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Acupuncture attenuates autonomic responses to smoking-related visual cues

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Summary
Objectives: In smokers, smoking-associated cues produce smoking urges and cravings, which are accompanied by autonomic dysfunction in response to these cues. We investigated whether or not acupuncture ameliorated cigarette withdrawal symptoms, as well as attenuated the autonomic responses to smoking-related visual cues in smokers using a power spectrum analysis of heart rate variability (HRV).
Interventions: Fifteen subjects were treated with real acupuncture (RA) at HT7 and 14 subjects received sham acupuncture (SA) at LI10 using the Park Sham Device.
Main outcome measure: The cigarette withdrawal scale (CWS) was measured on the third day after the subjects had quit smoking. We compared the low-frequency/high-frequency (HF/LF) ratio in the HRV of the RA and SA groups during a distraction task using neutral and smoking visual cues.
Results: The CWS of the RA group was significantly lower than that of the SA group. The increase in the LF/HF ratio of HRV induced by the smoking-related visual cues was also significantly lower in the RA group when compared with the SA group. Acupuncture not only ameliorated cigarette withdrawal, but also weakened the autonomic responses to smoking cues during withdrawal.
Conclusions: These findings suggest that acupuncture might help in smoking cessation by attenuating withdrawal symptoms and smoking cues-induced autonomic responses.

It has been estimated that 80% of all regular smokers want to stop smoking, and that the majority have tried to quit but failed.[1] Smoking relapse rates are high, with approximately 50% of smokers relapsing within 3 days and 75% within the first 14 days.[2] The most commonly reported reason for relapses during smoking cessation attempts is the desire to relieve the discomforts of smoking withdrawal, including irritability, anxiety, depression, weight gain and the craving for tobacco.[3] Therefore, mitigation of the withdrawal symptoms during the initial stages of a smoking cessation attempt may increase the success rate of smoking cessation.

There are several psychophysiological variables of interest during affective picture viewing. Changes in skin conductance response and heart rate are reliable indicators of arousal.[4] In addition, reactivity to smoking cues is commonly indexed using behavioural measures and measures of autonomic nervous system (ANS) activity, such as systolic and diastolic blood pressure, vasoconstriction, heart rate,

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heart rate variability (HRV), event-related heart rate deceleration and pupil dilation.[5–7] The appropriate restoration of ANS regulation induced by smoking-related visual cues would benefit smokers by reducing their smoking-associated distress.

Acupuncture has gained popularity and greater acceptance as a treatment option worldwide. Recent experimental studies demonstrated that acupuncture and/or electro-acupuncture exerted regulatory effects in several animal models of drug addiction, including nicotine, alcohol and morphine addiction.[8–13] Many clinical studies of smoking cessation have focussed on the effect of acupuncture on the subjective rating of nicotine withdrawal.[14,15] However, few studies have examined the effect of acupuncture on smoking-related cue reactivity and autonomic responses. It is likely that the effect of acupuncture on a subject's dependency on nicotine may reflect changes in his reactivity to smoking-related visual cues.

We hypothesised that acupuncture would improve the withdrawal symptoms and autonomic responses to smoking-related visual cues through the inhibition of sympathetic activation during nicotine withdrawal.

Methods

Subjects

To avoid the influence of gender and age on HRV, 29 male smokers (mean age = 27.9 years, SD = 2.4), who smoked at least 10 cigarettes per day, were recruited using advertisements in local newspapers in Seoul, Republic of Korea. At the start of each treatment, the participants' breath carbon monoxide (CO) content was measured using the Bedfont Smokerlyser (Bedfont Instruments, Kent, UK). All of the subjects refrained from taking alcohol, caffeine and medical drugs. They agreed to participate in this experiment and provided written consent forms. The protocol used in this study was approved by the Acupuncture and Meridian Science Research Center Ethical Committee of Kyung Hee University.

Treatment groups and trials

Subjects were accepted into the study if they satisfied the following inclusion criteria: men 18 years or older, who were willing to quit smoking and not taking other drugs during the course of the research treatment period. They were asked to refrain from using other cessation methods during the trial period.

The subjects were assigned randomly to a real acupuncture (RA; $N = 15$) or a sham acupuncture (SA; $N = 14$) group using a computer program. A qualified Korean medicine doctor (S.Y. Kim) administered acupuncture at acupoint HT7 for the RA group and at acupoint LI10 for the SA group on both hands. A control acupoint, LI10, was used to prevent the possible physiological effects from the use of a sham needle.[32,33] Each subject received daily acupuncture treatments for three consecutive days. The acupuncture needle was guided using the Park Sham Device in an attempt to exclude the placebo phenomena.[16] For the RA group, the acupuncture needle (0.25 mm diameter, 40 mm length) was inserted at the HT7 acupuncture point to a 6 mm depth, manipulated for 30 s and withdrawn 20 min later. For the SA group, a simulation of the technique was performed with a blunt sham acupuncture needle, except on acupoint LI10.

The cigarette withdrawal symptoms questionnaire

The cigarette withdrawal scale (CWS)-21 is a reliable and multidimensional measure for cigarette withdrawal symptoms. It is sensitive to the changes the subject experiences over time and can also be used to predict relapses.[17] The six subscales cover the main components of nicotine or tobacco withdrawal in the *Diagnostic and Statistical Manual of Mental Disorders* and the *International Statistical Classification of Diseases and Related Health Problems*: Depression/anxiety, craving, irritability/impatience, appetite/weight gain, insomnia and difficulty concentrating. The CWS was compared between the RA and SA groups on the third day after withdrawal. Cronbach's α was computed for the six subscale scores and the total score of the subjects. The findings ranged from 0.725 to 0.920 for each of the six subscales and averaged 0.894 for the total score.

Measuring HRV

To measure HRV, the subject rested in the sitting position for 10 min, and electrocardiogram (ECG) electrodes were placed on the thorax. The heart rates of the participants were recorded during the distraction task on the third day after they had stopped smoking. Each session lasted 5 min, during which they viewed neutral or emotional pictures (Fig. 1(A)). The ECG was measured using an electrocardiogram amplifier (Heart Rhythm Scanner, Biocom Technologies, USA). The HRV was analysed in accordance with the recommendations of the Task Force of the European Society of Cardiology and the North American Society of Pacing and Electrophysiology.[18] The power spectra were analysed at low frequency (LF; 0.04—0.15 Hz) and high frequency (HF; 0.15—0.40 Hz) ranges. The LF component, which corresponds to the 0.15 Hz slow fluctuations of arterial pressure, mainly represents sympathetic modulation of the sinus node, whereas the HF component, which is a measure of respiratory sinus arrhythmias, can be regarded as an index of vagal (parasympathetic) modulation. The ratio of the LF and HF components (LF/HF ratio) was determined as an index of the sympathovagal balance.

Image presentation of visual cues

The distraction task consisted of pictures in two categories (neutral and smoking pictures). The smoking session consisted of 30 colour photographs of smoking-related scenes (e.g., a man holding a cigarette to his mouth, and smoking paraphernalia such as lighters, cigarettes and an ashtray). The neutral session consisted of 30 colour photographs of non-smoking scenes matched as closely as possible for content (e.g., a man eating with a spoon). The pictures were approximately 34 cm wide and 28 cm high when displayed on a 17-in. monitor. The visual cues and rating tasks that were presented were developed on a Java application.