity of negative emotions than nonsmokers. Previous research demonstrating that ex-smokers have greater

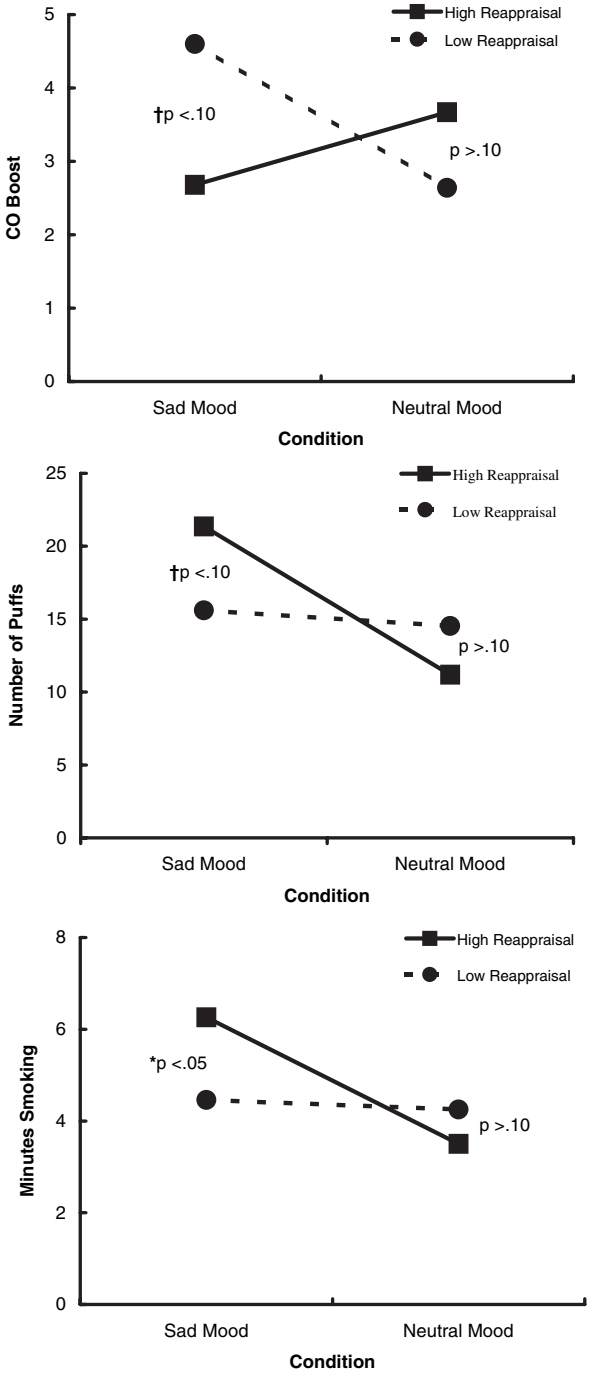

Figure 1. Smoking outcomes as a function of mood condition and Emotion Regulation Questionnaire reappraisal scores among depressed subsample ($n = 46$).

stress coping skills than current smokers provides some support for this hypothesis (Abrams et al., 1987; Carmody, Vieten, & Astin, 2007; Kamarck & Lichtenstein, 1988; Matheny & Weatherman, 1998). It is also possible that smokers did not regulate their emotions despite experiencing affect changes in response to the mood induction procedure. Future research should investigate whether reappraisal and suppression scores are predictive of smokers' actual use of these strategies. Although smokers can effectively suppress, maintain, and enhance unpleasant emotions upon instruction (Piper & Curtin, 2006), it remains to be determined if smokers can successfully utilize reappraisal strategies.

Reappraisal and suppression were also related to smoking characteristics. Frequent reappraisers reported lower boredom and negative affect reduction smoking expectancies. In contrast, frequent suppressors reported a longer history smoking and demonstrated greater attentional bias to smoking cues on the Emotional Stroop Task. These results correspond with research in young adults that showed reappraisal and suppression were differentially associated with smoking status and age of smoking initiation (Magar et al., 2008). The findings also expand upon this research by demonstrating a relationship between these strategies and important motivational correlates of smoking.

Stroop performance may have only been associated with suppression scores for several reasons. The Stroop is cognitively demanding in that color naming requires more attentional resources than reading colors (Waters & Sayette, 2006). Suppression has greater cognitive costs including limited attentional control compared with reappraisal (Gross & John, 2003). Thus, smokers who frequently use suppression may render themselves less capable of resisting smoking urges (Baker, Piper, McCarthy, Majeskie, & Fiore, 2004; Magen & Gross, 2007). Further research on smokers' attentional processes and emotion regulation strategies is warranted.

Emotion regulation strategies were unrelated to actual smoking outcomes among all smokers. However, among depressed smokers, reappraisal scores and condition had an interactive effect on smoking outcomes. Frequent reappraisers took longer to smoke their cigarette and took more cigarette puffs in response to the sad condition compared with infrequent reappraisers. In contrast, infrequent reappraisers demonstrated a greater boost in CO in response to sad mood than frequent reappraisers. Taking longer to smoke and taking more puffs may indicate lower smoking motivation among high reappraisers, though a more comprehensive assessment of smoking topography is needed to test this hypothesis. The finding that infrequent reappraisers had greater smoking exposure (i.e., higher increases in CO) than frequent reappraisers provides preliminary support for this notion. More research on the potential role of emotion regulation strategies in promoting smoking among depressed smokers is warranted as the smoking results may appear somewhat inconsistent (i.e., greater puffs may reflect higher rather than lower smoking motivation).

We recruited a diverse sample of male and female smokers. Potential gender and/or racial/ethnic differences may have confounded self-report and smoking behavioral data. Prior research has shown that men and racial/ethnic minority populations score higher on the ERQ suppression subscale (Gross & John, 2003). Moreover, smoking motivation and behavior may vary by gender and race/ethnicity. Women may be more influenced by nonnicotine factors of smoking (Perkins, Donny, & Caggiula, 1999; Perkins et al., 2006), respond differently to smoking cues (Field & Duka, 2004), be more likely to attribute their smoking to negative mood reduction (Brandon & Baker, 1991; Livson & Leino, 1988), and have greater difficulty quitting than men (Gritz, Neilsen, & Brooks, 1996; Perkins et al., 1999). Similarly, Hispanic and/or Black smokers may differ from White smokers on several nicotine dependence criteria (Daza et al., 2006), nicotine intake and metabolism (Pérez-Stable, Herrera, Jacob, &

Benowitz, 1998), and smoking cessation intentions and success (Daza et al.; Gilpin & Pierce, 2002). These differences may have affected the strength of the association between ERQ scores and smoking-related outcomes. More research is needed to determine whether emotion regulation strategies are related to smoking motivation among all smokers or only certain smoking subpopulations.

Several additional study limitations should be noted. Emotion regulation strategies were not manipulated, reappraisal and suppression scores were based on self-reports, emotion regulation strategies only accounted for a small percentage of outcome variance, no correction was made for multiple comparisons as this was an exploratory secondary analysis, the standardized assessment of negative affect was not reliable, and smoking outcomes were based on naturalistic observation. Moreover, variability in smoking outcomes may have been reduced by having participants only smoke one cigarette at a specific time during the experiment or possible uncontrolled nicotine withdrawal due to a 1-hr deprivation period.

This study provides preliminary support that adult smokers' emotion regulation strategies may be related to smoking maintenance, particularly among those vulnerable to depression. More research is needed to better understand the link between emotion regulation strategies and smoking, if smokers are less effective than nonsmokers regulating their emotions and if these potential deficits can be remedied through interventions.

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Declaration of Interests

None declared.

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