Effects of Auricular Acupressure on Dry Eye Syndrome, Stress, and Depressive Symptoms in Older Adults: A Single-blind, Randomized Controlled Trial

Yoon, Hyeongyeong

1) Assistant Professor, Department of Nursing, Eulji University, Seongnam, Korea

Purpose: This study investigated the effects of auricular acupressure on dry eye syndrome, stress, and depressive symptoms in older adults. Methods: This single-blind, randomized controlled trial was conducted among 42 people aged 65 years or older who experienced stress and had an Ocular Surface Disease Index score of 13 or higher. Auricular acupressure using vaccaria seeds was applied to both ears for 3 weeks at several acupoints, including the shenmen, liver, heart, endocrine system, eye, and anterior lobe areas. In the placebo group, blank patches were applied to the hip, lumbar vertebrae, shoulder, and cervical vertebrae points. The measures used were the Dry Eye Syndrome Scale, Perceived Stress Scale, salivary cortisol levels, electrodermal activity measured using a Fitbit device, and a depression scale. Results: Statistically significant differences were found between the groups for dry eye syndrome (t=3.442, \( p=.002 \)), perceived stress (t=3.455, \( p=.001 \)), salivary cortisol (z=-3.703, \( p<.001 \)), and depressive symptoms (t=2.113, \( p=.043 \)). Conclusion: Auricular acupressure improved in dry eye syndrome, perceived stress, salivary cortisol levels, and depressive symptoms in older adults. Therefore, it can be used as an alternative nursing intervention for dry eye syndrome, stress, and depressive symptoms.

Key Words: Acupressure; Depressive symptoms; Dry eye syndrome; Physiological stress

Accepted May 16, 2024

Corresponding author: Yoon, Hyeongyeong  https://orcid.org/0000-0001-5552-7262

Department of Nursing, Eulji University
553 Sanseong-daero, Sujeong-gu, Seongnam 13135, Korea
Tel: +82-31-740-7521, Fax: +82-31-740-7359, E-mail: hkyoon@eulji.ac.kr

© 2024 Korean Academy of Fundamentals of Nursing
https://www.kafn.or.kr
INTRODUCTION

Worldwide, populations are rapidly aging; in particular, the size and proportion of the elderly population are increasing [1]. Generally, the elderly experience various factors that cause stress, such as a decline in physical function due to aging, decline in economic power, an increased risk of chronic diseases, death of acquaintances, job loss due to retirement, and a complex health condition called geriatric syndrome [2,3].

One component of geriatric syndrome is dry eye syndrome, one of the most common eye diseases worldwide. In 2020, 2.438 million patients were treated for dry eye disease, of which 37.6% were over 60 years of age [4]. Dry eye syndrome refers to a disease in which symptoms of irritation, foreign body sensation, itching, and dryness occur because of damage to the ocular surface due to a lack of tears [5]. The causes of dry eye syndrome include the increased use of electronic devices, excessive fatigue, ultraviolet rays, and aging; for the elderly, this can be caused by a decrease in tear secretion due to aging [2]. Dry eye syndrome manifests with symptoms such as foreign body sensation, itching, and fatigue, impacting daily life [4]. A close relationship exists between dry eye syndrome and psychiatric conditions [6-8]. Meta-analyses in the literature demonstrated that depressive symptoms were more prevalent in patients with dry eye syndrome [7,8]; other studies have shown that these individuals experienced more psychological stress [6], and dry eye syndrome treatments were found to be effective in reducing depressive symptoms [8]. As high stress in the elderly increases their mortality risk, and depressive symptoms have a low survival rate [3], interventions are needed to manage dry eye syndrome, stress, and depressive symptoms in the elderly. Acupuncture, a complementary and alternative therapy, has been used in China to treat various diseases for thousands of years [9]. Auricular acupuncture (AA) treatments derived from ear acupuncture therapy use seeds, magnets, and stones instead of needles to stimulate a unique reaction area in the ear by applying pressure to the corresponding area to continuously stimulate it. This reaction point is considered to be connected to the body’s internal organs [9,10]. In 1990, the World Health Organization recognized 91 specific response points in the ear as an international standard, and these have been widely used [10]. Studies applying AA to the elderly include research on relieving the symptoms of chronic lower back pain [11]; general pain, shoulder pain, and range of motion in shoulder joints among the elderly with knee arthritis [12]; the effects of sleep on the elderly [13,14]; and depressive symptoms and anxiety among the elderly living in nursing homes [15].

Similar studies have been conducted on dry eye syndrome among the elderly; in one study, although the selection criterion was those aged 40 years or older, the average age of the registered experimental group was 59.8 years old [16], which is less than the traditional elderly threshold age of 65 years. Additionally, in a prior eight-week experiment, AA was applied only to an experimental group and no intervention was applied to the control group, which could affect the external validity of the findings. There is a claim that 35% of the treatment outcomes are due to the placebo effect, which is based on the natural healing mechanisms of humans [17], so comparative studies to control for the placebo effect are necessary when designing research. Another study reviewed dry eye syndrome in college students using aural pressure therapy, but the cause of dry eye syndrome in the elderly differed according to age [2]; further, this study was limited, in that the placebo effect could not be controlled because there was no intervention for the control group [18]. In another study, a male patient with dry eye syndrome was given ear acupuncture twice a week for three weeks, which was found to be effective for dry eye syndrome [19], but effectiveness is difficult to generalize based on a case report. AA is used for various diseases and symptom relief, with a treatment period typically lasting 4 to 5 days, followed by 1 to 2 days of rest before resuming compression [10]. Therapies involving AA are widely used because they are inexpensive yet effective, with few side effects [9], and AA provides a complementary, alternative therapy that can be easily applied by the elderly at home.

As, to our knowledge, no study has confirmed the psychological effects of dry eye syndrome, such as stress and depressive symptoms, among the elderly, it is necessary to supplement previous studies to increase the number of subjects and prove AA effectiveness through study designs to reduce the placebo effect. Therefore, this study specifically aimed to examine the differences between experimental and control groups in terms of: (a) dry eye syndrome, (b) perceived stress, (c) the level of electrodermal activity (EDA), (d) cortisol levels in saliva, and (e) depressive symptoms.

METHODS

1. Design

This randomized clinical trial was designed to assess
Effects of Auricular Acupressure on Dry Eye Syndrome, Stress, and Depressive Symptoms in Older Adults

2. Participants

The study period spanned December 2022 to February 2023, with participants among the elderly people registered at the Seongnam senior complex who met the selection criteria and voluntarily agreed to participate in the study. The Seongnam senior complex supports the use, experience, and research of various products for the elderly. Participants in this study were those who had signed a consent form in advance to receive information about the research via mobile phone. A recruitment notice was sent to 300 elderly people registered at the senior center through a cell phone text message; if they met the selection criteria and wanted to participate, they were asked to visit the senior center. The inclusion criteria were those aged 65 years or older with an Ocular Surface Disease Index (OSDI) score of 13 or higher, stress, and an absence of inflammatory lesions or wounds in the ear. As an exclusion criterion, those who were receiving other complementary and alternative therapies using acupuncture or auricular pressure were also excluded. Participants were randomly assigned to the experimental and control groups. The G*Power program version 3.1.9 was used to calculate the sample size. The number of target subjects was calculated using a t-test. As a result of this calculation, the number of study subjects was determined to be 20 in each of the experimental and control groups. By calculating a dropout rate of 15%, 23 people in each of the experimental and control groups were set as the target subjects. A random number table generated by Random Allocation Software Version 2.0.0 was used to assign participants to one of the two groups. To prevent spread in the experiment, the experimental group visited the center at 9:00 am, and the control group visited the center at 10:00 am. To prevent the Hawthorne effect, participants were single-blinded and did not know which group they belonged to.

In this study, 175 of 300 people did not meet the selection criteria, and 79 refused to participate; therefore, 254 people were excluded. Of those remaining, 46 and 23 were assigned to the experimental and control groups, respectively. However, one person in the experimental group was eliminated on the second day of the visit because of insufficient questionnaires, one person in the control group did not visit on the second day of the study, and one person voluntarily withdrew from the study. One person was subsequently omitted due to missing cortisol measurements, leaving 42 participants whose data were included in the final analysis (22 and 20 in the experimental and control groups, respectively; see also Figure 1).

3. Measurements

1) Dry eye syndrome

The extent of dry eye syndrome was measured using the OSDI. The OSDI tool used in this study was developed by Allergan in the United States, with 40 items to measure dry eye symptoms [20], but this was reduced to 12 items in 2000[21]. Items pertain to ocular symptoms (four items), vision-related functions (five items), and environmental factors (three items). Each item is scored on a five-point Likert scale. The score is calculated by multiplying the total score by 25 and dividing it by 12, and scores range from 0 to 100. Respondents with scores of 13 to 22 points were classified as having mild dry eyes, 23 to 32 as moderate, and 33 points or higher as severe. The reliability, as indicated by this tool’s Cronbach’s, was .92 in research by Schiffman et al. [21] and .85 in this study.

4. Stress

1) Perceived Stress Scale

The 10-item Perceived Stress Scale (PSS-10) was used to assess respondents’ insensitivity toward stress related to life situations over the last month [22]. In this study, a Korean version of the Perceived Stress Scale was used [23], with 10 questions scored using a four-point Likert scale. Items 4, 5, 7, and 8 were reverse-scored as negative questions, and total scores ranged from 0 to 40 points; the higher the total score, the higher the perceived stress level. The reliability as indicated by Cronbach’s α was .819 in Lee’s [23] study and .760 in this study.

2) Salivary cortisol levels

The Cortisol Kit analyzed samples using Roche’s Elecsys Cortisol II with the Electrochemiluminescence immunoassay (ECLIAs) method. The cotton roll included in the kit was held in the mouth for 5 minutes without chewing, and then the saliva-moistened cotton roll was transferred to a hygienic collection tube. It was centrifuged at 3,000 rpm for 10 minutes using a medical centrifuge. The centrifuged salivary samples were transferred to 2.0 ml microtubes and stored in a deep freezer. The stored specimens were sent to G Company for analysis after completion of data collection for all participants. Cortisol was collected between 9:00 am and 10:00 am because there was a difference in normal levels depending on the morning and afternoon collection time [24]. Morning cortisol levels
in saliva were used to measure the stress of study participants, and the normal range was 0.094 to 1.551 μg/dL [25]. The higher the respondent’s score, the higher their stress level.

3) EDA

The activation of sweat glands by the autonomic nervous system affects skin conduction, and electrical skin activity measured at the wrist uses this to detect stress [26]. An EDA scan can monitor the heart rate and minute electrical changes in the skin to indicate a stress score [27]. In this study, this score was measured by a Fitbit Charge 5 fitness tracking device (Fitbit by Google Inc.). To reduce errors, measurements were taken after a 10-minute rest period, and three nursing students directly assisted the subjects by applying and facilitating the measurements. To measure their EDA, participants wore the Fitbit Charge 5 on their wrist, turned on the EDA function, and held the sensors on both sides of the tracker with the thumb and index finger for three minutes. Before measuring EDA, sweating on the wrist may affect the results [27], so it was wiped once with an alcohol cotton pad, dried, and then worn. Since the measurement may be high when the autonomic nervous system is hyperactive, the measurement was performed after resting for 10 minutes in the waiting room. A higher score indicated less physical stress. The reliability of the measurement results in this study is .808.

Figure 1. CONSORT diagram: flow of participants through the study.
5. Depressive Symptoms

Depressive symptoms in the elderly can be measured using a short-form version of the Geriatric Depression Scale [28]. This study used the Geriatric Depression Scale Short Form Korean Version (GDSSFK), a shortened geriatric depression scale modified for the elderly in Korea [29]. The tool has 15 items, with the degree of depressive symptoms in the past week calculated as one point for “yes” and zero points for “no.” A score of 0 to 4 is normal, 5 to 8 indicates mild depressive symptoms, 9 to 11 indicates moderate depressive symptoms, and 12 to 15 indicates severe depressive symptoms. The tool’s reliability was confirmed with Cronbach’s $\alpha = .88$ at the time of development, and .85 in this study.

6. Rationale for AA Selection

The hypothalamus-pituitary-adrenal (HPA) axis helps to regulate homeostasis according to the control of the autonomic nervous system [30,31]. Eastern medicine uses stress acupuncture to treat various diseases caused by stress by stabilizing the autonomic nervous system and inhibiting the pituitary and adrenal cortical systems [30]. In AA therapy, shenmen points lower psychological stress, help with mental stability [9], and inhibit sympathetic nerve activity [30]. For example, the concha zone affects the liver, heart, and lungs [32]. The parasympathetic nerve is adjacent to the concha area of the ear, and when stimulated, the parasympathetic nerve is activated, aiding in mental stability [30]. The subcortex is located in the antitragus zone, and the eye located in the lobe zone acts on the nervous system as a corresponding part of the hypothalamus and pituitary gland [9]; the resulting serotonin regulates the sympathetic nervous system and activates noradrenaline in this system to decrease stress and depressive symptoms and increase secretions, such as tears [31].

7. Intervention

The following six AA points in this study were selected based on a review of domestic and international literature and a consultation with two auricular therapy experts: the shenmen, liver, heart, endocrine, anterior lobe, eye points (Figure 2). One expert with 30 years of experience directly performed the AA therapy. As the seeds stimulated the ear reaction points, the control group dotted the patch from which the seeds were removed with a green pen. Blind patches were applied to the hip, cervical vertebrae, lumbar vertebrae, and shoulders (Figure 2).

8. Preliminary Investigation

Both the experimental and control groups completed the OSDI, PSS, and GDSSFK questionnaires. After these surveys, to measure physiological indicators, respondents held a cotton from a saliva-collection container in the mouth for five minutes. When it was sufficiently moistened, it was placed in the collection container and the kit was medically centrifuged. Saliva samples were collected after centrifugation at 3,000 rpm for 10 minutes. At the beginning of the survey, the EDA was measured for each respondent through a Fitbit tracker.

9. Experimental Intervention

In this study, a commercialized patch consisting of a small, one-millimeter seed was attached to points in the ear’s reaction area. Regarding the pressure period, a three-week experiment was considered to be sufficient based on previous studies. For example, Cha et al. [13], Tseng et al. [15], and Park et al. [19] derived effective results in a two-week intervention period. The AA therapy was administered to the experimental and control groups for three weeks; specifically, it was applied to both ears once for six days, and the patch was removed on the seventh day. To remove foreign substances, such as oil or keratin, the ear was wiped with alcohol on cotton prior to applying the patch. The participants were instructed to apply acupressure to the auricular patch three times a day: morning, noon, and evening.
10. Post-investigation

A post-survey was conducted three weeks after the start of the experiment for both the experimental and control groups. Both groups completed OSDI, PSS, and GDSSFK questionnaires; saliva was collected in the same way as in the pre-survey; and participants’ EDA was measured.

11. Data Analysis

The analysis was performed using SPSS software, version 26.0. The general characteristics and test of homogeneity between the two groups before the experiment were analyzed using the percentage of data, mean and standard deviation, chi-squared test, Fisher’s exact test, and independent t-test. The differences between the two groups’ dry eye syndrome, PSS, EDA, and depressive symptoms were analyzed using an independent t-test, and the difference in cortisol changes was analyzed using a non-parametric Mann-Whitney U-test.

12. Ethical Consideration

This study was conducted after receiving approval (EU22-82) from the Institutional Review Board of Eulji University. Both the expert administering the intervention and the responsible researcher have completed research ethics education on Good Clinical Practice (GCP) and bioethics laws, and received prior training from the principal investigator on research methods and procedures. Only participants who voluntarily agreed to participate in the study were registered. After the study was completed, the study subjects were informed of their group classification, and the control group was informed that if they chose to, they could also receive the same AA as the experimental group. All tools were used with the consent of the original authors.

RESULTS

1. Homogeneity Testing for the General Characteristics of the Subjects and the Dependent Variables

Table 1 displays the participants’ general characteristics and homogeneity test results, with no statistically significant difference observed in the homogeneity test according to the general characteristics between the experimental and control groups. The subjects’ age distribution ranged from 65 to 84 years; the mean of the experimental group was 75.40 ± 4.94 years and the control group was 73.40 ± 4.76 years. Table 2 presents the homogeneity test results for the dependent variables: the degree of dry eye syndrome (t = 0.770, p = .446), PSS score (t = 1.127, p = .266), salivary cortisol score (z = -1.360, p = .174), and EDA score (t = 0.880, p = .384). No significant difference was observed between the two groups regarding the degrees of depressive symptoms (t = 0.352, p = .462), ensuring the groups’ homogeneity.

2 The effects of AA on dry eye syndrome, stress, and depressive symptom in the elderly

Table 3 illustrates the AA effects, including the results for dry eye syndrome (t = 3.442, p = .002), PSS (t = 3.455, p = .001), salivary cortisol (z = -3.703, p < .001), and depressive symptoms (t = 2.113, p = .043), which significantly differed between the two groups. The mean scores in the experimental group for dry eye syndrome decreased from 35.81 to 19.36, and the stress score decreased from 18.27 to 13.68. Additionally, the mean scores for salivary cortisol levels in the experimental group decreased from 0.285 to 0.218. The mean depressive symptoms score in the experimental group decreased from 4.77 to 2.09. However, the EDA measured using the Fitbit revealed no statistically significant difference (t = -1.081, p = .043).

DISCUSSION

This study applied AA to the control group for three weeks in a scientific study designed to control the placebo effect by applying placebo-based pressure therapy to elderly people with dry eye syndrome, stress, and depressive symptoms. In this study, dry eye syndrome was noted as severe with a score of 33 points or more before the intervention in both the experimental and control groups; however, the symptoms in the experimental group became mild after the intervention, with a decrease of 16.45 points. This study supported similar findings to those of Choi et al.[16], who conducted an 8-week study targeting middle-aged and old adults. In the experimental group, applying pressure to the tubercle, liver, and eye regions resulted in a decrease from 44.68 points to 30.90 points at week 4 and further decreased to 25.93 points at week 8, approximately an 18-point reduction. Similarly, Park et al.’s study [19] found a 14-point reduction in university students with dry eye syndrome after applying acupressure therapy to the tubercle, liver, eye, and shenmen regions for 2 weeks, from 38.4 points to 24.07 points. The acupressure therapy is maintained for 6 days with 1-2 days of rest inter-
Effects of Auricular Acupressure on Dry Eye Syndrome, Stress, and Depressive Symptoms in Older Adults

vals, following the protocol of Lee et al. [10]. However, there are no specific duration criteria for symptom improvement. The acupressure points for the eye and liver were commonly used in previous studies and have been proven effective for dry eye syndrome. Additionally, this study targeted 65-year-old male seniors, accounting for

### Table 1. General Sample Characteristics

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Categories</th>
<th>Exp. (n=22)</th>
<th>Cont. (n=20)</th>
<th>( x^2 ) or t</th>
<th>( p )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>Men</td>
<td>8 (39.0)</td>
<td>4 (5.5)</td>
<td></td>
<td>.315†</td>
</tr>
<tr>
<td></td>
<td>Women</td>
<td>14 (33.3)</td>
<td>16 (38.1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age (year)</td>
<td>Range (65~84)</td>
<td>75.40±4.94</td>
<td>73.40±4.76</td>
<td>1.338</td>
<td>.188</td>
</tr>
<tr>
<td>Education</td>
<td>Average (year)</td>
<td>12.45±2.98</td>
<td>13.37±4.00</td>
<td>0.837</td>
<td>.408</td>
</tr>
<tr>
<td></td>
<td>Middle school</td>
<td>5 (11.9)</td>
<td>6 (14.3)</td>
<td></td>
<td>.179†</td>
</tr>
<tr>
<td></td>
<td>High school</td>
<td>10 (23.8)</td>
<td>3 (7.1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>University or above</td>
<td>7 (16.7)</td>
<td>11 (26.2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marital status</td>
<td>Married</td>
<td>10 (23.8)</td>
<td>11 (26.2)</td>
<td></td>
<td>.390†</td>
</tr>
<tr>
<td></td>
<td>Unmarried</td>
<td>2 (4.8)</td>
<td>3 (7.1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bereaved</td>
<td>10 (23.8)</td>
<td>6 (14.3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HTN</td>
<td>Yes</td>
<td>10 (23.8)</td>
<td>5 (11.9)</td>
<td></td>
<td>.209†</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>12 (28.6)</td>
<td>15 (35.7)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>Yes</td>
<td>6 (14.3)</td>
<td>7 (16.7)</td>
<td>0.293</td>
<td>.741</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>16 (38.1)</td>
<td>13 (31.0)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cataract</td>
<td>Yes</td>
<td>7 (16.7)</td>
<td>11 (26.2)</td>
<td>2.299</td>
<td>.212</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>15 (35.7)</td>
<td>9 (21.4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glaucoma</td>
<td>Yes</td>
<td>3 (7.1)</td>
<td>3 (7.1)</td>
<td>&gt;.999†</td>
<td></td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>19 (45.2)</td>
<td>17 (40.5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eyeglasses</td>
<td>Yes</td>
<td>10 (23.8)</td>
<td>11 (26.2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>12 (28.6)</td>
<td>9 (21.4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perceived economic condition</td>
<td>Satisfied</td>
<td>4 (9.5)</td>
<td>4 (9.5)</td>
<td>&gt;.999†</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Unsatisfied</td>
<td>18 (42.9)</td>
<td>16 (38.1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Smoking</td>
<td>Smoker</td>
<td>1 (2.4)</td>
<td>2 (4.8)</td>
<td></td>
<td>.212†</td>
</tr>
<tr>
<td></td>
<td>Ex-smoker</td>
<td>1 (2.4)</td>
<td>4 (9.5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Non-smoker</td>
<td>20 (47.6)</td>
<td>14 (33.3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alcohol use</td>
<td>Drinker</td>
<td>6 (14.3)</td>
<td>1 (2.4)</td>
<td>.151†</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ex-drinker</td>
<td>2 (4.8)</td>
<td>2 (4.8)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Non-drinker</td>
<td>14 (33.2)</td>
<td>17 (40.5)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Cont.=control group; Exp.=experimental group; HTN=hypertension; † Fisher’s exact test.

### Table 2. Homogeneity of Dependent Variables between Groups

<table>
<thead>
<tr>
<th>Variables</th>
<th>Categories</th>
<th>Exp. (n=22)</th>
<th>Cont. (n=20)</th>
<th>t or z</th>
<th>( p )</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSDI</td>
<td></td>
<td>M±SD</td>
<td>M±SD</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>35.81±14.28</td>
<td>33.00±8.37</td>
<td>0.770</td>
<td>.446</td>
</tr>
<tr>
<td>Stress</td>
<td>EDA</td>
<td>16.40±5.85</td>
<td>15.05±3.84</td>
<td>0.880</td>
<td>.384</td>
</tr>
<tr>
<td></td>
<td>PSS</td>
<td>18.27±3.74</td>
<td>16.95±3.85</td>
<td>1.127</td>
<td>.266</td>
</tr>
<tr>
<td></td>
<td>Cortisol (µg/dL)</td>
<td>0.28±0.11</td>
<td>0.25±0.10</td>
<td>-1.360</td>
<td>.174</td>
</tr>
<tr>
<td>Depressive symptoms</td>
<td></td>
<td>4.77±3.29</td>
<td>3.95±3.88</td>
<td>0.352</td>
<td>.462</td>
</tr>
</tbody>
</table>

Cont.=control group; EDA=electrodermal activity; Exp.=experimental group; OSDI=Ocular Surface Disease Index; PSS=Perceived Stress Scale.
28.5% of the sample. However, a limitation arises from the preponderance of female seniors in previous studies confirming dry eye syndrome in middle-aged and elderly individuals, with only 2 out of 56 participants being male seniors, representing a mere 3.5%. Moreover, given that dry eye syndrome has the highest prevalence among seniors in their 60s, this study holds significance in demonstrating the effectiveness of health promotion for the elderly. However, Choi et al.’s study [16] had the disadvantage that it was difficult to observe the effect of auricular pressure therapy alone by teaching group education and ear massage before auricular pressure therapy.

In Park et al.’s study [19], the control group did not apply pressure, and the placebo effect in the experimental group could not be controlled due to the unequal control before and after the design, rather than using a single-blind design. Another study examined the effects on 43 patients who were diagnosed with dry eye syndrome and received acupuncture treatment at an Oriental medical facility [32]. Consequently, the OSDI score in that study decreased by 18.09 points, from 59.22 to 41.13. This is similar to the current study’s results, in which the OSDI score decreased by 16.45 points by applying AA for three weeks, indicating that AA and acupuncture have similar therapeutic effects. In research by Lee, Lee et al. [32], participants were registered for 20 minutes a day three to four times a week, and 24 acupuncture treatments were registered in 12 blood sites around the ears, hands, eyes, and eyebrows. However, this AA is considered to have a continuous treatment effect because the attached seeds constantly stimulate the response point. This study provided effects through continuous stimulation for three weeks each week. However, unlike acupuncture treatment, which involved 24 sessions [25], it did not set a range for the duration of application. Moreover, the study lacked a control group and compared treatment effects only within a single group, thereby failing to control for placebo effects.

Patients diagnosed with dry eye syndrome were more likely to experience psychological problems, such as stress, depressive symptoms, and anxiety [7], with a 40% higher prevalence and 1.81 times higher incidence of depressive symptoms [7]. Therefore, participants with dry eye syndrome and stress were selected to verify the degrees of improvement in both stress and depressive symptoms. In the present study, the perceived stress level decreased by 4.59 points in the experimental group, or from 18.27 to 13.68, but did not change in the control group. Eight weeks of AA on the shenmen, kidney, heart, adrenal gland, and occiput areas reduced the stress effect in adults aged 18 to under 65 from 17.78 to 15.44 [14]. This is similar to the results of a study [13] in which both physical and psychological stress decreased as a result of applying AA to the sympathetic, shenmen, adrenal, endocrine, and subcortical areas of middle-aged women for two weeks. Although the current study spanned three weeks, stress was reduced to a greater degree than in Lee and Park [14], where the intervention was performed for eight weeks. Cha et al.’s study [13] included middle-aged women between the ages of 40 and 60, with only an age criterion and none for stress. Additionally, it is significant that the time difference between the participants’ visits and the different AA locations were controlled to prevent the AA therapy’s spread.

The autonomic nervous system is important in main-

### Table 3. Comparisons of Scores for Stress, Dry Eye Syndrome, and Depressive Symptoms between Groups (N=42)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Categories</th>
<th>Group</th>
<th>Pretest M±SD</th>
<th>Posttest M±SD</th>
<th>Differences M±SD</th>
<th>t or z</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cont. (n=20)</td>
<td>33.00±8.37</td>
<td>32.80±7.55</td>
<td>20.20±6.32</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stress</td>
<td>PSS</td>
<td>Exp. (n=22)</td>
<td>18.27±3.74</td>
<td>13.68±2.69</td>
<td>4.59±2.75</td>
<td>3.455 .001</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cont. (n=20)</td>
<td>16.95±3.85</td>
<td>16.75±3.05</td>
<td>0.20±2.09</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cortisol (µg/dL)</td>
<td>Exp. (n=22)</td>
<td>0.29±0.11</td>
<td>0.22±0.29</td>
<td>0.07±0.30</td>
<td>-3.703 &lt;.001</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cont. (n=20)</td>
<td>0.25±0.11</td>
<td>0.27±0.11</td>
<td>-0.01±0.07</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EDA</td>
<td>Exp. (n=22)</td>
<td>16.40±5.85</td>
<td>15.74±6.00</td>
<td>-1.13±4.84</td>
<td>-1.081 .286</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cont. (n=20)</td>
<td>15.05±3.84</td>
<td>15.75±4.57</td>
<td>-0.70±3.29</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depressive symptoms</td>
<td>Exp. (n=22)</td>
<td>4.77±3.29</td>
<td>2.09±2.24</td>
<td>2.68±2.23</td>
<td>2.113 .043</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cont. (n=20)</td>
<td>3.95±3.38</td>
<td>4.30±4.15</td>
<td>-0.35±1.92</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Cont=control group; Exp=experimental group; OSDI=Ocular Surface Disease Index; PSS=Perceived Stress Scale; EDA=electrodermal activity.
Effects of Auricular Acupressure on Dry Eye Syndrome, Stress, and Depressive Symptoms in Older Adults

taining the body’s homeostasis, and cortisol in particular is the primary biomarker secreted from the HPA axis during stress and depressive symptoms [24,25]. In this study, the salivary cortisol level decreased by 0.066 in the experimental group; moreover, the depressive symptoms score decreased from 4.77 points in the experimental group to 2.09 points, and increased by 0.35 points in the control group, indicating a statistically significant difference. As a result of applying acupressure to middle-aged women’s sympathetic, shenmen, adrenal, endocrine, and subcortex areas for two weeks, the blood cortisol level decreased by 2.04 [13]. As a result of auricular acupuncture on the shenmen, kidney, liver, lung, and sympathetic areas of participants with major depressive symptoms, salivary cortisol decreased [33], supporting this study. However, cortisol is rapidly secreted approximately once an hour due to an ultraradian rhythm, and significantly varies depending on individual personality characteristics [34]; thus, it is necessary to control psychological and environmental factors and check for differences in cortisol by shortening the time interval. Further, depressive symptoms decreased by 2.68 points in the experimental group, demonstrating that, when AA was applied only to the shenmen area for two weeks among the elderly living in a nursing home, depressive symptoms scores decreased from 8.71 to 5.35 points [15], supporting this study.

The AA therapy was performed each time by selecting between four and six auricular points [10] and, following previous studies, applying pressure for five to six days, resting for one to two days, and applying acupressure again [14,16,18]. In this study, six acupoints were pressed, including the shenmen; the patch was removed after six days, and the acupressure was maintained for six days in a one-week cycle. In a study by Tseng et al.[15] tape with magnetic beads attached only stimulated one shenmen area-applied to the right ear for 7 days and the left for 7 days-and stimulation continued for 14 days without a break of 1 to 2 days. In this study, after six days of acupressure, a one-day rest period occurred, with no side effects; the EDA score was measured once before and after using the Fitbit to measure stress, but without a statistically significant difference. The EDA is highly accurate in detecting stress [26], based on signal data with a 10-Hz resolution and measured in tenths of a second [35]. Since the EDA score evaluates electrothermal activity at a very short period of time, it is noted that this study did not produce significant results using only one measurement; hence, future studies must check continuous data changes by measuring at least twice.

In summary, a three-week AA was effective in treating dry eye syndrome, stress, and depressive symptoms in the elderly, and the effect was verified as a physiological indicator given the reduced cortisol levels. The changes in dry eye were similar to the effects of acupuncture, but unlike acupuncture, AA has the significant advantage of being non-invasive, painless, simple, safe, fast, and low cost, so it was confirmed to be a cost-effective intervention to be applied in nursing. This study is significant in that the placebo effect was controlled by treating the elderly with dry eye syndrome and stress with a placebo AA in the control group; this was verified through a scientific design with increased internal validity in a single-blind, randomized experiment. This study’s results proved that auricular pressure therapy is effective even with physiological indicators, and is a cost-effective intervention method with a short time requirement. Thus, it is meaningful to establish a scientific basis that can generalize AA as a non-pharmacological nursing intervention for the nursing management of dry eye syndrome, stress, and depressive symptoms in the community-dwelling elderly.

However, despite this study’s strengths, the generalizability of its results is limited because this study recruited participants from only one region—Bundang in Korea—with a small sample size; therefore, the effects of AA should be verified by expanding the number of participants in a multicenter study to increase the sample’s representativeness. As this study applied AA for three weeks, a comparative study should verify the effects according to the application cycle.

CONCLUSION

This study’s findings confirm that AA can be an effective nursing intervention for alleviating complex dry eye symptoms, lowering stress and cortisol levels, and reducing depressive symptoms in the elderly. Therefore, it can be used as a self-care mechanism for the elderly in the community.

CONFLICTS OF INTEREST
The author declared no conflict of interest.

AUTHORSHIP
Study conception and design acquisition - Yoon H; Data collection - Yoon H; Analysis and interpretation of the data - Yoon H; Drafting and critical revision of the manuscript - Yoon H.

DATA AVAILABILITY
The datasets used and analyzed during the current study are available from the corresponding author.

https://doi.org/10.7739/jkafn.2024.31.2.243
REFERENCES


26. Stržinar Ž, Sanchis A, Ledezma A, Sipele O, Pregelj B, Škrjanc, I. Stress detection using frequency spectrum analysis of wrist-