Effect of Suppressing Thoughts of Desire to Smoke on Ratings of Desire to Smoke and Tobacco Withdrawal Symptoms

James A. K. Erskine¹, David Rawaf¹, Sophie Grice¹, and Michael Ussher¹

Abstract

Studies indicate that while suppressing smoking thoughts increases subsequent smoking, it may have no impact on desire to smoke. However, previous research has examined suppression of general smoking thoughts rather than thoughts specifically related to desire to smoke. The present study investigated whether suppression of thoughts of desire to smoke results in subsequently elevated ratings of desire to smoke. An experimental study examined the effects of suppressing thoughts of desire to smoke, versus expressing thoughts of desire to smoke, versus a control group thinking about anything, on ratings of desire to smoke and tobacco withdrawal symptoms at four time points (before manipulations, just after manipulations, 5 min after, 10 min after). In addition, effects of suppressing thoughts of desire to smoke on subsequent reports of thoughts of desire to smoke were examined. Suppressing the thoughts of desire to smoke caused thought rebound (i.e., greater subsequent reports of thoughts of desire to smoke). However, compared with control groups, this suppression did not elevate subsequent ratings of desire to smoke. Suppressing the thoughts of desire to smoke does not elevate subsequent ratings of this desire. Increased cigarette consumption following suppression of smoking thoughts may be mediated by mechanisms other than increased desire to smoke.

Keywords

smoking, tobacco, cravings, withdrawal, thought suppression

Introduction

Thought suppression (i.e., trying not to think about something) may cause a post-suppression rebound effect, whereby the individual comes to think about the to-be-avoided thought more often rather than less often (Clark, Ball, & Pape, 1991; Wegner, Schneider, Carter, & White, 1987). Furthermore, thought suppression may increase behavior associated with the suppressed thought (Erskine & Georgiou, 2011). For example, suppressing thoughts of food may increase subsequent food consumption (Erskine, 2008; Erskine & Georgiou, 2010).

Similarly, suppression of smoking thoughts can increase thinking about smoking (Salkovskis & Reynolds, 1994) and cigarette consumption (Erskine, Georgiou, & Kvavilashvili, 2010), and can make quitting more difficult (Toll, Sobell, Wagner, & Sobell, 2001). Erskine et al. (2010) postulated that suppression may exacerbate cigarette cravings, increasing desire to smoke and smoking behavior. Some studies have not found an association between thought suppression and increased smoking (Haaga & Allison, 1994; Nosen & Woody, 2009; Rogojanski et al., 2011a, 2011b). However, these studies are limited in that they did not differentiate between suppressing thoughts of smoking specifically or other thoughts (Haaga & Allison, 1994; Nosen & Woody, 2009; Rogojanski et al., 2011a, 2011b). In addition, Litven, Kovacs, Hayes, and Brandon (2012) observed that both suppression and acceptance strategies were associated with less craving and affect compared with the controls. However, this study was limited as all experimental manipulations occurred in the presence of the to-be-avoided or accepted stimulus.

In a study examining the effects of frequency of suppressing smoking thoughts, Nosen and Woody (2013) revised the White Bear Suppression Inventory (WBSI; Wegner & Zanakos, 1994), measuring everyday use of thought
suppression to make a specific smoking measure (termed the 
WBIS smoking version, with two subscales—thought intru-
sion and suppression). The intrusion subscale and the overall 
scale were related to increased craving, smoking urges, and 
negative affect. The suppression subscale was related to 
greater use of distraction, reappraisal, punishment, and 
worry, but was not related to the urge to smoke or negative 
affect. Higher scores on the measure were found in quitting 
smokers relative to continuing smokers.

As the desire to smoke is a good predictor of smoking 
relapse (Allen, Bade, Hatsuaki, & Center, 2008; Hughes, 
2006; Killen & Fortmann, 1997; West & Grunberg, 1991; 
West, Hajek, & Belcher, 1989) and thought suppression is a 
common smoking cessation strategy (Nosen & Woody, 2013; 
Salkovskis & Reynolds, 1994; Toll et al., 2001), it is impor-
tant to investigate whether suppression of smoking thoughts 
can lead to stronger subsequent desire to smoke, as theoretici-
ally this could increase relapse.

Despite the finding that suppressing smoking thoughts 
resulted in greater subsequent smoking (Erskine et al., 2010), 
a follow-up study demonstrated that suppressing smoking 
thoughts did not lead to increased desire to smoke, although 
participants did report greater hunger (Erskine et al., 2012). 
However, participants in the suppression condition were 
asked to suppress “their thoughts about smoking” rather than 
thoughts about their desire to smoke. Erskine and colleagues 
concluded that either thought suppression results in increased 
cigarette consumption without elevated desire to smoke or 
the specific content that is suppressed is critical to the eleva-
tion of this desire. The concept of desire to smoke is likely to 
be broader than mere thoughts about smoking. Therefore, to 
equate the desire for something with thought about it may 
miss important components of desire, such as more physio-
logical signals and emotions (Kavanagh, Andrade, & May, 
2005).

In view of these differences, it is significant that the pre-
vious study of Erskine et al. (2012) had participants sup-
press smoking thoughts and examine the effect on desire to 
smoke. It is possible that suppressing smoking thoughts 
elevates subsequent smoking thoughts but does not neces-
sarily activate the emotional aspects of desire to smoke. 
Therefore, the present study was designed to extend Erskine 
et al.’s (2012) study by investigating whether suppression of 
“thoughts of the desire to smoke” leads to subsequently 
elevated desire to smoke or tobacco withdrawal symptoms, 
relative to groups either expressing the desire to smoke or 
thinking anything they wished. Furthermore, the present 
study aimed to investigate desire to smoke over several 
time points.

In addition, the study investigated several questionnaire 
measures thought to be associated with suppression of smok-
ing thoughts and cravings. These were as follows: a general 
measure of the frequency of use of thought suppression, a 
measure of mindfulness, and a measure of how many partici-
pants attempt to restrain their smoking behavior.

It was predicted that suppression of thoughts of the desire 
to smoke would subsequently result in elevated ratings of 
desire to smoke and also a thought rebound, whereby partici-
pants would subsequently think of their desire to smoke 
more following suppression compared with the other condi-
tions. These effects were hypothesized to occur at all later 
measurement points. Finally, it was predicted that general 
use of thought suppression would be related negatively to 
mindfulness (see Baer, Smith, Hopkins, Krietemeyer, & 
Toney, 2006) and positively to attempts to control smoking 
via a variety of means as measured by the Smoking Restraint 
Questionnaire (SRQ; Erskine et al., 2012), and that mindful-
ness would be negatively related to attempts to control smok-
ing (SRQ).

**Method**

**Participants**

Participants were recruited via adverts in a large London 
teaching hospital medical school. Participants were aged 18 
to 65 years, reported smoking ≥10 cigarettes per day for >1 
year, had no intention to quit smoking in the immediate 
future, were not in psychiatric treatment, not pregnant, 
reported fluent English, and demonstrated an expired carbon 
monoxide (CO) reading of >8 parts per million (ppm). 
Participants received £10.

**Measures**

At baseline, participants provided demographic information 
and smoking history, including the Fagerström Test for 
Cigarette Dependence (FTCD, Fagerström, 2012; 
Heatherton, Kozlowski, Frecker, & Fagerström, 1991). The 
Mood and Physical Symptoms Scale (West & Hajek, 2004; 
West & Russell, 1985) was used to determine the dependent 
variables of desire to smoke and tobacco withdrawal symp-
toms. Desire to smoke was assessed by asking, “How strong 
is your desire to smoke right now?” The withdrawal symp-
toms assessed were irritability (i.e., How irritable do you feel 
right now?), depression, anxiousness, restlessness, difficulty 
concentrating, and hunger (in all cases, 1 = not at all, 4 = 
somewhat, to 7 = extremely). Several measures that have pre-
viously been related to thought suppression were included: 
The Mindful Attention Awareness Scale (MAAS; Brown & 
Ryan, 2003) assessed awareness of the present moment (15 
items, scale in each case: 1 = almost never, 6 = almost 
always). This scale has previously shown excellent reliabil-
ity (Cronbach’s alphas of .86 and .87 in two separate sam-
ple). and shown very good convergent and divergent validity 
(Brown & Ryan, 2003) The WBIS (Wegner & Zanakos, 
1994) assessed frequency of thought suppression in every-
day life (15 items, 1 = strongly agree, 5 = strongly disagree). 
This scale has demonstrated excellent reliability (Cronbach’s 
alpha of between .87 and .89 across multiple samples) and
shown good convergent and divergent validity (Wegner & Zanakos, 1994). The SRQ (Erskine et al., 2012; reported Cronbach’s alpha = .70) assessed attempts to alter/reduce one’s smoking behavior (seven items, Scale: 1 = not at all/no attempts to 5 = very much so/on most days/more than 6 attempts).

Procedure

Participants were tested individually and asked to smoke an hour before taking part. On arrival, they reported the time of their last cigarette. Anyone smoking within the past 30 min or more than 90 min ago was asked to return at another time to take part. Participants provided an expired CO reading using a Bedfont Smokerlyzer.

Participants were informed that they would be required to verbalize all of their thoughts out loud on several occasions and that they may be asked to actively think or not think of particular concepts. Participants were not informed that the aim of the study was to examine the effects of thought suppression on cravings. Participants provided written informed consent, and the study was approved by a local ethics committee.

After providing baseline data for demographic and smoking history, participants began the first thought verbalization task. The first period was a practice session where individuals were asked to verbalize all of their thoughts, on any topic, out loud for 3 min, while alone in the room. Next, participants reported their baseline ratings for desire to smoke and tobacco withdrawal symptoms. They were then randomly allocated into one of three experimental conditions (suppression, expression, and control). Instructions were as follows:

Suppression group:

I would like you to continue speaking aloud your thoughts for a further five minutes, but this time please try to avoid thinking about your desire to smoke. Each time you think about your desire to smoke, please press the buzzer.

Expression group:

I would like you to continue speaking aloud your thoughts for a further five minutes, but this time please try to think about your desire to smoke. Each time you think about your desire to smoke, please press the buzzer.

Control group:

I would like you to continue speaking aloud your thoughts for a further five minutes. Once again there are no restrictions on what you might think about, but each time you think about your desire to smoke, please press the buzzer.

It is common in thought suppression studies to have participants press a buzzer every time they think of the concept under study in all conditions, including the control group. This is to overcome issues involved in mentioning a concept (i.e., priming the concept) in some conditions and not others (see Erskine & Georgiou, 2010; Wegner et al., 1987).

Following the 5 min of thought verbalization, participants again provided ratings of their desire to smoke and withdrawal symptoms. To investigate the desire to smoke over time, there were two further periods of thought verbalization for 5 min each, when all participants followed the control instructions. Once again, after each verbalization period, participants completed measures of their desire to smoke and withdrawal symptoms.

Common to research on thought suppression buzzes and mentions of smoking desire that were not buzzed were totaled (by listening to the voice recordings of the verbalizations) in each 5-min period to calculate the total number of smoking desire thoughts (Wegner et al., 1987). In all experimental conditions, desire to smoke and withdrawal symptoms were rated at four times: immediately after the practice verbalization (baseline) and immediately after each of the three experimental verbalization periods. The session ended with participants completing the MAAS, WBSI, and SRQ.

Statistical Analysis

Statistical analyses used SPSS version 19 with mixed-model ANOVA techniques. In each analysis, the independent variable was the participant group (suppression vs. expression vs. control). If there were time-based measures (e.g., desire to smoke and withdrawal symptoms), repeated measures was used. Sex was included as a between-subjects variable in all analyses but as it demonstrated no main or interactional effects, it was omitted.

The present study also investigated the correlations between scores on the WBSI, SRQ, FTCD, MAAS, and the baseline measures of desire (see Table 1). In view of findings reporting that the WBSI may contain two subscales (Höping & de Jong-Meyer, 2003), we also investigated the pure thought suppression subscale reported by Höping and de Jong-Meyer (2003) and correlated it with other measures.

Results

Fifty-one smokers participated. Two participants were removed for failing to follow the experimental instructions by not suppressing in the suppression condition or expressing in the expression condition. Table 2 indicates that the groups were similar at baseline, except for irritability. Due to outliers, mean scores on buzzes were square root transformed; however, for ease of interpretation, raw mean scores are reported.

The first analysis examined whether participants had followed the instructions by calculating the frequency of thoughts of the desire to smoke during active suppression, expression, or monitoring. An ANOVA, using all
three conditions, demonstrated a significant difference in the frequency of thoughts of the desire to smoke, $F(2, 46) = 6.29$, $p = .004$, $\eta^2 = .22$. The mean (SD) number of smoking desire thoughts by group were as follows: suppression = 4.94 (4.26), expression = 10.81 (7.42), think anything control = 6.27 (3.83). Planned comparisons demonstrated that the expression group had a greater frequency of smoking desire thoughts than the suppression ($p = .001$) and the “think anything” ($p = .03$) groups, but the suppression and “think anything” groups were not significantly different ($p = .26$). These findings show that participants followed the instruction. It is common in thought suppression studies for the suppression and control condition to have an equivalent frequency of thought, albeit significantly lower than the expression group (see Erskine & Georgiou, 2010).

The next analysis investigated scores on desire to smoke and withdrawal symptoms at the four times (see Table 3 for means). Mixed-model ANOVAs were conducted with the time of desire/withdrawal measurement as the within-subject factor and experimental group as the between-subjects factor. Desire to smoke demonstrated a main effect of time, $F(1.93, 88.78) = 29.23$, $p = .001$, $\eta^2 = .39$. Follow-up tests indicated that desire to smoke rose over time on average. Thus, desire at Time 1 was significantly lower than the desire at Times 2, 3, and 4 ($p < .001$ in all cases), but Times 2, 3, and 4 were not different. There was no time by group interaction ($F < 1$). Furthermore, there was no between-subjects effect of group ($F < 1$).

Results for the withdrawal symptoms using similar mixed-model ANOVAs were as follows. For irritability and...
Table 3. Desire to Smoke and Intrusive Smoking Thoughts Over Time.

|                        | Suppression (n = 18) | Expression (n = 16) | Control (n = 15) |
|------------------------|----------------------|---------------------|------------------|
| **Desire to smoke**    |                      |                     |                  |
| Time 1 (baseline)      | 2.83 (1.51)          | 2.31 (1.14)         | 2.47 (1.19)      |
| Time 2 (immediately after) | 3.33 (1.61)      | 3.25 (1.13)         | 2.80 (1.08)      |
| Time 3 (5 min after)   | 3.50 (1.51)          | 3.38 (1.26)         | 3.47 (1.46)      |
| Time 4 (10 min after)  | 4.06 (1.59)          | 3.75 (1.44)         | 4.00 (1.51)      |
| **Intrusive smoking thoughts** |               |                     |                  |
| Time 1 intrusions (under manipulation) | 4.94 (4.26) | 10.81 (7.42)       | 6.27 (3.83)      |
| Time 2 intrusions (think anything) | 5.44 (3.37) | 7.75 (7.04)        | 6.40 (3.91)      |
| Time 3 intrusions (think anything) | 9.61 (6.26) | 5.56 (4.43)        | 6.47 (4.61)      |

Correlations

There was no relationship between the use of thought suppression in everyday life (WBSI scores) and the desire to smoke at baseline ($r = .02$). The pure thought suppression subscale correlated with other measures similarly to the overall WBSI.

A significant negative relationship was found between the use of thought suppression (WBSI) and mindful awareness (MAAS scores, $r = -.60$, $p = .001$), whereas a significant positive relationship was found between the use of thought suppression (WBSI) and attempts to alter or reduce smoking (SRQ scores, $r = .45$, $p = .001$). Cronbach’s alpha for the SRQ was .81.

In addition, we found significant low-to-moderate correlations between the number of desire thoughts reported by participants during the first verbalization period (when they were suppressing, expressing, or monitoring) and ratings of desire to smoke at baseline ($r = .32$, $p = .03$), immediately after ($r = .41$, $p = .004$), 5 min after ($r = .41$, $p = .004$), and 10 min after ($r = .33$, $p = .02$). Furthermore, smoking desire thoughts during the second and third 5-min verbalization periods (when all participants were monitoring their thoughts) were also significantly positively correlated with the desire to smoke ratings at all time points.

Discussion

The findings of the present study indicate that suppressing thoughts of desire to smoke leads to a thought rebound as indicated by elevated thinking about desire to smoke in the second verbalization period after the manipulation. The results also show that the group that suppressed thoughts of their desire to smoke did not subsequently report significantly greater ratings of desire to smoke, relative to the other groups. The latter findings are consistent with Erskine et al. (2012), which reported that suppressing the smoking thoughts in general did not result in elevated ratings of desire to smoke. Thus, it may be that suppression of either smoking thoughts in general or of thoughts of the desire to...
smoke does not lead to increased desire. These findings suggest that the phenomenon whereby suppressing smoking thoughts leads to increased smoking (Erskine et al., 2010) cannot be explained due to an effect of thought suppression on the desire to smoke. These findings suggest that desire is not the same as simple thoughts of desire, as a thought rebound was in evidence in the suppression condition but this did not translate into ratings of greater desire to smoke in this group.

The observed lack of an effect on ratings of desire to smoke, while showing a rebound effect for thoughts of desire to smoke, may be because the rebound effect is specific; thus, when thoughts are suppressed, thoughts are subsequently increased. However, desire to smoke includes more than thoughts about desire to smoke (e.g., it may include non-cognitive elements such as physiological cravings or affective components; Kavanagh et al., 2005; Kuhl, 1987; Shiffman, West, & Gilbert, 2004). Therefore, the specifically cognitive task of suppressing thoughts of desire to smoke may be insufficient to result in a rebound effect for ratings of desire. There were significant low-to-moderate positive correlations between thoughts of desire to smoke and ratings of the desire to smoke at all time points, ranging from \( r = .27 \) to \( r = .42 \). This supports thinking of desire as a component of ratings of actual desire, however ratings of desire may assess elements beyond the cognitive.

The findings confirm reports (Baer et al., 2006; Erskine et al., 2012) of the strong negative relationship between WBSI and MAAS scores \( (r = -.60, p<.001) \). In view of the observation that mindful interventions are effective for reducing cigarette cravings (Bowen & Marlatt, 2009; Cropley, Ussher, & Charitou, 2007; Ussher, Cropley, Playle, Mohidin, & West, 2009), the negative relationship between mindfulness and thought suppression suggests that suppression could potentially be detrimental to smoking cessation. Furthermore, a direct comparison of thought suppression and mindfulness intervention in smokers demonstrated that while both strategies resulted in a significant reduction in smoking, only the mindfulness condition reduced negative affect, depressive symptoms, and nicotine dependence scores (Rogojanski et al., 2011a). These findings mirror the results of Erskine et al. (2010) who also demonstrated a significant reduction in smoking behavior during active suppression of smoking thoughts.

In line with studies suggesting that the WBSI measures both a tendency to suppress thoughts and thought intrusions (Höping & de Jong-Meyer, 2003; Nosen & Woody, 2009), the present study also used the previous subscale of Höping and de Jong-Meyer (2003) purporting to measure pure thought suppression. However, this measure did not correlate any differently with the other measures than found for the overall WBSI. Furthermore, the correlation between the subscale for intrusion and the subscale for thought suppression was above .60, suggesting that they may be similar concepts.

There were several limitations of this study. First, the sample comprised mostly young smokers limiting generalizability, and participants were only abstinent for 1 hr prior to taking part. It is possible that longer abstinence prior to taking part may have led to significant effects of suppressing the desire to smoke on subsequent desire, as with a longer period of abstinence, one might anticipate more intrusive thoughts regarding the desire to smoke. At baseline, the mean \( (SD) \) desire to smoke in the present study was 2.55 (1.29) on the 0- to 7-point scale. Previous research using the same rating scale following 15 hr of abstinence reported mean \( (SD) \) baseline desire to smoke of 5.6 (1.3) (Taylor, Katomeri, & Ussher, 2005). Thus, the absence of the predicted effect on ratings of desire to smoke may be partly due to the short period of abstinence; in light of this limitation the findings must be treated with caution.

In summary, this study did not demonstrate significant elevations in ratings of desire to smoke as a result of suppressing thoughts of desire to smoke. However, it did demonstrate a thought rebound, whereby suppressing thoughts of the desire to smoke resulted in greater subsequent thoughts of desire. Furthermore, once again mindfulness and thought suppression were strongly negatively related. The findings suggest that while suppressing desire can lead to greater subsequent thoughts of desire, it may not necessarily translate to greater subsequent ratings of desire to smoke. However, in light of previous evidence showing that suppressing smoking thoughts increases subsequent smoking (Erskine et al., 2010), thought suppression remains a potentially detrimental strategy for smoking cessation.

**Note**

1. As scores on irritability had differed significantly between the groups at baseline and Mindful Attention Awareness Scale (MAAS), scores narrowly missed differing significantly at baseline, these were entered as covariates and the ANOVA reported above was re-run. Adding these covariates resulted in no changes to the overall results, and therefore, the original ANOVA without covariates was accepted.

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**Author Biographies**

**Dr James Erskine** is senior lecturer in Psychology and Behavioural Medicine at St George’s Medical School London.

**Mr David Rawad** is a graduate from St George’s with a BSc (Hons) in Biomedical Sciences and is currently there studying final year medicine.

**Ms Sophie Grice** is a former BSc (Hons) Biomedical Sciences student at St George’s, University of London.

**Prof. Michael Ussher**, Professor of Behavioural Medicine, conducts randomised controlled trials, surveys and experimental studies relating to smoking cessation, physical activity promotion and mindfulness-based interventions.