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Attentional bias modification in smokers trying to quit: A longitudinal study about the effects of number of sessions ☆

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ABSTRACT

Attentional bias modification (ABM) to avoid smoking-related cues is a potentially new intervention in addition to existing therapy to stop smoking. We examined immediate and long-term changes in attentional bias and treatment outcomes from multiple ABM sessions in 67 smokers trying to quit. After assessing attentional bias baseline, participants were randomly allocated to one of three training groups: three sessions of ABM (avoid 3); two sessions of placebo-ABM and one session of ABM (avoid 1); and three sessions of placebo-ABM (avoid 0). At baseline, all groups had similar positive attentional bias, which became negative at 24 h post-training. After 1 month, avoid 1 and avoid 3 still exhibited negative attentional biases. Only avoid 3 maintained this effect at 6-month, but not at 12-month assessments. ABM produced a long-lasting automatic and maintained avoidance to smoking-related cues which depended on number of sessions; however its effects on treatment outcomes are uncertain.

1. Introduction

Evidence suggests that implicit cognitive mechanisms such as attentional bias and cues reactivity influence the decision and behavior of drug use, playing an important role in maintaining this addiction (Field & Cox, 2008). The cues reactivity refers to the variety of responses (physiological or behavioral) that are observed when drug addicts, former addicts or frequent users are exposed to some stimuli that were previously associated with the drug effects (Rooke, Hine, & Thorsteinsson, 2008). Drug-related stimuli produce responses associated with its effects, including craving, excitement and difficulty sustaining abstinence (Robbins & Ehrman, 2004). Although cognitive–behavioral therapy is effective for smoking cessation (Focchi & Braun, 2005), it is aimed at explicit processes (e.g. motivation for treatment, relapse prevention), and not implicit automatic processes. Thus, investigation of new techniques focused on implicit cognition as complementary to traditional interventions is preeminent (Schoenmakers et al., 2010).

Attentional bias modification (ABM) has been widely studied as an implicit training strategy to reduce cue reactivity in anxiety disorders (Amir, Beard, Burns, & Bomyea, 2009; MacLeod, Rutherford, Campbell, Ebsworthy, & Holker, 2002; Schmidt, Richey, Buckner, & Timpano, 2009) and a few studies in addiction (Attwood, O'Sullivan, Leonards, Mackintosh, & Munafo, 2008; Field, Duka, Tyler, & Schoenmakers, 2009; Field & Eastwood, 2005; Schoenmakers et al., 2010). Since individuals affected by emotional disorders such as anxiety, depression, and addiction have increased attention toward events (words or images) related to their pathologies (Amir et al., 2009; Peuker, Lopes, & Bizarro, 2009), ABM could be a novel and promising approach with a potential clinical utility as an additional intervention. Attentional bias is the tendency for a person to drive or maintain attention to stimuli due to the value attributed to them. Theoretical models suggest that attentional bias results from repeated pairing of smoking cues with direct effects of nicotine, leading to a sensitized reaction to smoking-related cues which become salient (Field & Cox, 2008; Franken, 2003; Lopes, Peuker, & Bizarro, 2008; Robinson & Berridge, 1993). Smoking-related stimuli tend to capture the attention of smokers, and this is considered relevant to drug seeking and smoking cessation outcomes (Waters, Shiffman, Bradley, & Mogg, 2003). Smokers have positive bias for a cigarette compared to nonsmokers (Bradley, Field, Mogg, & De Houver, 2004; Lopes et al., 2008; Moog, Bradley, Field, & De Houwer, 2003) when deprived of nicotine (Field, Mogg, Zetteler, & Bradley, 2004) and even when motivated to quit smoking (Waters et al., 2003). On the other hand, former smokers showed long-lasting negative attentional bias, i.e. an avoidance to smoking-related cues, which might be a successful outcome of a smoking cessation attempt (Peuker & Bizarro, 2013). Thus, strategies that help to reduce and/or make this bias negative may contribute to a higher success rate in smoking cessation treatment.

The visual-probe task is one of the most widely used tasks to investigate attentional bias (MacLeod, Mathews, & Tata, 1986), and a modified version is employed in ABM (MacLeod et al., 2002) which

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has the advantage of assessing and training implicit cognition using equivalent procedures. In this computerized task, the participant must locate and identify a probe that appears to the left or right visual field. The appearance of the probe is preceded by the appearance of a pair of images (smoking-related and matched control). The difference between reaction times to the probe when it replaces each image indicates the interference of the content of the image on attentional processes. In a standard visual probe task, the probe replaces both images in equal frequency while in ABM, the probe always replaces the control images when training aims to develop avoidance to smoking-related images. Thus, in ABM one learns the implicit rule to disengage attention from smoking-related images and instead attend to the control image. It is expected that this change in attentional bias generalizes to real exposure to drug cues, reduces craving and helps to acquire and maintain abstinence.

In order to study all attentional processes involved in attentional bias, it is necessary to target both initial, automatic detection of stimuli and later, maintained engagement stages of attention (Field, Mogg, Zetteler, & Bradley, 2004; Robbins & Ehrman, 2004). Initial orienting of attention is a relatively rapid process, which can be assessed when the stimuli are presented for brief exposure durations (e.g. 50–200 ms), while biases in maintained attention are more likely to be revealed when stimuli are presented for longer stimulus durations (e.g. 2000 ms) (Field, Mogg, Zetteler, & Bradley, 2004). Manipulation of the presentation duration of the stimuli, that is, the stimulus onset asynchrony (SOA), in the visual probe task indicated that attentional bias occurs in all stages of attention in smokers (Ehrman et al., 2002; Field, Mogg, & Bradley, 2004b). Similarly, former smokers exhibited negative attentional bias in short and long SOAs (200 ms, 500 ms and 2000 ms), but as the SOA became longer, their avoidance became stronger (Peuker & Bizarro, 2013). However, it is not clear how ABM changes automatic and maintained attention. Field et al. (2009) showed that after ABM, attentional bias in smokers was stronger at longer SOA (500 ms) than shorter (50 ms), regardless of whether ABM was employed to attend or to avoid smoking-related pictures. Schoenmakers et al. (2010) conducted a study using ABM to avoid alcohol-related pictures with abstinent alcoholic patients who showed a reduction in attentional bias for longer SOA (500 ms) but not for a shorter one (200 ms). These differences might be attributed to motivation for treatment (only alcoholic patients were in treatment). Nevertheless, the influence of AMB on attention processes requires further investigation.

Studies on ABM in smokers have employed a single session of training which did not produce robust changes in attentional bias and other smoking-related outcomes (Attwood et al., 2008; Field et al., 2009; McHugh, Murray, Hearon, Calkins, & Otto, 2010). Five sessions of ABM had no effect on attentional bias, subjective craving and abstinence outcomes in smokers who set a quit day, had 7 sessions of behavioral support and used nicotine patches (Begh et al., 2013). In abstinent alcoholic patients, 5-session ABM reduced attentional bias, produced clinically relevant effects and generalized to new stimuli, but did not reduce craving (Schoenmakers et al., 2010).

Craving correlates positively with attentional bias in smokers (Mogg & Bradley, 2002; Moog et al., 2003; Zack, Belsito, Scher, Eissenberg, & Corrigal, 2001), but it is still not clear how ABM changes craving or other variables related to smoking behavior. Positive correlations between craving and attentional bias scores were found just in males trained to attend to smoking-related cues (Attwood et al., 2008). A single session of ABM did not change subjective craving or other clinically relevant variables despite a short-lasting reduction on attentional bias after AMB (Field et al., 2009). Thus, it is not clear if ABM targets implicit automatic attentional process and, if it does, in which conditions (e.g. number of trials) it can help smokers to get better outcomes from smoking cessation therapy.

In the present randomized controlled experimental study, we investigated the immediate (24 h) and long-term (1, 6 and 12 months) effects of different numbers of sessions of ABM on attentional bias and other smoking-related variables (number of cigarettes smoked per day, carbon monoxide in exhaled air, level of nicotine dependence and urge to smoke) in smokers enrolled in a smoking cessation program. We hypothesize that 3 sessions but not 1 session of ABM would produce negative attentional bias to smoking-related pictures in all processes of attention, that is, we had a dose response effect expectation.

2. Materials and methods

2.1. Participants

Smokers ($n = 67$) were recruited from 97 participants enrolled in a smoking cessation program (SCP) available to staff and students of a university campaigning for a smoke-free environment. To be included, participants had to meet the following criteria: a) be at least 18 years-old, b) have normal or corrected vision, c) smoke at least 5 cigarettes for more than 30 days (same criteria as Attwood et al., 2008), d) did not undergo any other treatment to quit smoking during the study period, e) did not score as dependent on any drug other than nicotine according to the Alcohol, Smoking and Substance Involvement Screening Test (see Material), f) and did not fulfill criteria for mental disorders on the Self Report Questionnaire (see Material). Participants were randomly allocated to one of three conditions defined according to the number of sessions of ABM: Group avoid 3 ($n = 22$), performed three sessions of ABM; Group avoid 1 ($n = 22$) performed two sessions of placebo condition (visual probe task with neutral pictures) and one session of ABM; and group avoid 0 ($n = 23$) performed two sessions of placebo condition and one session of a standard visual probe task with a different set of smoking-related pictures to ensure that this group was exposed to a set of smoking-related pictures during ABM.

Another group of 22 smokers from the same population who were not participants in the SCP and did not wish to quit smoking had their attentional bias assessed but did not take part in the ABM study. Other criteria to participate were the same. The attentional bias and other smoking-related variables of this group were compared to ABM groups at baseline only.

2.2. Overview of experimental design

A mixed experimental design was employed. Between-subjects variables were groups defined by the number of trials of ABM. Within subjects variables were SOAs (50, 500 and 2000 ms) and assessments. All dependent measures were measured in 5 assessments: once before ABM and on follow-ups after the last session of ABM (24 h, 1, 6 and 12 months).

2.3. Materials

Scores above seven in the Self Report Questionnaire (SRQ-20; Harding et al., 1980; validated in Brazil by Mari & Willians, 1986) and scores above 16 in the Brazilian version of the Alcohol, Smoking and Substance Involvement Screening Test (ASSIST; Henrique, De Micheli, Lacerda, Lacerda, & Formigoni, 2004) were used as exclusion criteria. Number of cigarettes smoked per day, scores in Fagerström Test for Nicotine Dependence (FTND; Heatherton, Kozlowski, Frecker, & Fagerström, 1991) and level of carbon monoxide (CO) in breath using Smokerlyser (Bedfont, 1993) indicated severity of dependence and cigarette consumption for all assessments. The Questionnaire of Smoking Urges-Brief (Cox, Tiffany, & Christen, 2001; validated in Brazil by Araújo et al., 2007) monitored the urge to smoke for all assessments.

The standard visual probe task (MacLeod et al., 1986) was used to measure the attentional bias before and after ABM in all 5 assessments