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Original article

Effects of auricular acupressure on pain and disability in adults with chronic neck pain

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ABSTRACT

Aim: The aim of this study was to examine the effect of auricular acupressure (AA) on pain, pain threshold (PT), disability, and cervical range of motion in adults with chronic neck pain.
Background: About 30–50% of the world's population suffers from chronic neck pain, and the cost of treatment is increasing.
Materials and methods: This single-blind, randomized sham-controlled study was conducted on 48 adults with chronic neck pain in South Korea. The experimental group (n = 25) received AA on specific acupoints for neck pain, whereas the control group (n = 23) received AA on unspecific acupoints. Participants received 4 weeks of auricular-acupressure intervention. Outcomes were assessed by the visual analog scale (VAS), PT, neck-disability index (NDI), and cervical range of motion. Measurements were taken 3 times: before intervention, 2 weeks into the intervention, and after the intervention.
Results: Statistical differences between the two groups emerged in PT (p = .003), the NDI (p = .033), cervical flexion (p = .004), and left rotation (p = .004), but not on the VAS.
Conclusions: This study showed that AA leads to improvements on PT, neck disability, and cervical range of motion. Therefore, AA can be used as an alternative nursing intervention for chronic neck pain.

1. Introduction

Chronic neck pain is a common chronic musculoskeletal disorder, as 30–50% of the world's population suffers from it (Cohen, 2015). The number of patients complaining of disability due to neck pain is on the rise and is a major health and socioeconomic problem worldwide (Hogg-Johnson et al., 2009). In the United States, about USD $87.6 billion was spent on healthcare costs because of back and neck pain, and it ranked third among the highest medical expenses incurred by patients. In addition, the increase in medical expenses for chronic neck pain has been the highest for the last 18 years, along with diabetes (Dieleman et al., 2016). In Korea, the number of patients who visited hospitals with a herniated cervical disc and neck pain increased by 16.6% from 2011 to 2015, from 227 to 265 (Health Insurance Review & Assessment Service, 2016).

Current treatments for neck-pain patients include nerve-blocking therapy, simple analgesics, physical exercise, and physiotherapy. Patients who did not benefit from these medical treatments often used complementary and alternative therapies (Murthy et al., 2014; Yuan, Guo, Lin, Sun, & Zhang, 2015). Auricular acupressure (AA) is one popular complementary therapy (Xia, Xie, Hu, Xu, & Tong, 2018). Based on traditional Chinese medicine (TCM) theory, AA alleviates pathological status by stimulating specific auricular points through applied seeds (Oleson, 2013; Xia et al., 2018). In particular, many studies showed AA to be effective in dynamic pain relief such as post-operative pain, chronic back pain, and dysmenorrhea, as well as relaxation (Movahedi, Ghafari, Nazari, & Valiani, 2017; Xia et al., 2018; Yeh et al., 2014). However, no studies have applied AA for chronic neck pain.

In most previous studies, AA's effects on pain were mostly measured using questionnaires such as the Visual Analogue Scale (VAS) or Brief Pain Inventory (Yeh et al., 2013; Yeh et al., 2014). However, currently, medical staff widely use pain threshold (PT) to objectively quantify the degree of pain in patients who complained of skeletal muscle pain using instruments. PT is an important way to objectively quantify subjective results (Ay, Konak, Evcok, & Kibar, 2017; Santoro et al., 2015; Yang et al., 2017).

In general, patients feel neck pain as discomfort, stiffness, or a dull pain, caused by the strained trapezius muscle around the cervical vertebrae (Jimbo, Atsuta, Kobayashi, & Matsuno, 2008). The most

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common symptom is pain around the neck, but if tension of the trapezius muscle persists over time, the range of motion in neck movement diminishes, resulting in cervical disability (Takasaki et al., 2011). The cervical range of motion (CROM) decreases gradually with age and causes further neck pain (Salo, Hakkinen, Kautiainen, & Ylinen, 2009). The fear-avoidance model supports this concept. The two responses to pain are confrontation and avoidance, and most people probably avoid painful behaviors due to fear of pain. As a result, it causes physical disability in painful body parts (Lethem, Slade, Troup, & Bentley, 1983).

Therefore, this study aimed to evaluate the effects of AA on chronic neck pain by stimulating the definitive points on the ear surface using a randomized controlled trial (RCT). The VAS and PT were used to assess subjective and objective neck pain, while the Neck Disability Index (NDI) and CROM were used to assess subjective and objective cervical disability, respectively.

2. Methods

2.1. Design and participants

This study was a single-blind, randomized, sham-controlled study conducted from December 2017 to March 2018. Study participants were recruited by announcing the study on the bulletin boards of three universities and three churches in D city, South Korea. Eligible participants were randomly assigned to the experimental and control groups in a 1:1 ratio by drawing lots. The experimental group comprised participants who chose an odd number; those who chose an even number were assigned to the control group. The criteria for participant selection were as follows: (a) adults aged 18 to 65 years, (b) adults with neck pain for at least 6 months, (c) a score of 5 or more on the NDI, (d) no medical history of neck injury, cervical fracture, or cervical surgery, (e) no allergic diseases, such as lesions or atopic dermatitis in both ears, (f) agreed not to receive other treatments for neck pain during the experimental period, and (g) were willing to participate in the study and be randomly allocated into study groups. The sample size for this study was calculated using the G-Power 3.1. According to previous studies (Movahedi et al., 2017; Yeh, Morone, et al., 2014), the effect size was 0.75, power (1 - β) was 0.80%, and the significance level (α) was 0.05. The resulting number of participants required for each group was 23 people. Eligible participants were assigned, 25 in each of the experimental and control groups, in consideration of a dropout rate of 20%. Two participants dropped out of the control group, so the total number of the participants was 48 (see Fig. 1).

2.2. Interventions

The researcher completed the professional educational program on AA provided by the Korean Nurses Association for Complementary Alternative Therapy. Participants were applied AA alternatively on each ear with *S. alba* seeds. After sterilizing the ear with a 70% alcohol swab, the seeds were taped onto one of each participant's ears, specifically to the auricular points. Seeds stayed in place for 5 days and were removed on the sixth day. This intervention process was repeated using the same method once a week for 4 weeks.

The acupoints for the experimental group were Shenmen (TF4), kidney (CO10), liver (CO12), shoulder (SF5), cervical vertebra (AH13), and occiput (AT3; Korean Acupuncture & Moxibustion Academy, 2012). The acupoints for the control group were six helix points (HX4-5, HX9-12), which are unrelated to neck pain (see Fig. 2). The researcher instructed participants in the experimental and control groups to press the seed-applied areas whenever they felt neck pain during their daily activities. The rationale for pressing was to reinforce the effect of AA by compressing the auricular acupoints (Oleson, 2013; Xia et al., 2018).

Participants in both groups were asked not to receive other interventions for neck pain during the study. If the participants received other treatments, they were asked to inform the researcher. Also, the researcher explained to participants that they would be omitted from the study if they removed the seeds before reaching the fifth day and asked them to inform the researcher if they did so.

2.3. Measures

Participants were evaluated for pain and disability. The researcher measured the intensity of neck pain using the VAS, with scores ranging from 0 to 100 mm in length (0 means no pain, 10 means severe pain). The VAS was used to assess the degree of subjective pain participants felt measured at three points: before initiation of the intervention, 2 weeks into the intervention, and after the intervention.

PT of participants is an objective outcome, assessed by Dolorimeter (Baseline, NY, USA). PT of the neck was the value measured at the moment the participant felt pain by applying constant force vertically to the pain-triggering point at the scapula muscle. The researcher measured PT three times: before initiation of intervention, 2 weeks into the intervention, and after the intervention.

The researcher assessed subjective cervical disability felt by participants with the NDI. This is a self-applied questionnaire consisting of 10 items, rated from 0 to 5. Total scores ranged from 0 to 50, with higher scores indicating greater disability. The Cronbach's alpha was 0.82 in this study. The researcher measured NDI twice: before and after the intervention.

The researcher verified objective cervical disability by measuring CROM using a plastic pocket goniometer (Baseline, NY, USA). Participants were seated in chairs with backs straightened and asked to actively move in the direction of the flexion and extension: Right/Left lateral flexion, Right/Left rotation. Then, the researcher measured and recorded the angles. The measurement only assessed the extent of active joint motion of participants after fixing the measurement tool to their noses and ears. The researcher measured CROM twice: before and after the intervention.

2.4. Ethical considerations

The Institutional Review Board (IRB) of E University (No. 148-3) approved this study. After recruiting those who voluntarily participated in the study, the researcher explained the purpose and method of this study, level of risk and benefits, and time expected for data collection, using terms and expressions that were easy to understand. Then participants submitted a written consent form saying they agreed to participate in the study. The researcher informed participants of the study group of which they were a member after the completion of the study and, if those in the control group wanted, the researcher would give them the same AA that the experimental group received.

2.5. Analysis

Data were analyzed using SPSS WIN 21.0. The researcher performed descriptive statistical analysis on the demographic data, analyzing the homogeneity of the experimental and control groups with Fisher's exact test, chi-square, and independent *t*-test. The effects of neck pain and neck disability between the groups were analyzed using independent *t*-test and repeated measures ANOVA.

3. Results

A total of 48 people participated in this study: 25 in the experimental group and 23 in the control group. The mean age was 44.68 ± 9.16 in the experimental group and 40.26 ± 13.55 in the control group. The mean VAS score before the intervention was 4.87 ± 1.95 in the experimental group and 4.28 ± 1.69 in the control group, and the NDI score was 11.32 ± 4.98 in the experimental group

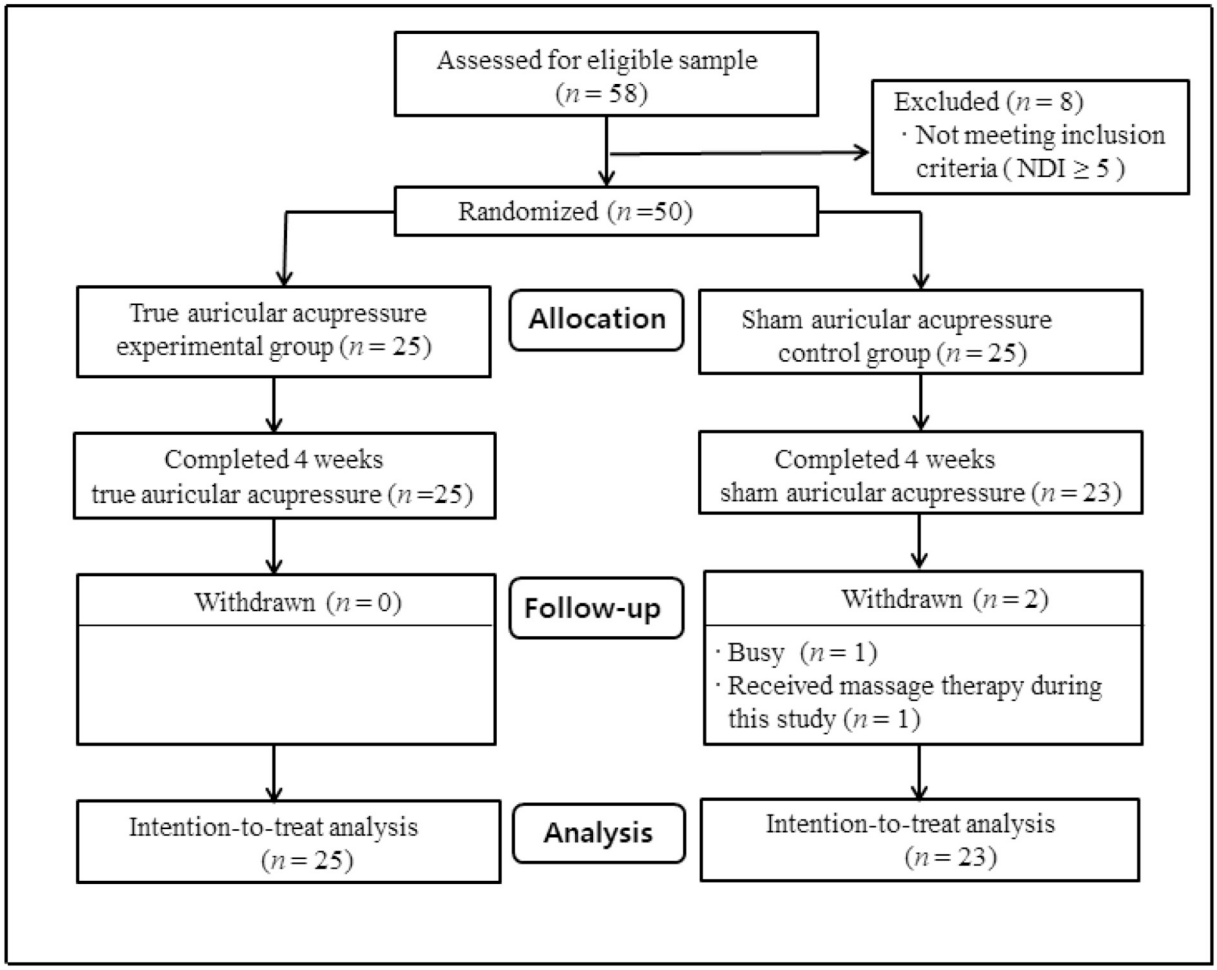

Fig. 1. Participant flow chart.

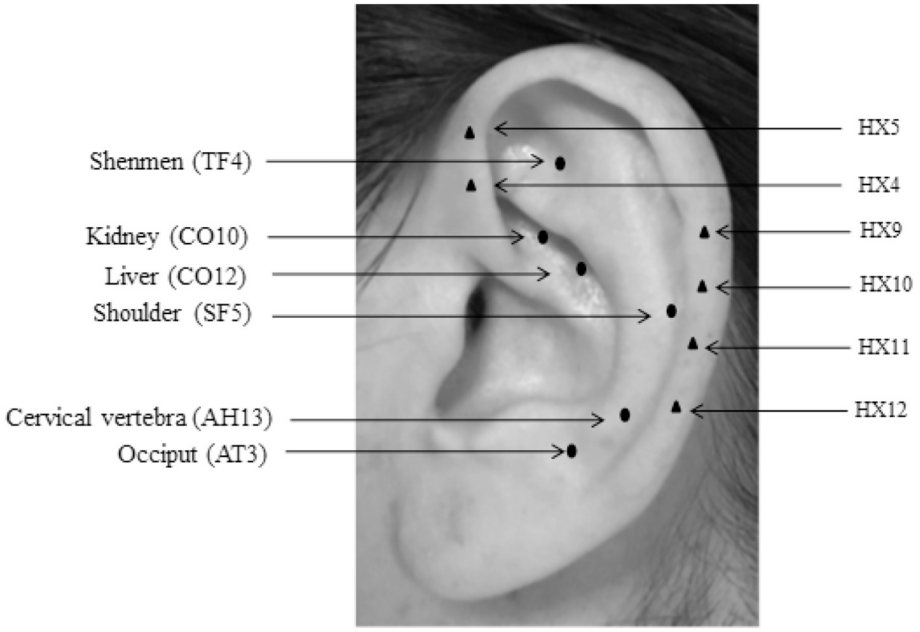

Fig. 2. Auricular acupoints used in two groups.

Table 1
Comparison of demographic and clinical characteristics between two groups.

		Exp. (n = 25)		Cont. (n = 23)		χ^2 or t	p
		n (%)	Mean ± SD	n (%)	Mean ± SD		
Age (years)			44.68 ± 9.16		40.26 ± 13.55	1.31	.197
Gender	Female	17 (68.0)		14 (60.9)		0.26	.606
	Male	8 (32.0)		9 (39.1)			
Duration of pain (years)	≤1 years	12 (48.0)		14 (60.9)		0.85	.790[a]
	1–2 years	5 (20.0)		3 (13.0)			
	≥2 years	8 (32.0)		6 (26.1)			
Clinical experience for pain	Yes	6 (24.0)		6 (26.1)		0.02	.868
	No	19 (76.0)		17 (73.9)			
VAS			4.87 ± 1.95		4.28 ± 1.69	1.11	.272
PT			3.11 ± 1.08		3.28 ± 0.96	0.55	.579
NDI			11.32 ± 4.98		10.00 ± 4.04	1.00	.322
Cervical flexion			22.40 ± 8.18		20.87 ± 6.85	0.69	.488
Cervical extension			25.80 ± 6.56		27.61 ± 7.95	0.86	.393
Right lateral flexion			23.00 ± 6.29		21.09 ± 7.06	0.99	.326
Left lateral flexion			22.80 ± 5.96		23.04 ± 7.02	0.13	.897
Right rotation			45.00 ± 7.90		45.87 ± 6.15	0.42	.675
Left rotation			43.40 ± 8.12		45.22 ± 5.73	0.88	.379

Note. Exp. = true auricular acupressure experimental group, Cont. = sham auricular acupressure control group. VAS = visual analog scale, PT = pain threshold, NDI = neck disability index
[a] Fisher's exact test.

Table 2
Effects of auricular acupressure on visual analog scale (VAS) and pain threshold (PT).

Variables	Exp. (n = 25)	Cont. (n = 23)	Repeated ANOVA		
	Mean ± SD	Mean ± SD	Source	F	p
VAS					
Pretest	4.87 ± 1.95	4.28 ± 1.69	Time (T)	25.51	< .001
Interim test	3.70 ± 1.62	3.77 ± 1.66	Group (G)	0.09	.759
Posttest	3.34 ± 2.09	3.41 ± 1.73	T × G	2.43	.093
PT					
Pretest	3.11 ± 1.08	3.28 ± 0.96	Time (T)	2.87	.061
Interim test	3.62 ± 1.26	3.24 ± 0.84	Group (G)	1.01	.321
Posttest	3.73 ± 1.20	3.13 ± 0.81	T × G	6.17	.003

Note. Exp. = true auricular acupressure experimental group, Cont. = sham auricular acupressure control group.

Table 3
Effects of auricular acupressure on the neck-disability index (NDI) and cervical range of motion (CROM).

Variables	Exp.(n = 25)	Cont. (n = 23)	Independent t-test	
	Mean ± SD	Mean ± SD	t	p
NDI				
Pretest	11.32 ± 4.98	10.00 ± 4.04	1.00	.332
Posttest	6.96 ± 4.49	7.78 ± 2.98	0.74	.463
Difference of pre–post	4.36 ± 3.45	2.21 ± 3.30	2.19	.033
Cervical flexion				
Pretest	22.40 ± 8.18	20.87 ± 6.85	0.69	.488
Posttest	26.00 ± 7.50	23.70 ± 7.41	1.06	.291
Difference of pre–post	3.60 ± 5.10	2.82 ± 5.9	0.48	.632
Cervical extension				
Pretest	25.80 ± 6.56	27.61 ± 7.98	0.86	.393
Posttest	29.20 ± 7.17	26.74 ± 7.62	1.15	.255
Difference of pre–post	3.40 ± 4.94	0.86 ± 4.92	2.99	.004
Right lateral flexion				
Pretest	23.00 ± 6.29	21.09 ± 7.06	0.99	.326
Posttest	24.80 ± 6.03	22.17 ± 7.04	1.39	.171
Difference of pre–post	1.80 ± 4.76	1.08 ± 3.67	0.57	.567
Left lateral flexion				
Pretest	22.80 ± 5.96	23.04 ± 7.02	0.13	.897
Posttest	25.00 ± 6.29	23.91 ± 6.90	0.57	.571
Difference of pre–post	2.20 ± 4.34	0.86 ± 3.88	1.11	.271
Right rotation				
Pretest	45.00 ± 7.90	45.87 ± 6.15	0.42	.675
Posttest	48.60 ± 8.35	46.52 ± 6.29	0.96	.339
Difference of pre–post	3.60 ± 5.86	0.65 ± 4.07	2.00	.051
Left rotation				
Pretest	43.40 ± 8.12	45.22 ± 5.73	0.88	.379
Posttest	49.00 ± 5.95	46.52 ± 5.31	1.51	.136
Difference of pre–post	5.60 ± 6.17	1.30 ± 3.09	3.00	.004

Note. Exp. = true auricular acupressure experimental group, Cont. = sham auricular acupressure control group.

and 10.00 ± 4.04 in the control group. Thus, homogeneity of the two groups was confirmed (see Table 1).

Table 2 shows the analysis developed through repeated measurement on VAS and PT. VAS showed a significant difference in time (F = 25.51, p < .001) but no significant difference in the interaction effect between group and time. PT showed a significant difference in the interaction effect between the groups and time (F = 6.17, p = .003).

Table 3 summarizes the effects on the between-group differences in NDI and CROM. The NDI in the experimental group decreased from 11.32 ± 4.98 to 6.96 ± 4.49, and the difference between the two groups was shown to be statistically significant (t = 2.19, p = .033). CROM showed a statistically significant increase in range of motion with cervical extension (t = 2.99, p = .004) and left rotation (t = 3.00, p = .004).

4. Discussion

Because few studies have examined the effects of AA on pain and disability in adults with neck pain, this study was important. According to previous studies, alternative and complementary therapies for neck pain were mainly performed with the use of auricular acupuncture (Yang et al., 2017), taping therapy (Ay et al., 2017), and massage therapy (Patel et al., 2012). Because AA is noninvasive, economical, and effective for a variety of pain types compared to other alternative and complementary therapies (Yeh, Chiang, et al., 2014), this study examined the effect of AA on neck pain.

According to the results, the VAS scores in both groups significantly decreased with time, but no significant difference arose between groups. In the Bishop and Lewith (2008) study, belief influences treatment outcomes as psychological predictors. Thus, we determined that most participants of the study had positive beliefs about AA, which caused a placebo effect in the control group, and resulted in decreased

VAS scores as well. We suggest a large-scale randomized clinical trial study with a qualitative study to find good evidence that patients' beliefs and expectations of AA's outcomes are associated with clinical outcomes.

According to a previous study (Yang et al., 2017) that examined the effectiveness of treatment using an objective way to avoid such subjective results, this study measured PT with VAS for assessment of pain. In the Yang et al. (2017) study, PT values seemed to interact with group and time, indicating that AA was effective. Because no study has applied AA to patients with neck pain, the researcher examined a similar study using auricular acupuncture. In this study, the PT values significantly increased among the patients with neck pain after applying traditional acupuncture, and such a result is consistent with the outcome obtained in this study (Yang et al., 2017). Also in a study conducted with healthy adults, PT increased in an AA-treated group after introducing artificial pain in the fingers (Santoro et al., 2015). These interventions were understood to be effective interventions for neck pain because AA and auricular acupuncture relieved pain and resulted in increased PT. However, few studies have verified the effect of AA on chronic neck pain with PT. Therefore, we recommend a replication of this study.

To assess cervical disability, the researcher implemented two methods in this study by measuring NDI and CROM. NDI improved in the experimental group after applying AA. For CROM, the angles of cervical extension and left rotation increased. According to a study conducted by Cha and Kim (2015), upper extremity function scale scores of stroke patients improved after applying AA for 4 weeks; thus, their study had similar findings to those obtained in this study. Acupoints applied to the experimental group of this study improved the range of neck motion by alleviating patients' shoulder pain. No significant changes in 4 of 6 directions of CROM emerged. For chronic neck pain, a minimum of 10 weeks of AA is recommended in a clinical setting (Stux & Hammerschlag, 2001). Subjective symptoms of cervical disability alleviated in a short period of time, but physical symptoms require at least 10 weeks. Therefore, the researcher suggests promoting a long-term study for > 10 weeks to verify the effect of neck range of motion after applying AA on chronic neck pain.

This study has some limitations. First, the sample size in this study was small. Second, the study was constructed using a single-blind design. Third, the research period was short. More long-term studies would verify the effect of AA by extending the study to participants with dynamic backgrounds. Significance of this study can be found in the notion that the researcher measured the effect of AA for neck pain using PT and CROM, which are semi-objective outcomes. AA has a positive effect on the level of neck pain and cervical disability and improves the motion range of the neck. Therefore, the researcher suggests applying AA as a complementary treatment method for patients with neck pain.

5. Conclusion

This study aimed to evaluate the effectiveness of AA on VAS, PT, NDI, and CROM in adults with chronic neck pain by applying AA for 4 weeks. Results showed that AA was effective on PT, NDI, and CROM. The significance of this study can be found in the notion that the researcher measured neck pain and cervical disability using subjective and objective indicators. In the future, medical personnel can use AA to improve chronic neck pain.

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