The American Journal of Chinese Medicine, Vol. 40, No. 3, 429–442

DOI: 10.1142/S0192415X12500334

Systematic Review and Meta-Analysis of the Effects of Acupoint Stimulation on Smoking Cessation

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Abstract: Smoking represents a serious worldwide public health problem because of its close association with the development of chronic disease and cancer. Acupoint stimulation has been used as treatment mode for smoking cessation but its efficacy remains controversial. This systematic review and meta-analysis aimed to determine the effects of acupoint stimulation on smoking cessation rate and daily cigarette consumption. Electronic literature searches in eight electronic databases up to March 2011 were performed to identify acupoint stimulation for smoking cessation. The outcomes assessed were smoking cessation rate and cigarette consumption. We assessed abstinence from smoking at the earliest and last measured time points, and at the 3- and 6-month follow-ups. Meta-analysis was performed using CMA software. A total of 20 RCTs were included in the meta-analysis. A significant effect of acupoint stimulation was found in smoking cessation rates and cigarette consumption at immediate, 3- and 6-month follow-ups, with effect sizes 1.24 (95%CI = 1.07 ∼ 1.43, $p = 0.003$), −2.49 (95%CI = −4.65 ∼ −0.34, $p = 0.02$), 1.70 (95%CI = 1.17 ∼ 2.46, $p = 0.01$), and 1.79 (95%CI = 1.13 ∼ 2.82, $p = 0.01$), respectively. Multi-modality treatments, especially acupuncture combined with smoking cessation education or other interventions, can help smokers to eschew smoking during treatment, and to avoid relapse after treatment.

Keywords: Acupoint Stimulation; Smoking Cessation; Meta-Analysis; Acupuncture; Acupressure; Electroacupuncture.

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Introduction

Smoking represents a serious worldwide public health problem because of its close association with the development of chronic disease and cancer. According to the World Health Organization (WHO), the total number of tobacco-attributable deaths will increase from 5.4 million in 2005 to 6.4 million in 2015, and 8.3 million in 2030 (Mathers and Loncar, 2006; WHO, 2009). Smoking imposes a large economic burden on society; currently as much as 15% of the total health care costs in developed countries. The estimated cost of smoking in the US on health resources ranges from 0.6% to 0.85% of the gross domestic product (Parrott and Godfrey, 2004). Smoking cessation greatly improves life expectancy, reduces morbidity, and decreases health care costs associated with treating smoking-related conditions (Asaria *et al.*, 2007). Interventions for smoking cessation are therefore essential. Nicotine replacement therapy (NRT) is the most common form of smoking cessation pharmacotherapy and effective for the treatment of tobacco dependence. However, a meta-analysis identified that NRT was associated with a variety of side effects, such as heart palpitations, chest pains, nausea and vomiting, and insomnia (Mills *et al.*, 2010). Non-NRTs have also shown to be effective as second-line therapies for smoking cessation. It is believed that their noradrenergic effects substitute the noradrenergic action of nicotine. However, there is weak or no preclinical evidence for this mechanism, and non-NRTs can have adverse effects, including headache, anxiety, nausea (Okuyemia *et al.*, 2002), dry mouth, constipation (Hughes *et al.*, 2007), and sleep disturbance (McRobbie *et al.*, 2005).

Acupoint stimulation, a non-pharmacological therapy, is a convenient, economical, and safe treatment mode for smoking cessation with few side effects (Moner, 1996). It involves stimulating the central nervous system by means of acupuncture, electroacupuncture, laser acupuncture, and auriculotherapy (Chen *et al.*, 2010). Previous studies have described the mechanisms by which it exerts it effects; stimulating beta endorphin, enkephalin, epinephrine, norepinephrine, serotonin, and dopamine neurotransmitters (Fu, 2000; Jin *et al.*, 1996; Takeshige *et al.*, 1992). Evidence indicates that acupuncture also acts on the nucleus accumbens to inhibit the elevation in dopamine, which is associated with withdrawal symptoms (Watkins *et al.*, 2000; Yoon *et al.*, 2004). Acupoint stimulation increases endorphin levels and regulates the sympathetic nervous system to suppress nicotine addiction (Wang *et al.*, 2006), reduce the desire to smoke (Cabioglu *et al.*, 2007), change the taste of tobacco (Kang *et al.*, 2005), and promote cessation for a short period (Chen *et al.*, 2006; He *et al.*, 2001). Some studies have demonstrated the efficacy of acupoint stimulation as an aid to smoking cessation (Bier *et al.*, 2002; Wang *et al.*, 2010). Results from other studies, however, have suggested that true acupoint stimulation might not be superior to sham acupoint stimulation for smoking cessation (Yeh *et al.*, 2009). Based on Cochrane systematic review, acupuncture clinical trials with blind and controlled designs provided no evidence to indicate that acupuncture and related techniques increased the number of smokers who successfully stopped smoking; and there is insufficient evidence to eliminate the possibility that acupuncture might not have a greater effect than a placebo (White *et al.*, 2011). This systematic review and meta-analysis

aimed to determine the effects of acupoint stimulation on smoking cessation rates and daily cigarette consumption.

Materials and Methods

Literature Search and Study Selection

Studies on the effects of acupoint stimulation on smoking cessation, published between January 1977 and March 2011, were independently identified by two investigators. The electronic databases used to identify the randomized controlled trials (RCTs) were PubMed, MEDLINE, Cochrane Library Register of Controlled Trials, CINAHL Plus with Full Text, EMBASE/Excerpta Medica, Chinese Electronic Periodical Services (CEPS), and China Academic Journals Full-text Database (CJFD). The search strategy formulated in PubMed was adapted to make it applicable to the other databases. The keywords and medical subheadings were smoking, smoking cessation, smoker, acupoint stimulation, acupuncture, acupressure, electroacupuncture, percutaneous electrical nerve stimulation, randomized, placebo, controlled trial, and clinical trial. Articles written in languages other than English or Chinese were excluded.

Two reviewers independently selected studies and resolved disagreements by discussion. The selection criteria were published RCTs with at least one acupuncture-related intervention for smoking cessation. The control interventions included non-treatment, placebo acupuncture, placebo acupressure, or medication. In addition, the studies had a Jadad score of at least 1. The main outcome measures were smoking cessation rate and daily cigarette consumption. Trials on animals were excluded. When the study population of two or more research papers included the same, or some of the same, participants, the article that described the largest population was used. When use of the same population was suspected based on similarities of participants and intervention characteristics, those articles were excluded to prevent multiple publication bias.

Data Extraction and Quality Assessment

Data were extracted from each article meeting the inclusion criteria by two independent reviewers. Data were entered into a systematic coding form that included detailed questions on interventions, methods, and outcomes. When multiple treatment times were reported, the data for the longest times were compared. The methodological quality of each included study was assessed by Jadad score (Jadad *et al.*, 1996) by the same two reviewers, separately.

Data Synthesis and Analysis

Standard meta-analysis methods were used to determine standardized effect size estimates, and Comprehensive Meta-Analysis (CMA) Version 2.2 (Biostat, Inc., Englewood, NJ) was used to perform statistical analyses (Borenstein *et al.*, 2008). Relative risk (RR) was

calculated for dichotomous variables. Forest plots were used to present summary and individual study effect sizes with 95% CI. Heterogeneity was quantified using the I^2 statistic. If I^2 was $> 50\%$, a random-effects, instead of a fixed-effects, model was used and sensitivity analysis was applied to investigate the effects of methodological quality, as well as the types of intervention, on the calculated pooled effect size (Higgins and Green, 2011). Publication bias was assessed by visual examination of the funnel plots and by Egger's asymmetry test. Sensitivity analysis, to determine the effects of individual effect sizes on pooled RR estimates was performed by recalculating RR after omitting each study one at a time (Egger *et al.*, 1997). A p-value of < 0.05 was considered significant.

Results

Study Characteristic

After screening the titles and abstracts of all articles identified by the search strategy, 833 potentially relevant articles were selected and retrieved for more detailed information. Figure 1 displays the search processes. Table 1 shows the main characteristics and rigor scores of 20 included studies; with 19 (95%) published in English and one (5%) in Chinese. There were a total of 4923 participants; including 3061 (62.2%) in the cessation groups, 1708 (34.7%) in control groups, and 768 (15.6%) who withdrew from the analyses. The mean age was 39.2 years (range, 16 to 73). The mean smoking duration was 20.75 years (range, 0.25–53). All included studies were of sufficient quality to allow further analysis. The duration of acupoint stimulation for smoking cessation varied from one to eight weeks, and the duration of follow-up varied from ten days to 36 months. Nineteen studies evaluated the smoking cessation rate and three studies evaluated daily cigarette consumption. Smoking cessation rate ranged from 7.4% to 94.45%, and the mean daily

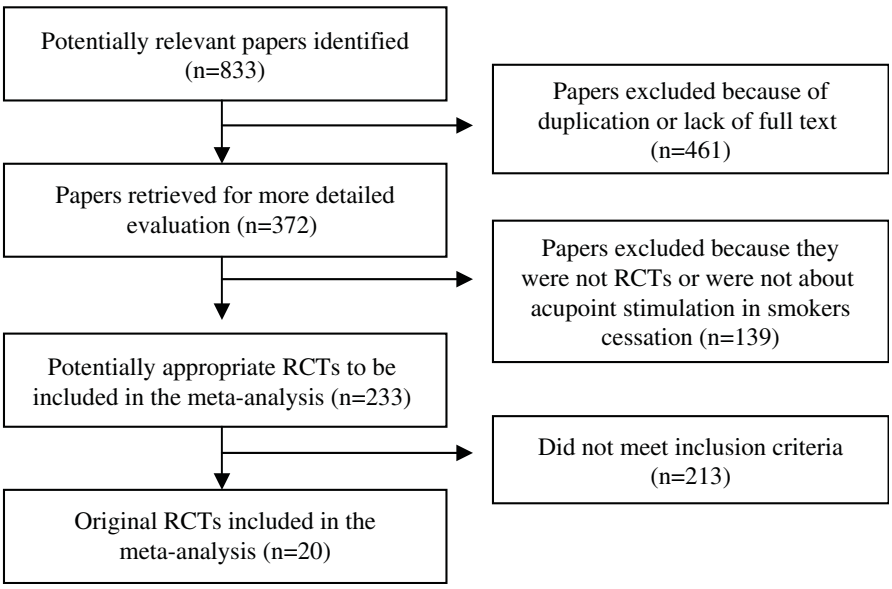

Figure 1. The process of selecting studies included for meta-analysis.

Table 1. Characteristics of Included Studies on Acupoint Stimulation for Smoking Cessation

Study (year)	*n*	Mean Age (year)	Dropout *n* (%)	Blind	Intervention	Control	Treatment (T) & Follow Up (F)	Outcome	Jadad
Bier *et al.* (2002)	141	All = 46.4	AA & A = 29 (64.4) AA & A & education = 38 (65.5) PAA & PA = 26 (68.4)	Single	Group 1 = AA: *Shenmen, Sympathetic, Lung, Kidney, Liver*; A: *Hegu* Group 2 = AA & A & education	PAA & PA: 5 mm from the true acupoint & education	T: 4-wk AA & 5-wk education F: 3, 6, 12, 15, & 18 months	Cessation rate, Beck Depression Inventory, Zung Self-Rating Anxiety Scale	2
Clavel and Benhamou (1985)	651	Not reported	Not reported	None	A: *Shuaigu, Qiuhou*	Control 1 = nicotine gum Control 2 = none	T: 1 months F: 13 months	Cessation rate	1
Clavel-Chapelon *et al.* (1997)	996	Not reported	First yr = 2 (0.20) Fourth yr = 32 (3.21)	Single	A: *Bitong, Shuaigou* & nicotine gum	Control 1 = PA & placebo nicotine gum Control 2 = PA & nicotine gum Control 3 = A & placebo nicotine gum	T:4-wk A; 6 months nicotine gum F: 2 & 4 years	Cessation rate	2
Cottraux *et al.* (1983)	558	Not reported	AA = 9 BT = 8 PM = 2 WL = 9	None	AA: *Gall bladder, Lung, Shuai gu, Tongziliao*	Control 1 = BT Control 2 = PM (lactose capsules) Control 3 = WL	T: 15 days F: 3, 6, 9, & 12 months	Cessation rate, smoking reduction	2
Georgiou *et al.* (1998)	265	All = 43.3 ± 12.08	All = 49 (18.5)	None	Electrode placement: *Quimai, Yifeng* Group 1 = modulated Group 2 = continuous	Electrode placement: *Jianzhongshu* Control 1 = modulated Control 2 = continuous	T: 1 wk F: 1, 3, 6 & 12 months	Cessation rate,Carbon monoxide, Fagerstro Èm score	2
Gilbey and Neumann (1977)	92	Not reported	AA = 12 (27.3) PAA = 15 (31.3)	Single	AA: *Lung*	PAA: *Kidney*	T: 1 wk F: 1 & 3 months	Cessation rate	2
Gillams *et al.* (1984)	81	AA = 36 PAA = 39 GT = 41	AA = 3 (10.7) PAA = 3 (11.1) GT = 19 (73.1)	Single	AA: *Lung*	Control 1 = PAA: ineffective point Control 2 = GT	T: 1 months F: 3 & 6 months	Cessation rate	2
Han (2006)	42	Female = 38 Male = 40	Not reported	None	A: *Timme* EAP: *Mouth, Lung, Subcortex, Endocrine, Heart*	EAP: *Mouth, Lung, Subcortex, Endocrine, Heart*	T: 10 days F: 1 months	Cessation rate	1

Table 1. (*Continued*)

Study (year)	*n*	Mean Age (year)	Dropout *n* (%)	Blind	Intervention	Control	Treatment (T) & Follow Up (F)	Outcome	Jadad
He *et al.* (2001)	46	Intervention = 38 ± 8.1 Sham A = 40 ± 9.2	Intervention = 0 (0) Sham = 2 (10)	None	EA: *Shenmen, Lung, Mouth, Lieque, Kongzui* AAp & EP: *Shenmen, Mouth, Lung, Trachea, Hunger, Endocrine*	Sham EA: *Shousanli, Sanyanglui,* AAp & EP:*Knees, Lumbar vertebra*, etc.	T: 3 wks	Consumption, Serum cotinine, Serum thiocyanate, Plasma fibrinogen Serum TBARS	1
Kerr *et al.* (2008)	387	Not reported	AA & A = 5 (3.7) Part of placebo = 4 (3.2) Placebo = 38 (29.9)	Double	AA & laser: *Shenmem, Lung, Adrenal, Addiction* A & laser: *Shenmen, Daling, Hegu* Group 1 = all treatments Group 2 = 3/4 treatments	AA & placebo laser	T: 2 wks F: 3, 6, & 18 months	Cessation rate	3
Lamontagne *et al.* (1980)	75	32.8	AA = 1 (4) Relax = 1 (4) Self-monitoring = 1 (4)	None	AA: *Ear0, Lung*	Control 1 = Relaxation Control 2 = Self-monitoring	T: 2 wks F: 1, 3, & 6 months	Cessation rate	2
Leung (1991)	95	AA = 38.5 BT = 5.1 WL = 36.8	AA = 8 (25) BT = 5 (15.6) WL = 4 (12.9)	None	AA: *Shenmen, Lung*	Control 1 = BT Control 2 = WL	T: 10 day F: 1, 3, & 6 months	Cessation rate	2
Martin and Waite (1981)	405	36 ± 13	3 weeks = 22% 3 months = 3% 6 months = 6%	Single	Group 1 = AA: *Lung, Hunger* Group 2 = AA & EP: *Lung, Hunger, Hoku, Tongue*	Sham Control 1 = AA & EP: *Shoulder, Eye* Control 2 = AA: *Shoulder, Eye* Control 3 = A: ankle Control 4 = *Lung, Hunger*	T: 3 wks F: 3 & 6 months	Cessation rate	2
Parker and Mok (1977)	41	Not reported	Not reported	None	Group 1 = EA: *Shenmen, Lung* Group 2 = AA & EP: *Shenmen, Lung*	Sham Control 1 = EA: *Shoulder, Eye* Control 2 = AA & EP: *Shoulder, Eye*	T: 3 wks F: 6 wks	Cessation rate	1

Table 1. (*Continued*)

Study (year)	*n*	Mean Age (year)	Dropout *n* (%)	Blind	Intervention	Control	Treatment (T) & Follow Up (F)	Outcome	Jadad
Steiner *et al.* (1982)	32	Not reported	A = 5 (31.3) PA = 4 (25)	None	1: A: *Hegu, Huagai, Zhongwan, Lieque* AA: *Lung, Stomach* 2: A: *Pichu, Zhongfu, Taiyuan, Neiguan, etc.* 3: A: *Hegu, Huagai, Neiguan*, or Akabane treatment 4: A: *Pichu, Neiguan*	PA: non-acupoint	T: 2 wks	Cessation rate Consumption	2
Waite and Clough (1998)	78	AA = 40 PAA = 45	Not reported	Single	AA & EP, seeds (acupoint not reported) & structure counseling	PAA: needle placed superficial (acupoint not reported) & structure counseling	T: 2 wks F: 6 months	Cessation rate, Urine cotinine	2
White *et al.* (1998)	76	AA = 40.8 ± 10.9 PAA = 42.5 ± 13.9	AA = 11 (29) PAA = 13 (34)	Double	AA: *Lung*	PAA: non-acupoint	T: 14 days F: 9 months	Cessation rate, Nicotine withdrawal symptoms	3
Wu *et al.* (2007)	131	53.7 ± 16.8	AA = 5 (7.8) PAA = 8 (11.9)	None	AA: *Shenmen, Sympathetic, Mouth, Lung*	Sham AA: *Knee, Elbow, Shoulder, Eye*	T: 8 wks F: 6 months	Cessation rate, Nicotine withdrawal symptom, Adverse effects	2
Yeh *et al.* (2009)	79	AA & A = 28 ± 7.79 Sham = 27 ± 7.63	EEA + AP = 9 (11.4) Sham = 11 (13.9)	None	AAp & EP, seeds: *Shenmen, Lung, Stomach, Mouth, Endocrine* EP: *Timmee*	Sham: 5 mm from the true acupoint	T: 6 wks	Cessation rate, Consumption, Carbon oxide, Serum cotinine	2
Yiming *et al.* (2000)	330	Not reported	AA = 32 (20) PAA = 30 (17.6)	Double	AA & laser: *Shenmen, Mouth, Lung, External nose*	AA & sham laser: *Shenmen, Mouth, Lung, External nose*	T: 4 wks F: 3 months	Cessation rate	3

Abbreviations: A = acupuncture, AA = auricular acupuncture, AAp = auricular acupressure, EA = electroacupuncture, EP = electrode placemen, PA = placebo acupuncture, PAA = placebo auricular acupuncture, PEA = placebo electroacupuncture, PM = placebo medicine, WL = waiting−list, BT = behavior therapy, GT = group therapy.

cigarette consumption was 20 cigarettes (range, 5–60). When the study design included more than two groups, the effectiveness of interventions was evaluated after dividing studies into data units. The analysis of smoking cessation rate, therefore, involved 33 data units, and that of daily cigarette consumption included four data units.

Immediate Effects on the Smoking Cessation Rate

Analysis of 19 RCTs (33 data units) measuring smoking cessation rates identified statistical evidence of heterogeneity ($Q = 83.34$, $p < 0.001$; $I^2 = 61.60\%$). This study, thus, divided the papers according to country where the study was performed, treatment period, and acupoint stimulation approach, to evaluate the cause of heterogeneity. Heterogeneity was significant for studies published in Eastern countries (China, Hong Kong, Singapore, and Taiwan; $Q = 12.73$, $p = 0.03$; $I^2 = 60.72\%$; six data units) and Western countries (Britain, Canada, France, Germany, New Zealand, and the US; $Q = 70.57$, $p < 0.001$; $I^2 = 63.16\%$; 27 data units). Heterogeneity was also significant for studies with treatment periods within 14 days ($Q = 71.30$, $p < 0.001$; $I^2 = 78.96\%$; 16 data units); and for studies with treatment periods between 15 and 56 days ($Q = 26.59$, $p = 0.05$; $I^2 = 29.82\%$; 17 data units). Country and treatment period were, thus, not the cause of heterogeneity.

Heterogeneity was significant for RCTs evaluating acupuncture ($Q = 51.65$, $p < 0.001$; $I^2 = 63.21\%$; 20 data units) and laser acupuncture ($Q = 38.28$, $p < 0.001$; $I^2 = 94.78\%$; three data units); but homogeneity was significant for RCTs evaluating other acupuncture-related modalities ($Q = 3.61$, $p = 0.94$; $I^2 = 0\%$; ten data units). When laser studies were excluded, further meta-analysis showed weakly significant heterogeneity ($Q = 43.18$, $p = 0.04$; $I^2 = 32.85\%$). A visual inspection of the funnel plots (not provided) and the results of the Egger's test ($t = 1.26$, $SE = 0.43$, $p = 0.23$) showed that the studies were within the confidence limits, confirming symmetry and supporting no publication bias. After pooling all data in a random-effects model, the interventions were effective ($RR = 1.24$, 95%CI = 1.071.43, $p = 0.003$; Fig. 2).

Follow-Up Effects on the Smoking Cessation Rate

Nine RCTs (17 data units) reported smoking cessation rates at the three-month follow-up. Heterogeneity was significant ($Q = 42.37$, $p < 0.001$; $I^2 = 62.24\%$). A visual inspection of the funnel plots (not provided) and the results of the Egger's test ($t = 1.64$, $SE = 0.99$, $p = 0.12$) indicated that the studies were within the confidence limits, confirming symmetry and supporting no publication bias. After pooling data in a random-effects model, the interventions were effective ($RR = 1.70$, 95%CI = $1.17 \sim 2.46$, $p = 0.01$; Fig. 3). Nine RCTs (17 data units) reported smoking cessation rates at the 6-month follow-up. Heterogeneity was significant ($Q = 37.83$, $p = 0.002$; $I^2 = 57.71\%$). A visual inspection of funnel plots (not provided) and the results of the Egger's test ($t = 0.30$, $SE = 0.99$, $p = 0.77$) supported no publication bias. After pooling data in a random-effects model, the interventions were effective ($RR = 1.79$, 95%CI = $1.13 \sim 2.82$, $p = 0.01$; Fig. 4).

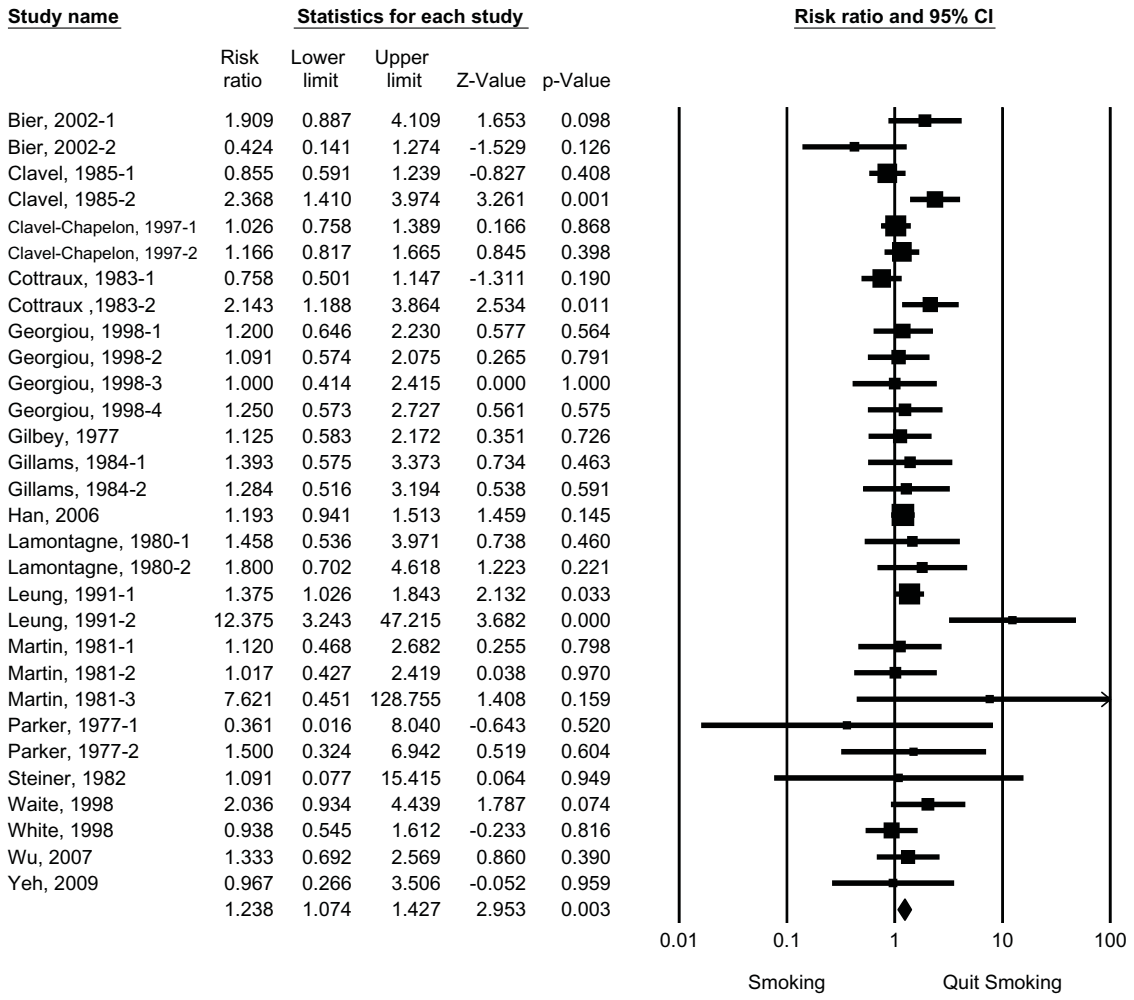

Figure 2. Effect size for smoking cessation in 17 RCTs.

Immediate Effect on the Cigarette Consumption

Three RCTs (four data units) of acupuncture reported daily cigarette consumption and showed high heterogeneity ($Q = 60.16$, $p < 0.001$; $I^2 = 95.01\%$). Further analysis, according to country and treatment period, identified the cause of this heterogeneity. Heterogeneity was absent for studies published in Eastern countries (Taiwan; $Q = 0.00$, $p = 1.00$; $I^2 = 0.00\%$; two data units) but significant for studies published in Western countries (Norway and US; $Q = 9.31$, $p = 0.01$; $I^2 = 78.51\%$; three data units). Heterogeneity was insignificant ($Q = 1.60$, $p = 0.21$; $I^2 = 37.12\%$; two data units) for RCTs with treatment periods within 14 days, and significant ($Q = 48.03$, $p < 0.001$; $I^2 = 97.92\%$) for RCTs with treatment periods between 15 and 56 days. Country of publication and treatment period were, thus, not the cause of heterogeneity. A visual inspection of funnel plots (not provided) and the results of the Egger's test ($t = 2.93$, SE $= 2.95$, $p = 0.10$) supported no publication bias. After pooling data in a random-effects model, the interventions were effective (SE $= 1.10$, 95%CI $= -4.65 \sim -0.34$, $p = 0.02$; Fig. 5).

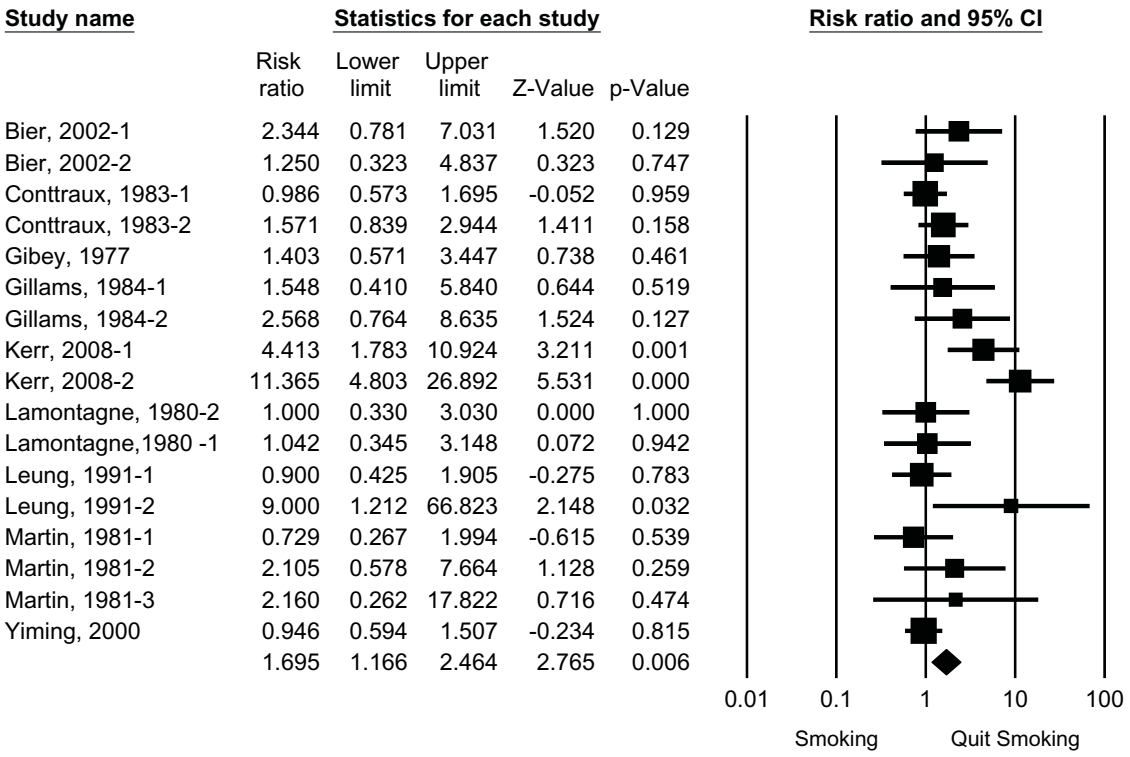

Figure 3. Effect size for smoking cessation at three-month follow-up in nine RCTS.

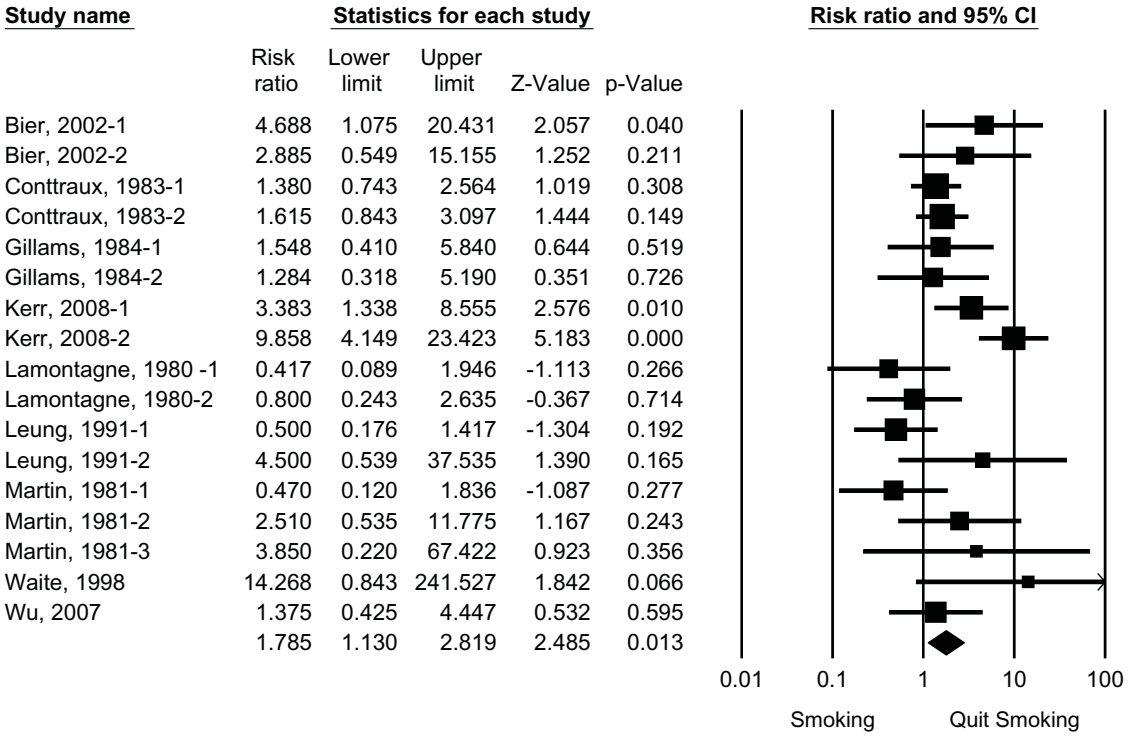

Figure 4. Effect size for smoking cessation at six-month follow-up in nine RCTS.

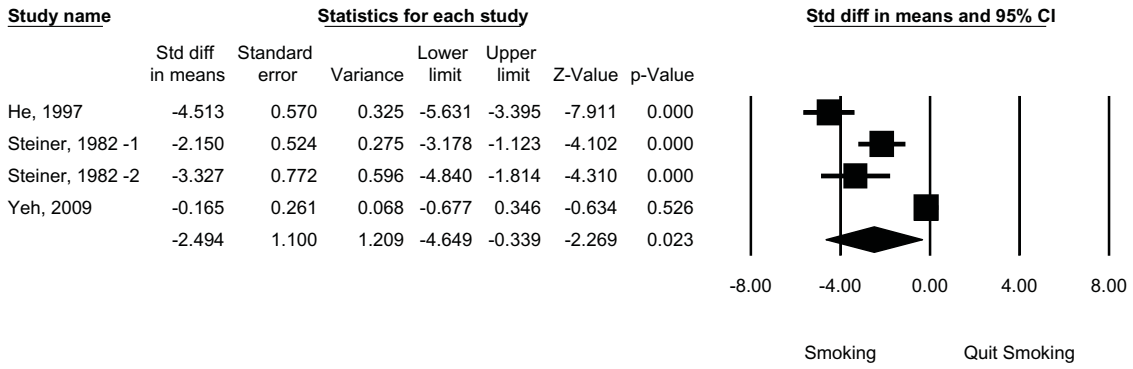

Figure 5. Effect size for daily cigarette consumption in three RCTs.

Discussion

Results from this meta-analysis indicate that acupoint stimulation is an effective treatment for smoking cessation, as demonstrated by its effects on smoking cessation rate. The pooled effects of acupoint stimulation were superior to those of control or sham interventions. The RR for smoking cessation increased 1.24-fold immediately after acupoint stimulation treatment; 1.70-fold at the three-month follow-up, and 1.79-fold at the six-month follow-up, compared to control or sham interventions. Of seven RCTs of auricular acupuncture, four identified that treatment had no significant effect on smoking cessation (Gilbey and Neumann, 1977; Lamontagne *et al.*, 1980; Steiner *et al.*, 1982; Wu *et al.*, 2007). The rate of smoking cessation in three RCTs of electroacupoint stimulation varied between 13% and 50% (Martin and Waite, 1981; Georgiou *et al.*, 1998; Yeh *et al.*, 2009); in two RCTs of acupuncture combined with education, behavior therapy, or relaxation therapy, it varied between 38% and 41% (Waite and Clough, 1998; Bier *et al.*, 2002).

In this study, a variety of methods of acupoint stimulation had a positive effect on smoking cessation. Prior investigations have described that acupuncture combined with smoking cessation education had a longer-term effect at the six-month follow-up than placebo treatment or acupuncture alone (Bier *et al.*, 2002; Waite and Clough, 1998). However, the superiority of the effects of the combination treatment on smoking cessation, compared to those of placebo treatment or acupuncture alone, has yet to be verified. The group's previous study identified that acupressure combined with Internet education was more efficacious than acupressure alone (Chen *et al.*, 2006). Smoking can be influenced by several factors; therefore cessation programs need to address as many of those factors as possible. Once smokers have stopped smoking, the most difficult challenge for them is overcoming the withdrawal symptoms and dealing with the emotional factors, which may lead to relapse.

According to the results of this meta-analysis, acupoint treatment for smoking cessation was effective for two to four weeks; and could remain effective for up to six months. However, the length of the included study periods should also be considered. A period longer than one month would tend not to be feasible because participants might not be motivated to complete the experiments if they had stopped smoking. Also, a follow-up period longer than six months might not be feasible because participants may lose

motivation to continue with the assessments if they had resumed smoking. The withdrawal rate of 15.6% in this analysis was acceptable (Shadish *et al.*, 2002), although 20% of the included studies did not report a withdrawal rate. To determine whether initial improvements from the treatment persist for a reasonable period of time, participant observation should last at least three months. Once smoking cessation has been achieved, a maintenance program to reduce relapse should be implemented, especially for women (Volkow, 2009). The average age of the participants in this meta-analysis was 39.2 years. Although those who stopped smoking before the age of 34 benefited the most, those who stopped smoking between the ages of 45 and 54 years also experienced benefits (Doll *et al.*, 2004).

Only three included studies evaluated the effects of acupoint stimulation on daily cigarette consumption; and the heterogeneity of the data was substantial. This small number of primary studies examining acupoint's effects on daily cigarette consumption, therefore, represented a limitation of the assessment. In addition, the meta-analysis was limited to Chinese- and English-language articles, thus excluding potentially valuable articles in other languages. Another limitation was the quality of the included RCTs. Use of a more rigorous design in future studies is warranted.

In conclusion, this study's findings indicate that acupoint stimulation increases smoking cessation rate and reduces daily cigarette consumption. Multi-modality treatment, especially acupuncture combined with smoking cessation education or other interventions, can help smokers to eschew smoking during treatment, and to avoid relapse after treatment. However, lifelong smoking cessation is the ultimate goal. Future studies would benefit from measuring daily cigarette consumption following a variety of smoking cessation interventions. It is expected that deaths from smoking-related diseases will start to decrease in 2030 and continue decreasing beyond 2030. Further evaluation of interventions for smoking cessation in middle aged or younger smokers, before the onset of major illness, is warranted.

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