

# Effectiveness of Auricular Acupressure Combined with Medication and Medical Advice for Smoking Cessation

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**Objective:** Nicotine withdrawal symptoms (NWS) are the main impediments to the quitting attempt. The present study investigated the effectiveness of specific auricular acupressure combined with medication and medical advice to quit smoking.

**Materials and Methods:** Two hundred eighty-two patients voluntarily participated in a smoking cessation program at the Smart Quit Clinic, Charoenkrung Pracharak Hospital. The patients were randomly divided into two groups, the treatment group (n=141) receiving specific auricular acupressure and the control group (n=141) receiving non-specific auricular acupressure. Five specific auricular acupressure points, including shenmen, lung, mouth, stomach, and sympathetic, were used to treat NWS. Each point was pressed with Wang Bu Liu Xing for one minute. The acupressure was applied three times a day for 12 weeks. The succession of cessation was assessed using carbon monoxide (CO) levels in exhaled breath and relief of NWS.

**Results:** The success of smoking cessation in the treatment group was significantly higher than the control group after cessation at weeks 12 and 24. Specific auricular acupressure such as shenmen, lung, mouth, stomach, and sympathetic, could reduce anxiety, craving on smoking, insomnia, and nervous symptoms since the first week after cessation.

**Conclusion:** Specific auricular acupressure using Wang Bu Liu Xing is an effective and safe treatment method for relieving NWS.

**Keywords:** Auricular acupressure; Nicotine withdrawal symptoms (NWS); Smoking cessation; Wang Bu Liu Xing

Received 25 October 2023 | Revised 8 December 2023 | Accepted 19 December 2023

**J Med Assoc Thai 2024; 107(4): 248-56**

**Website:** <http://www.jmatonline.com>

Smoking is one of the main biological risk factors for non-communicable diseases (NCDs) such as cardiovascular disease (CVD), stroke, cancer, diabetes, and chronic obstructive pulmonary disease<sup>(1)</sup>. Nowadays, the cause of death from NCDs in Thailand is around 400,000 lives yearly, which accounts for 74% of all deaths. In this number, over 80,000 people, or 18% of all deaths, die annually due to cigarette smoking. In 2021, the estimated tobacco consumption was more than 10 million people, and around 17% of adults were daily smokers<sup>(2)</sup>. The risk of respiratory and CVD increased with the number of daily cigarettes smoked and the duration

of smoking<sup>(3,4)</sup>. Thus, smoking cessation is the most effective action to reduce the risk of disability and premature death.

The transtheoretical model of health behavioral changes is commonly used to guide patients in smoking cessation. Four stages of change include pre-contemplation, contemplation, preparation, and action<sup>(5)</sup>. Presently, there are tobacco addict treatments such as nicotine replacement therapy (NRT)<sup>(6)</sup>, pharmacotherapy<sup>(7)</sup>, and medical advice<sup>(8)</sup>. However, these methods do not eliminate the nicotine withdrawal symptoms (NWS), for example, emotional distress, depressed mood, anxiety, insomnia, and slower heart rate, which are barriers to smoking cessation attempts<sup>(9)</sup>. The symptoms will occur within two hours after smoking cessation or reduction, then become severe within 24 to 48 hours and last for weeks or months. Pharmacological and non-pharmacological approaches are currently treatment methods for NWS. The pharmacological method consists of NRT such as nicotine patches and nicotine gum, and non-nicotine therapy such as Bupropion and varenicline. The non-pharmacological method includes therapeutic behaviors, herbal use,

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## How to cite this article:

Sivapornpun V, Eamlaorsuk M, Junyapoon S. Effectiveness of Auricular Acupressure Combined with Medication and Medical Advice for Smoking Cessation. *J Med Assoc Thai* 2024;107:248-56.

DOI: 10.35755/jmedassocthai.2024.4.13965

and alternative medicine<sup>(10)</sup>. However, medicines can cause side effects<sup>(11)</sup>. For instance, common side effects of Bupropion hydrochloride involve shaking hands, rash, headache, insomnia, and dry mouth<sup>(12)</sup>. In addition, its interventions may only be effective for months.

Auricular acupressure is a simple, non-invasive intervention that can decrease NWS and improve the refusal of smoking self-efficacy<sup>(13,14)</sup>. Acupoint stimulation can increase endorphin<sup>(15)</sup> and serotonin<sup>(16)</sup>. These hormones can be transmitted from the brain to particular organs through the rest of the body through nerves and meridian-modulated adaptive physiological reactions<sup>(17)</sup>. Several positions of auricular acupressure are used for addictive chemical cessation<sup>(18)</sup>. However, five positions of auricular acupressure are widely used for smoking cessation namely shenmen, lung, mouth, stomach, and sympathetic point. Shenmen's points could help to increase the release of endorphins, which are significantly and generally used to treat symptoms such as pain relief, peace of mind, relaxation, better sleep, reducing the symptoms of drug addictions, and reducing inflammation. The lung point is related to lung tissues. Mouth and stomach points can detoxify the respiratory system. The sympathetic point could induce relaxation by enlarging blood vessels and restoring the balance of the sympathetic nervous system<sup>(19)</sup>.

Wang Bu Liu Xing or Cowherb seed (*Vaccaria segetalis*), a native herb in China, has been used as material for auricular acupressure due to its small size, round shape, and smooth surface. Specific auricular acupressure with Wang Bu Liu Xing can trigger the signals transmitted from the ear points to the nerves around the ears and further transmitted to the spinal cord and the brain, results in the release of endorphin and enkephalin, an increase of serotonin in the hypothalamus, and dopamine in the nucleus accumbent and amygdala. These lead to the stress and anxiety reduction. Moreover, positive feelings, such as peace and comfort, are induced, leading to a deep level of relaxation. Thus, auricular acupressure with Wang Bu Liu Xing can help smokers reduce NWS and decrease the period of unstable concentrations of Bupropion and metabolite in plasma. In addition, auricular acupressure with Wang Bu Liu Xing is painless and cheap<sup>(19)</sup>. Studies reported that auricular acupressure has benefits in achieving smoking cessation<sup>(19,20)</sup>. However, there are few studies on a combination of conventional treatment and auricular acupuncture for smoking cessation.

The present study aimed to evaluate the effect of auricular acupressure with Wang Bu Liu Xing combined with Bupropion and medical advice on NWS treatment. One tablet of 150 mg Bupropion was taken twice daily after breakfast and dinner. The five specific auricular points were applied. Each point was pressed for one minute using the tip of the index finger and thumb three times a day for 12 weeks. The successful outcomes of smoking cessation were examined by NWS reduction and exhaled carbon monoxide (CO) levels after four and 24 weeks.

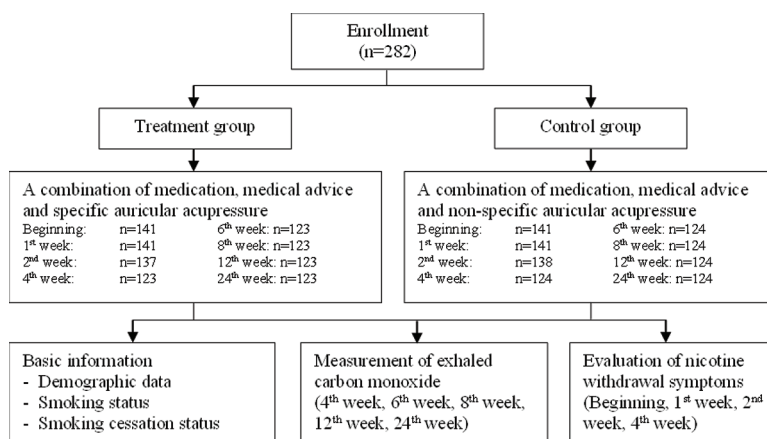
## Materials and Method

### Design and participants

The present study was conducted between June 2019 and December 2020 at Fahsai Clinic (the Smart Quit Clinic), Department of Community Medicine, Charoenkrung Pracharak Hospital, Bangkok, Thailand. The smoking cessation program was announced to the general public through advertisements and posters at Charoenkrung Pracharak Hospital. Two hundred eighty-two volunteer smokers were recruited. The participants were divided into two groups by computer-generated randomized allocation method using a block of four techniques. Double-blinded trials, in which neither the patients nor the doctors knew the group's nature, were applied to reduce the experimental bias. In this study, both treatment and control groups received medication and medical advice because the placebo-controlled trial was unethical. The treatment group (141 people) received specific auricular acupressure, whereas the control group (141 people) received non-specific auricular acupressure for 12 weeks.

### Research tools

The smoking and cessation status of patients were examined using a questionnaire, based on literature reviews<sup>(21)</sup>, and revised by clinical smoking cessation experts. It contained two parts, 1) demographic data including gender, age, and marital status and 2) smoking status including smoking frequency, smoking duration, nicotine dependence, and inpatient diagnosis of comorbidities such as diabetes, hypertension, CVD, cerebrovascular diseases, emphysema, asthma. Inclusion criteria were 1) smoker age between 18 and 70 years old, 2) total score of the Fagerstrom Test for Nicotine Dependence at 4 or greater, 3) not disadvantaged and possessing self-care ability and verbal expressive ability, 4) informed consent, and 5) voluntary participation. Exclusion criteria were 1) acute psychosis and



**Figure 1.** A conceptual framework of experimental procedure.

cognitive disability and 2) evidence of pathological conditions of the ear such as infection, wearing a hearing aid, and allergy to adhesive dressings. The degree of nicotine dependence was assessed using the Fagerstrom Test for Nicotine Dependence, Thai version 12<sup>(22,23)</sup>. The test comprised six items that evaluate the quantity of cigarette consumption, the compulsion to use, and dependence through yes or no items, scored from 0 to 1, and multiple-choice items scored from 0 to 3. The scores were calculated according to the following scale with 0 to 2 as very low dependence, 3 to 4 as low dependence, 5 as moderate dependence, 6 to 7 as high dependence, and 8 to 10 as very high dependence. The yield of the total score ranges from 0 to 10. The higher score indicates a more intense patient's physical dependence on nicotine. The patients involved in the present study were instructed to answer the questionnaires.

### Research method

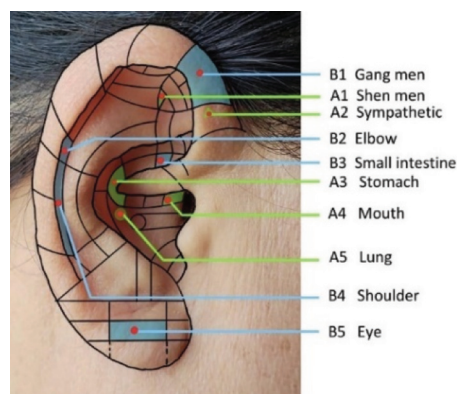
A combination of medication, medical advice, and auricular acupressure was applied as a smoking cessation method. A conceptual framework of experimental procedure is shown in Figure 1.

### Medication

In the present study, all participants in both groups were prescribed one tablet of Bupropion (150 mg) twice a day, after breakfast and dinner for 24 weeks.

### Medical advice

The 5As guidelines, which are Ask, Advise, Assess, Assist, and Arrange<sup>(24)</sup> were used as medical advice for both groups as follows, 1) ask about tobacco use, 2) advise to quit, 3) assess willingness



**Figure 2.** Auricular acupressure points using Wang Bu Liu Xing, specific positions (A1-A5), non-specific positions (B1-B5).

Drawn by Sawid Khummoon using OneNote program.

to make a quit attempt, 4) assist in quit attempt, 5) arrange follow-up.

### Intervention

A Chinese herb seed with 0.1 mm in diameter (Wang Bu Liu Xing) was attached on an adhesive tape. The adhesive patches were placed at five specific points namely shenmen (A1), sympathetic (A2), stomach (A3), mouth (A4), and lung (A5) in the inner surface of the auricle for treatment group whereas control group received non-specific auricular acupressure points at Gang men (B1), elbow (B2), small intestine (B3), shoulder (B4), and eye (B5) as shown in Figure 2. The adhesive patches were placed in one ear and swapped to the other ear weekly by a physician who practiced traditional Chinese medicine to ensure the patches were in the correct places. All participants were instructed to apply pressure to each acupoint using the tip of the index finger and thumb

for one minute each time, three times a day for 12 weeks, and additionally whenever they desired to smoke during the study period. Gently massage of each ear was employed in a clockwise direction. The adhesive patches must be kept dry and stuck on the ear at all times. The patients were advised to sleep on the other side of the attached patch and not scratch. The broken patch was immediately replaced with a new one.

### Measurement of exhaled carbon monoxide

Outcomes were measured in terms of CO levels in the exhalation at the pre-treatment as before intervention and post-treatment right after intervention, at weeks 4, 6, 8, and 12, and follow-up at week 24 after intervention time-points. The level of CO was measured by PiCO<sup>+</sup> Smokerlyzer® (Bedfont Scientific Ltd., Upchurch, Kent, UK), which is calibrated every six months by the Medical Device Center, Charoengkrung Pracharak Hospital. The levels of CO exposure ranged according to the following concentrations: 0 to 6 ppm mean no CO in breathing or a small amount, which indicates success in smoking cessation, 7 or more ppm mean CO exists in breathing, which indicates failure in smoking cessation and currently smoking. However, this measurement was limited because the half-life for CO is about three to five hours. Therefore, CO was detected in the exhalation when the patient recently smoked cigarettes, or at up to 6 hours before the examination. In addition, the CO source could not identify if it were caused by direct or secondhand smoking.

### Evaluation of nicotine withdrawal symptoms

NWS were evaluated using the Minnesota Withdrawal Scale-Revised (MNWS) by Hughes and Hatsukami<sup>(21)</sup>, translated in Thai by Kanokururote<sup>(25)</sup>. The severity levels of NWS, based on the participants' perceptions, were classified into nine levels, 1) irritability, 2) anxiety, 3) depression, 4) craving to smoke, 5) difficulty concentration, 6) increased appetite, 7) insomnia, 8) frustration, and 9) nervous. Each level contained a score ranging from 0 to 4 with a total sum of 0 to 36 points. A total sum of the severity score of 0 means no NWS, whereas that of 36 means the most severe level. The NWS were evaluated at the beginning and after cessation at week 1, 2, and 4. In the present study, NWS were evaluated for four weeks according to the work of Maltz<sup>(26)</sup> reported that it takes a minimum of about 21 days for a person to form a new habit.

### Statistical analysis

Analyses were performed at a significant level of 0.05 using an IBM SPSS Statistics, version 26.0 (IBM Corp., Armonk, NY, USA) concurrent license (Research and Medicine Center Medical Service Department, Bangkok Metropolitan Administration). Descriptive statistical analysis was used to examine demographic and clinical characteristics of participants. Inferential statistical analysis used t-tests for continuous variables and chi-square tests for independence or Fisher's exact test for categorical variables to examine homogeneity between the two groups. One-way repeated measures ANOVA was used to assess the differences in severity scores of NWS. The sphericity assumption was examined using Mauchly's test. If it was violated ( $p < 0.05$ ), the Greenhouse-Geisser correction was applied.

### Ethical considerations

The present research received permission to collect the data from the Director of Charoengkrung Pracharak Hospital. The ethical considerations were approved by the Bangkok Metropolitan Administration Human Research Ethics Committee (BMAHREC), Thailand (Ethic No. S018h/63). Regarding the informed consent process, the patients were informed of the research procedures, risks, and benefits before treatments. All participants were free to decide on their own before giving their informed consent and withdraw from the study at any time during the study. The present study preserved the rights of all participants, their names and personal information were kept confidential.

### Results

The basic information is listed in Table 1. Two hundred eighty-two participants with a history of smoking were involved in the present study, but 35 participants quit this program. The mean age was  $52.48 \pm 13.27$  and  $51.92 \pm 15.24$  years while the smoking frequency was 17 (IQR 11) and 15 (IQR 10) cigarettes per day for treatment and control groups, respectively. The smoking duration was 5 years (IQR 25) in both groups. The majority of participants were male at 92.91% and married at 68.09% for treatment group and 60.28% for control group.

The Fagerstrom scores for nicotine dependence of patients in treatment and control groups were  $5.57 \pm 1.56$  and  $5.30 \pm 1.52$ , respectively. It indicated that the patients had moderate physical dependence on nicotine. The inpatient diagnosis indicated that one comorbid condition was the dominant

**Table 1.** Basic information distribution of smoking patients

	Treatment (n=141)	Control (n=141)	Statistics	p-value
<b>Demographic data</b>				
Sex; n (%)			<0.001	>0.999 <sup>c</sup>
• Male	131 (92.91)	131 (92.91)		
• Female	10 (7.09)	10 (7.09)		
Marital status (number (%))			2.685	0.261 <sup>c</sup>
• Single	32 (22.70)	35 (24.82)		
• Married	96 (68.09)	85 (60.28)		
• Divorced	13 (9.22)	21 (14.89)		
Age (years); mean±SD	52.48±13.27	51.92±15.24	-0.325	0.745 <sup>T</sup>
<b>Smoking status</b>				
Smoking frequency (cigarettes per day); median [IQR]	17 [11]	15 [10]	9,658.500	0.675 <sup>U</sup>
Smoking duration (years); median [IQR]	5 [25]	5 [25]	9,166.000	0.641 <sup>U</sup>
Nicotine dependence; Fagerstrom test (scores); mean±SD	5.57±1.56	5.30±1.52	-1.469	0.143 <sup>T</sup>
<b>History of disease</b>				
Inpatient diagnosis of comorbidities; n (%)			1.670	0.893 <sup>U</sup>
• 0	24 (17.02)	28 (19.86)		
• 1	68 (48.23)	63 (44.68)		
• 2	32 (22.70)	35 (24.82)		
• 3	14 (9.93)	13 (9.22)		
• 4	2 (1.42)	2 (1.42)		
• 5	1 (0.71)	0 (0.00)		
Diabetes; n (%)			0.500	0.480 <sup>U</sup>
• With	35 (24.82)	30 (21.28)		
• Without	106 (75.18)	111 (78.72)		
Hypertension; n (%)			0.138	0.711 <sup>U</sup>
• With	50 (35.46)	53 (37.59)		
• Without	91 (64.54)	88 (62.41)		
Cardiovascular diseases; n (%)			0.698	0.404 <sup>U</sup>
• With	37 (26.24)	31 (21.99)		
• Without	104 (73.76)	110 (78.01)		
Cerebrovascular diseases; n (%)			0.357	0.550 <sup>U</sup>
• With	30 (21.28)	26 (18.44)		
• Without	111 (78.72)	115 (81.56)		
Emphysema; n (%)			0.056	0.812 <sup>U</sup>
• With	10 (7.09)	9 (6.38)		
• Without	131 (92.91)	132 (93.62)		
Asthma; n (%)			0.146	>0.999 <sup>F</sup>
• With	4 (2.84)	3 (2.13)		
• Without	137 (97.16)	138 (97.87)		

<sup>c</sup> Chi-square test for independence, <sup>T</sup> Independent t-test, <sup>U</sup> Mann-whitney U-test, <sup>F</sup> Fisher's exact test

followed by 2, 0, 3, 4, and 5 comorbid conditions, respectively. Reported comorbidities in treatment and control groups by decreasing frequency were hypertension at 35.46% and 37.59%, CVD at 26.24% and 21.99%, diabetes at 24.82% and 21.28%, cerebrovascular disease at 21.28% and 18.44%, emphysema at 7.09% and 6.38%, and asthma at 2.84%, 2.13%. There was no significant

difference in the baseline characteristics between the treatment and the control groups as shown in Table 1.

Table 2 shows the succession of smoking cessation in terms of CO levels in the exhalation. The smoking-cessation success rate improved gradually after cessation from week 4 to 24. Its rate in the treatment group was higher than in the control

**Table 2.** Succession of smoking cessation in terms of carbon monoxide (CO) levels in the exhalation

Duration after cessation	Group	Outcomes of smoking cessation				p-value
		Success	Non-success	Total	% Successful outcomes	
4 <sup>th</sup>	Treatment	66	57	123	53.66	0.182 <sup>ns</sup>
	Control	56	68	124	45.16	
6 <sup>th</sup>	Treatment	93	30	123	75.61	0.420 <sup>ns</sup>
	Control	88	36	124	70.97	
8 <sup>th</sup>	Treatment	106	17	123	86.18	0.102 <sup>ns</sup>
	Control	97	27	124	78.23	
12 <sup>th</sup>	Treatment	119	4	123	96.75	0.015*
	Control	110	14	124	88.71	
24 <sup>th</sup>	Treatment	119	4	123	96.75	0.040*
	Control	112	12	124	90.32	

<sup>ns</sup> No significance difference, \* Significance difference p-value by Pearson chi-square for independence at p<0.05

**Table 3.** The mean severity scores of nicotine withdrawal syndrome (NWS) with different time intervals

	Beginning date; mean±SD (n <sub>trt</sub> =141, n <sub>con</sub> =141)	1 <sup>st</sup> week; mean±SD (n <sub>trt</sub> =141, n <sub>con</sub> =141)	2 <sup>nd</sup> weeks; mean±SD (n <sub>trt</sub> =137, n <sub>con</sub> =138)	4 <sup>th</sup> weeks; mean±SD (n <sub>trt</sub> =123, n <sub>con</sub> =124)	p-value within group
1. Irritability, easily upset					
Treatment	2.74±1.05 <sup>a</sup>	2.58±0.94 <sup>b</sup>	2.23±0.77 <sup>c</sup>	1.98±0.68 <sup>d</sup>	<0.001*
Control	3.84±1.45 <sup>a</sup>	2.94±1.20 <sup>b</sup>	2.36±0.90 <sup>c</sup>	2.10±0.68 <sup>d</sup>	<0.001*
2. Anxiety					
Treatment	2.43±0.93 <sup>a</sup>	2.09±0.77 <sup>b</sup>	1.93±0.68 <sup>c</sup>	1.86±0.67 <sup>d</sup>	<0.001*
Control	2.95±1.08 <sup>a</sup>	2.53±0.87 <sup>b</sup>	2.34±0.71 <sup>c</sup>	2.14±0.63 <sup>d</sup>	<0.001*
3. Depression					
Treatment	2.09±0.85 <sup>a</sup>	1.80±0.67 <sup>b</sup>	1.72±0.64 <sup>c</sup>	1.67±0.61 <sup>c</sup>	<0.001*
Control	2.47±1.06 <sup>a</sup>	1.90±0.68 <sup>b</sup>	1.82±0.62 <sup>c</sup>	1.80±0.62 <sup>c</sup>	<0.001*
4. Craving on smoking					
Treatment	2.70±0.96 <sup>a</sup>	2.51±0.80 <sup>b</sup>	2.26±0.72 <sup>c</sup>	2.12±0.71 <sup>d</sup>	<0.001*
Control	3.56±1.17 <sup>a</sup>	3.19±0.94 <sup>b</sup>	2.77±0.75 <sup>c</sup>	2.31±0.60 <sup>d</sup>	<0.001*
5. Difficult to concentration					
Treatment	2.61±0.99 <sup>a</sup>	2.36±0.76 <sup>b</sup>	2.10±0.66 <sup>c</sup>	1.85±0.65 <sup>d</sup>	<0.001*
Control	2.75±1.11 <sup>a</sup>	2.50±0.86 <sup>b</sup>	2.24±0.67 <sup>c</sup>	1.97±0.70 <sup>d</sup>	<0.001*
6. Increased appetite					
Treatment	1.56±0.81 <sup>a</sup>	1.49±0.67 <sup>b</sup>	1.39±0.57 <sup>c</sup>	1.37±0.53 <sup>c</sup>	<0.001*
Control	1.89±0.97 <sup>a</sup>	1.75±0.75 <sup>b</sup>	1.58±0.65 <sup>c</sup>	1.51±0.63 <sup>c</sup>	<0.001*
7. Insomnia					
Treatment	1.71±0.80 <sup>a</sup>	1.67±0.75 <sup>b</sup>	1.64±0.70 <sup>c</sup>	1.63±0.69 <sup>c</sup>	<0.001*
Control	2.21±1.15 <sup>a</sup>	2.03±0.91 <sup>b</sup>	1.91±0.78 <sup>c</sup>	1.86±0.74 <sup>c</sup>	<0.001*
8. Frustration					
Treatment	1.68±0.81 <sup>a</sup>	1.62±0.75 <sup>ab</sup>	1.57±0.72 <sup>bc</sup>	1.54±0.67 <sup>c</sup>	<0.001*
Control	1.68±0.86 <sup>a</sup>	1.62±0.73 <sup>a</sup>	1.55±0.68 <sup>b</sup>	1.51±0.64 <sup>b</sup>	<0.001*
9. Nervous					
Treatment	1.75±0.81 <sup>a</sup>	1.71±0.77 <sup>b</sup>	1.66±0.70 <sup>bc</sup>	1.52±0.63 <sup>c</sup>	<0.001*
Control	2.36±0.92 <sup>a</sup>	2.25±0.79 <sup>b</sup>	2.10±0.72 <sup>c</sup>	1.99±0.72 <sup>d</sup>	<0.001*

\* Significant difference at p<0.05 calculated by one-way repeated measures ANOVA with a Greenhouse-Geisser correction at 95% confidence interval. The values with different superscript letters (a, b, c, d) in each row denote statistically significant differences.

group but there was no significant difference after cessation at week 4, 6, and 8 (p>0.05). However, the success rates in the treatment group at 96.75% was

significantly higher than in the control group at 88.71% and 90.32% after cessation at week 12 and 24 (p<0.05).

**Table 4.** Comparison nicotine withdrawal syndrome after cessation between treatment and control groups

Symptom	Group	1 <sup>st</sup> week (n <sub>trt</sub> =141, n <sub>con</sub> =141)		2 <sup>nd</sup> weeks (n <sub>trt</sub> =137, n <sub>con</sub> =138)		4 <sup>th</sup> weeks (n <sub>trt</sub> =123, n <sub>con</sub> =124)	
		Mean±SD	p-value	Mean±SD	p-value	Mean±SD	p-value
1. Irritability, easily upset	Treatment	2.58±0.94	2.815**	2.23±0.77	1.201 <sup>ns</sup>	1.98±0.68	1.397 <sup>ns</sup>
	Control	2.94±1.20		2.36±0.90		2.10±0.68	
2. Anxiety	Treatment	2.09±0.77	4.577**	1.93±0.68	4.855**	1.86±0.67	3.331**
	Control	2.53±0.87		2.34±0.71		2.14±0.63	
3. Depression	Treatment	1.80±0.67	1.238 <sup>ns</sup>	1.72±0.64	1.269 <sup>ns</sup>	1.67±0.61	1.677 <sup>ns</sup>
	Control	1.90±0.68		1.82±0.62		1.80±0.62	
4. Craving on smoking	Treatment	2.51±0.80	6.553**	2.26±0.72	5.800**	2.12±0.71	2.209*
	Control	3.19±0.94		2.77±0.75		2.31±0.60	
5. Difficult to concentration	Treatment	2.35±0.76	1.471 <sup>ns</sup>	2.10±0.66	1.715 <sup>ns</sup>	1.85±0.65	1.421 <sup>ns</sup>
	Control	2.50±0.86		2.24±0.67		1.97±0.70	
6. Increased Appetite	Treatment	1.49±0.67	3.077**	1.39±0.57	2.513*	1.37±0.53	1.914 <sup>ns</sup>
	Control	1.75±0.76		1.58±0.65		1.51±0.63	
7. Insomnia	Treatment	1.67±0.75	3.569**	1.64±0.70	3.033**	1.63±0.69	2.601**
	Control	2.03±0.91		1.91±0.78		1.86±0.74	
8. Frustration	Treatment	1.62±0.75	-0.080 <sup>ns</sup>	1.57±0.72	-0.221 <sup>ns</sup>	1.54±0.67	-0.341 <sup>ns</sup>
	Control	1.62±0.74		1.55±0.68		1.51±0.64	
9. Nervous	Treatment	1.71±0.77	5.785**	1.66±0.70	5.115**	1.52±0.63	5.489**
	Control	2.25±0.79		2.10±0.72		1.99±0.72	

<sup>ns</sup> No significance difference, \*\*,\*\*\* Significance difference calculated by t-test at p<0.05 and <0.01, respectively

The mean severity scores of NWS within and between treatment and control groups were evaluated statistically based on significant differences using one-way repeated measures ANOVA with a Greenhouse-Geisser correction (p<0.05) as illustrated in Tables 3 and 4, respectively. The mean scores of NWS within groups tended to decrease with increasing duration after cessation as shown in Table 3. The score of irritability, anxiety, craving on smoking, and difficult to concentration symptoms were significantly different with different time intervals while those of depression, increased appetite, insomnia, and nervous symptoms were not significantly different after cessation at week 2 and 4. The mean scores of frustration symptom were significantly different at beginning date compared to after cessation at week 2 and 4.

The mean scores between treatment and control groups of anxiety, craving on smoking, insomnia, and nervous symptoms were statistically significantly different whereas those of depression, difficult to concentration, and frustration symptoms were not significantly different with different time intervals (Table 4). The mean scores of irritability symptom were not significantly different after cessation at week 2 and 4 while those of increased appetite symptom were no significant difference after cessation at week 4 (Table 4).

## Discussion

The stimulation of acupoints by acupressure leads to complex neuro-hormonal responses<sup>(27)</sup>. The possible mechanisms are the counteraction among hypothalamic-pituitary-adrenocortical axis, leading to overproduction of cortisol and causing relaxation response<sup>(28)</sup>. In addition, it adjusts the physiological response by increasing endorphin and serotonin transmittance to the brain and specific organs through nerves and meridians<sup>(29-31)</sup>. This finding agrees with the work of Ho et al.<sup>(32)</sup>, indicating that smoking cessation was achieved at posttreatment week 8 and 24 after combined acupuncture and auricular acupressure treatments.

The symptoms of anxiety, craving smoking, insomnia, and nervousness could be relieved after cessation for a week. It is probably because stimulation of the shenmen's point could activate the release of endorphin leading to improve peace of mind, relaxation, and better sleep whereas applying pressure to the sympathetic point could induce in relaxation by expanding blood vessels and restoring the balance of the sympathetic nervous system<sup>(19)</sup>. These findings were associated with the study of Kamonkraingrai et al.<sup>(33)</sup> in terms of alleviation of anxiety and insomnia symptoms but it was also inconsistent with their study<sup>(33)</sup> in terms of relieving of depression, difficulty to concentration, and irritability

symptoms between groups, between times, and between times and groups ( $p < 0.001$ ).

### Limitation

The present study has limitations. First, only patients from Charoengkrung Pracharak Hospital were recruited. Second, the participants were middle-aged with an average age of 52 years and had dangerous congenital diseases. Therefore, they might have high intrinsic motivation to quit smoking. Third, no placebo-controlled trial was employed due to unethical reasons.

### Conclusion

Auricular acupressure using Wang Bu Liu Xing coupled with medical advice and medication could be a potential alternative to enhance the effectiveness of smoking cessation. The success of smoking cessation, measured by CO levels in the exhalation, in the treatment group was significantly higher than that of the control group after cessation at week 12 and 24. The symptoms of anxiety, craving smoking, insomnia, and nervousness could be alleviated from the first week after cessation. The results indicated that a combination of conventional treatment methods such as medication and medical advice, and specific auricular acupressure could be a safer and more effective smoking cessation than conventional treatments alone.

### What is already known on this topic?

Auricular acupressure could reduce NWS, which helps smokers to quit smoking.

### What does this study add?

A long-term study in smoking cessation proved that using specific auricular acupressure combined with medication and medical advice is a safe and effective smoking cessation treatment.

### Acknowledgement

The funding for this study was supported by Charoengkrung Pracharak Hospital. The authors gratefully acknowledge Mr. Sawid Khummoon, Alternative Medicine, for drawing the Auricular acupressure points picture. The authors would like to thank Mr. Krairerk Sintavanuruk, MD, Miss Ratirat Sayanhansa, Miss Waraporn Netphrao, Department of Research and Development, Charoengkrung Pracharak Hospital and Miss Sujitra Sukonthamut, Department of Statistics, School of Science, King Mongkut's Institute of Technology Ladkrabang for

their assistance.

### Conflicts of interest

The authors declare no conflicts of interest.

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