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From appetitive to aversive: Motivational interviewing reverses the modulation of the startle reflex by tobacco cues in smokers not ready to quit

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ABSTRACT

Motivational Interviewing (MI) is a treatment method that has proven effective for increasing motivation to change and decreasing the consumption of different drugs. However, the results of studies examining the impact of MI on tobacco consumption are contradictory. Moreover, evidence of the effectiveness of MI for modifying well-validated psychophysiological indices of motivational change is still lacking. The aim of the present study was to use the startle probe paradigm and self-report measures of motivational change to assess the effectiveness of MI, compared to Prescriptive Advice (PA) and no treatment, in a sample of 53 smokers (28 male) who were not ready to quit smoking. After the intervention, the MI group reported increased motivation to change compared to both the PA and control groups. MI participants also had a potentiated startle reflex in response to tobacco-related pictures compared to the other two groups. These findings provide evidence that MI reverses the underlying motivational system activated by tobacco related cues.

Introduction

In public health systems, the time that health professionals spend with patients is usually brief. This short time must be used as effectively as possible, especially when dealing with smokers with low motivation to quit smoking (Velicer, Prochaska, Fava, Norman, & Redding, 1998). The two most common approaches to address this population of smokers are Motivational Interviewing and Prescriptive Advice (American Psychiatry Association, 2006).

Motivational interviewing (MI) is a counselling approach that focuses on helping clients explore and resolve ambivalence by centering on motivational processes within the individual (Miller & Rollnick, 1991). MI seeks to elicit and strengthen motivation to change using a collaborative and person-centered approach. Specific principles that are applied throughout MI are expressing empathy, developing discrepancy, avoiding argumentation, rolling with resistance and supporting self-efficacy (Emmons & Rollnick, 2001; Miller & Rollnick, 2009). The MI is closely related to the Transtheoretical Model, a theoretical model of behaviour change that construes change as a process involving progress through a series of five stages (precontemplation, contemplation, preparation, action and maintenance) (Prochaska, DiClemente, & Norcross, 1992).

Prescriptive Advice (PA) is a directive approach in which the health professional assumes a firm and authoritarian attitude towards the smoker telling him/her what to do and how to do it. Being persuasive and directive, the professional sets the goals of treatment and defines the reasons to quit smoking and the strategies to be implemented in order to achieve this (Audrain-McGovern et al., 2011; Davis et al., 2011). Some studies have suggested that PA might be preferable for people who want a more directive attitude by the health professional and who are waiting to hear what to do and how to do it (Lim, Norman, Clifton, & Noakes, 2009; Sekimoto et al., 2004).

The effectiveness of MI for the treatment of substance abuse is well documented (Lundahl & Burke, 2009). In Lundahl and Burke's review of four meta-analyses, MI was found to be significantly more effective than no treatment and equal to or potentially more effective than other well-established interventions for problems related to alcohol and other drugs (cocaine and heroin). However, the results of these early meta-analyses concerning the superiority

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of MI for tobacco cessation were contradictory. Two subsequent metaanalyses did find evidence favourable to MI in achieving abstinence in adolescent smokers compared with other interventions (Heckman, Egleston, & Hofmann, 2010; Hettema & Hendricks, 2010).

Some studies have specifically compared the effectiveness of MI and PA. Davis et al. (2011) found that 15-min sessions of MI or PA were equally effective for smokers in the precontemplation and contemplation stages of change. No significant differences were found between the groups on variables such as intention to quit, intention to reduce, verbal report reduction, verbal report to quit or biological outcome verified through spirometry. However, smokers who received the MI session were more willing to answer follow-up calls, which is associated with increased adherence to treatment.

In a subsequent study, Colby et al. (2012) compared the effectiveness of MI and brief advice (similar to PA) for smoking cessation in adolescents. The results showed a significant difference in reported cigarettes smoked per day during the first month after intervention in the group receiving MI compared to the group receiving brief advice. However, this difference was not maintained 3 and 6 months after the intervention. It was also found that MI had influences on normative perceptions, while brief advice did not. No differences were found between the two interventions with regard to self-reported motivation or self-efficacy to quit smoking.

Although investigations have found similar results when MI and PA are administered as brief interventions, with some specific benefits for MI, no study to date has objectively evaluated changes in the underlying motivational mechanisms of smokers when comparing these two types of interventions. The objective assessment of the two basic motivational mechanisms (appetitive versus defensive) underlying behavioural change is possible from psychophysiological measures, such as the modulation of the startle reflex when viewing pictures with different affective content (Lang, 1995, 2010). It has been systematically observed that, compared to low arousing neutral pictures, highly arousing pleasant pictures inhibit the startle reflex, whereas highly arousing unpleasant pictures potentiate it (Bradley, Codispoti, Cuthbert, & Lang, 2001; Grillon & Baas, 2003; Vila et al., 2003). This effect has been explained according to the motivational priming hypothesis (Lang, 1995): viewing pleasant pictures inhibits the startle reflex due to the incongruence between the motivational mechanism activated by the pictures (appetitive) and the type of reflex being elicited (defensive), whereas viewing unpleasant pictures potentiates the startle reflex due to the congruence between the motivational mechanism activated by the pictures (defensive) and the type of reflex being elicited (defensive).

The modulation of the startle reflex has been studied in smokers using tobacco-related pictures (Cui et al., 2012; Engelmann, Gewirtz, & Cuthbert, 2011; Lam et al., 2012; Muñoz, Idrissi, Sánchez-Barrera, Fernández-Santaella, & Vila, 2013; Muñoz et al., 2010; Rehme et al., 2009). These studies report that tobacco-related pictures, compared to neutral and unpleasant pictures, inhibit the startle reflex, thus indicating that in smokers not seeking treatment, tobacco pictures activate the appetitive motivational system. Recently, the modulation of the startle reflex has also been used to objectively evaluate the effectiveness of various psychological therapies, such as exposure therapy for spider phobia (Kashdan, Adams, Read, & Hawk, 2012) and mindfulness for chronic worry (Delgado et al., 2010). However, no studies have evaluated the effectiveness of MI using the startle probe paradigm.

The aim of the present study was to use this paradigm, together with self-report measures of motivational change, to assess the effectiveness of MI, compared to PA and no treatment, to modify the underlying motivational mechanisms activated by tobacco cues. It was hypothesized that before treatment, smokers in a precontemplation or contemplation stage would show startle reflex inhibition while viewing tobacco-related pictures compared to neutral and unpleasant pictures. No group differences were expected before treatment. After treatment, MI and PA participants would show the opposite pattern: startle reflex potentiation while viewing tobacco-related pictures, compared to neutral and pleasant pictures. However, the startle potentiation to tobacco-related pictures would be significantly higher for participants receiving MI than those receiving PA. No significant changes were expected after treatment in the control group. Self-report measures were also expected to reflect higher motivational change after treatment with MI, followed by PA and control participants.

Methods

Participants

Participants were 54 healthy university students, 28 men (20–31 years *M* age: 23.64, *SD*: 3.09) and 26 women (20–31 years; *M* age: 22.84, *SD*: 3), who reported more than a year of tobacco use, who smoked an average of more than 10 cigarettes per day and who were in the precontemplation (15 men and 20 women) or contemplation (13 men and 6 women) stage according to their score on University of Rhode Island Change Assessment (URICA) (DiClemente et al., 1991; Velicer et al., 1995). No participant was undergoing psychological or pharmacological treatment. Volunteers were excluded from the study if they reported auditory deficits, uncorrected visual deficits, history of head trauma, or major neurological disorder. The study was approved by University of San Buenaventura Review Board and University of Granada Review Board, and the subjects provided written informed consent.

Design

Participants were randomly assigned to three groups: two intervention groups – motivational interviewing (MI) ($n = 18$) and prescriptive advice (PA) ($n = 18$) – and one waitlist control group (CG) ($n = 17$). The proportion of men/women and precontemplation/contemplation stage was balanced within each group. All participants underwent psychological and psychophysiological assessment procedures before and immediately after the intervention. In the lab, participants provided informed consent and completed baseline assessments. They were then randomized to receive either 20 min of MI or PA two weeks later, or they were assigned to the control group. The intervention was designed to match the time available in the average health professional–patient interaction. Data from one participant in the control group were eliminated due to excessive physiological artefacts.

Intervention procedure

Both interventions, MI and PA, were developed individually following the indications described in Colby et al. (2005, 2012) and Davis et al. (2011). One therapist with a Master's degree and ten years of clinical research experience delivered both interventions. In the motivational intervention, the therapist applied the principles of MI (Miller & Rollnick, 2002) and developed the following points: 1) establishing rapport; 2) exploring pros and cons of smoking and quitting; 3) delivering psychological baseline assessment feedback through the results of self-report measures (stage and processes of change); 4) imagining the future with and without smoking; 5) reviewing a menu of change options; and 6) enhancing self-efficacy for change.