The Effectiveness of Acupressure in Improving the Quality of Sleep of Institutionalized Residents

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Background. Elderly people often suffer from disturbed sleep. Because traditional Chinese medicine indicates that acupressure therapy may induce sedation, testing the effectiveness of acupressure in enhancing the quality of sleep of institutionalized residents with a well-designed scientific study is needed.

Methods. A randomized block experimental design was used. The Pittsburgh Sleep Quality Index (PSQI) questionnaire was used as a screening tool to select subjects with sleep disturbance. By matching the effects of hypertension, hypnosis, naps, and exercise, subjects were randomly assigned to an acupressure group, a sham acupressure group, and a control group. Each group had 28 subjects for a total of 84 subjects. The same massage routine was used in the acupressure group and the sham acupressure group, whereas only conversation was employed in the control group.

Results. There were significant differences in PSQI subscale scores of the quality, latency, duration, efficiency, disturbances of sleep, and global PSQI scores among subjects in the three groups before and after interventions. Furthermore, there was a significant reduction in the frequencies of nocturnal awakening and night wakeful time in the acupressure group compared to the other two groups.

Conclusions. This study confirmed the effectiveness of acupressure in improving the quality of sleep of elderly people and offered a nonpharmacological therapy method for sleep-disturbed elderly people.

SLEEP is one of the basic human needs. The subjective quality of sleep deteriorates as age increases. Elderly people often have sleep disturbances such as frequent nocturnal awakenings or early morning arousal, as well as verbal complaints of not having slept well (1). While Tzou (2) found that about 36.4% of residents in a living-assisted facility in Taiwan felt disturbances of sleep, Monane (3) found that the rate of sleep disturbances was 94% in a similar population in a Western country. When sleep does not meet individual needs, an individual might become irritable, confused, depressed, or paranoid, which may deter recovery from diseases (4). People with sleep disturbance could be in a high-risk population vulnerable to accidents. Though there is much research about sleep, few studies have focused on the improvement of the quality of sleep. Acupuncture is one of the therapies of traditional Chinese medicine. Several acupoints on the hands, head, and back can be used to enhance sedation and sleep, such as in the Shenmen technique (5). However, acupuncture is an invasive procedure and can only be done by licensed practitioners.

In contrast to acupuncture, acupressure is a noninvasive procedure that employs acupressure and massage of Chinese origin to stimulate meridian or acupoints of the human body. Acupressure can balance life energy (chi) to promote health and offer comfort (6,7). The acupoints are chosen according to the subject's feeling of soreness, heaviness, numbness, and distention. Huang (8) suggested that pressures from 3 to 5 kg should be used until subjects feel distended, numbed, or without discomfort. Acupressure manual techniques can be soft or smooth, using pressing finger movements in order to relieve a subject's nervousness. These techniques can consist of manual motions of pushing, rubbing, kneading, pressing, massage, or grasping, as well as holding tight (9). By way of manual performance, acupressure produces physiological effects (6,7,10–14), relieves loneliness, enhances the feeling of well-being, and improves sleep (10,14). Acupressure may also promote the circulation of blood and chi, harmony of yin and yang, and secretion of neurotransmitters, thus maintaining normal functions of the human body and providing comfort. All effects of acupressure may improve the quality of sleep. Moreover, nurses, nurses' aides, or relatives of patients can administer acupressure. To investigate the effectiveness of acupressure in improving the quality of sleep of institutionalized elders, this research hypothesized that there were significant differences between mean score difference in pre- and postintervention among acupressure, sham acupressure, and control groups.

Methods

A randomized block experimental design was used. By matching the effects of hypertension, hypnotics, naps, and exercise, subjects were randomly assigned to an acupressure group, sham acupressure group, or control group. Acupoints were chosen from the head, neck, and hands in the acupressure group, whereas nonacupressure points were used in the sham group. The same manual techniques, but with different acupoints and conversation, were used in both groups. Only conversation was employed in the control group. Each intervention lasted for 15
minutes in each of these three groups concurrently. This research was a single-blind study. To reduce the effect of the order of manipulation, the order for subjects was randomly selected.

Procedure
This study consisted of two stages: screening and major studies. In the beginning, purposive sampling was used. Subjects were from a public living-assisted facility with more than 750 beds in Taipei. A screening program was carried out to recruit subjects who met the criteria. The sampling criteria were (a) 5 points or over in the questionnaire of the Pittsburgh Sleep Quality Index (PSQI) to ensure selection of subjects with sleep disturbance; (b) residents with clear mental status, without dementia (one of the criteria for residing in public assistance facilities; should a resident develop dementia after admittance, he/she may be transferred to a disabled ward), and able to communicate in Mandarin or Taiwanese; (c) not out of town during weekdays; (d) aged 60 years or older; (e) able to sit for more than 15 minutes; and (f) absence of any amputations of the upper extremities and no infection, injury, bleeding, thrombophlebitis, or tumors nearby the chosen acupressure points in the head, neck, and hands.

A ratio of 1 in 3 was used in a systematic random sampling of all institutionalized residents. This study recruited 246 subjects who met the criterion of sleep disturbance. The principal investigator interviewed 11 illiterate candidates (13.1%) and asked 73 literate candidates (86.9%) to fill out questionnaires during the selection process. Among the 246 screened subjects, there were 176 subjects (71.5%) with accumulated points over 5 shown by their sleep quality questionnaires. One hundred twenty-eight (71.7%) of those met criteria set for this study. Among these, 102 subjects (79.7%) agreed to participate in this study. The authors assigned the subjects to one of three groups based on whether or not the subjects had hypertension, exercised, took sleep medications, and naps. These four variables created 16 possible matching categories. However, only 84 of the original 124 subjects who met the initial criteria completed the entire research process, giving a 65.6% completion rate. Eighteen subjects dropped out of the study for various reasons, including hospitalizations and foreign travel. Each of the three groups lost 6 subjects, which left 28 subjects in each group for a total of 84 participants.

The major study consisted of preintervention, intervention, and postintervention phases. The intervention was performed from Monday through Friday continuously for 3 weeks. The data were collected for the preintervention phase (baseline data collection) in the first week and for the postintervention phase in the fifth week. The information about sleep quality was obtained via questionnaire on Monday in the first and the fifth weeks of the study. During week 2 through week 4, information about the last nocturnal sleep (LNS) was collected on a daily basis, noting such things as the frequencies of nocturnal awakenings and the duration of nocturnal awakening. The major study was carried out based on the matching of four variables: having or not having hypertension, sleep medications, naps, and exercises.

Validity of Acupressure Performance
Prior to this study, the principal investigator completed 10 weeks of basic training in acupuncture and obtained 20 credits of continuing education certified by the Association of the Modern Acupuncture Research and one university credit in the principles of traditional Chinese medicine. An acupressure protocol was developed based on literature reviewed and consultation with licensed traditional Chinese physicians, who had graduated from medical schools in Taiwan and had practiced acupuncture for more than 10 years. To control internal validity, principles of acupressure performance were set up as follows:

1. Selections of the acupressure points, manual techniques of massages, and time of intervention.—Five acupoints that could be used to enhance sleep, such as Baihui, Fengchi, Anmian in the head, and Shenmen in the ears and hands, were chosen for the subjects in the acupressure group. The correctness of acupressure was confirmed if the subjects felt sore, numb, heavy, distended, and/or warm. Non (sham) acupoints, which were 1 cm to 3 cun (corresponding body unit) away from meridian, were used to replace true acupoints. Three cun is equal to the breadth of the middle segments of the index, middle, ring, and little fingers together. Time of interventions was limited to 15 minutes, consisting of 5 minutes of finger massage and 10 minutes of acupoint massage (2 minutes per each acupoint). Administration time of interventions was between 1 PM and prior to sleep (before 10 PM). One course of interventions lasted for 5 days per week (rest on weekends). These interventions lasted for 3 consecutive weeks.

2. Control of fingers’ pressure, accuracy of acupoints, and manual techniques.—The following controls were implemented to ensure the internal validity of the force of finger pressures, accuracy of acupoint selection, and manual techniques of acupressure:
(a) The force of finger pressure was controlled with an evaluation of intrarater reliability in order to maintain the consistency of the pressure. The pressure was measured with a scale that had a unit of 20 gm and maximum capacity of 6 kg. The principal investigator was self-trained for one month. The force of finger pressures was measured 60 times at the same place and height for 3 weeks. The mean forces of fingers of left and right hands were from 3.69 to 3.98 kg (SD 0.14–0.36). A “tiredness” factor of finger pressure was determined with measurements of forces before the first subject was treated every Monday and after the last one was treated on the same day. Mean forces were 3.86 kg (SD 0.44) and 3.24 kg (SD 0.28) before and after acupressure interventions, respectively.
(b) Accuracy of acupoint selection was also evaluated. Thirty subjects were selected to determine the principal investigator’s accuracy in selection of acupoints. The selection of five respective acupoints and nonacupoints by the principal investigator was recorded, and the accuracy of the selected acupoints was determined by two experts, who confirmed a 100% accuracy.
(c) To evaluate the appropriateness of manual techniques of acupressure, five experts were selected. Percentage agreements ranging from 80% to 100% were found for these experts’ evaluations about the appropriateness of selection of acupoints, properties of manual techniques, and time of acupressure. Then, the principal investigator employed a videotaped record to determine the accuracy of manipulation duration when acupressure therapies were carried out. The variance of time of duration of performed acupressures was 0–3 seconds in the
Acupressure group (mean variance with SD: 1.4±.84 sec) and 0-4 seconds (1.4±1.5 sec) in the sham acupressure group.

**Interview Questionnaire**

The Pittsburgh Sleep Quality Index (PSQI) developed by Buysse and associates in 1989 (15) was used to screen subjects for sleep disturbance. This questionnaire covered seven indices, including subjective quality, latency, duration, efficiency, sleep disturbances, use of sleeping medication, and daytime functional status. The score ranges from 0 to 21 points; those with total scores over 5 points were considered as meeting the criteria of sleep disturbance. The questionnaire can differentiate those with no sleep problem, major depression disorder, disorder of initiating sleep, and disorder of excessive somnolence with an identification accuracy of 88.5%. The sensitivity and specificity of questionnaires were 89.6% and 86.5%, respectively. Cronbach’s alpha determined internal consistency of the original questionnaire as 0.83, and the correlation coefficient of the test–retest was 0.85. Tzou’s (2) translated and modified Chinese version of the PSQI was used in this study. After consulting experts in Taiwan, Tzou deleted the daytime functional status instead of sleep efficiency in the Chinese version. The Cronbach’s alpha for the Chinese version in Tzou’s study is 0.84, indicating adequate internal consistency of the questionnaire. After obtaining permission from Tzou, the reliability of PSQI in the Chinese version was determined using 246 subjects in the screening study, yielding a Cronbach’s alpha of 0.86. Because Tzou (2) followed the original cutoff score of 5 and subscales on the PSQI, the cutoff score and subscales in this study were the same as Buysse and associates’ work (1989).

**Data Analysis**

After data collection, data were coded and then analyzed by using the Statistical Package for the Social Science (SPSS) version 6.0 for Windows. Data were analyzed using descriptive statistics, chi-square test, one-way ANOVA, ANCOVA, and paired t tests.

**RESULTS**

**Demographic Data of Subjects**

The mean age for all subjects was 79.04 years (SD = 7.77) and ranged from 61 to 98 years. Fifty-two of 84 subjects were men, and 32 were women. Most of the subjects lived with their roommate or spouse (78.6%), and 79.8% of the subjects were taking medicine. The median of their chronic diseases was 3. They stayed in an institution from 2 months to 25 years, and the mean months were 78 (SD = 52 months). There was no significant difference in the data pertaining to gender, living conditions, current use of drugs, numbers of chronic diseases, age, admission time to the living-assisted facility, habits of naps, exercise, time in bed, consumption of milk, tea, and coffee, or smoking among subjects in the three groups. These data indicated homogeneity of demographic data of subjects across groups.

**Sleep Quality of Subjects**

There were seven indices to represent subjects’ quality of sleep in the questionnaire. Table 1, obtained from preintervention determination, shows that ranges of subjects’ global PSQI scores are from 8 to 18 points (12.79 ± 2.62) in the acupressure group, from 7 to 17 points (12.75 ± 2.46) in the sham acupressure group, and from 8 to 17 points (12.71 ± 2.37) in the control group. The analysis of the data using one-way ANOVA showed no significant difference (p > .05) among the sleep quality indices of the three groups. These results indicated homogeneity of sleep quality indices in subjects in the three groups. The homogeneity of preintervention data would benefit evaluation of the effectiveness of different interventions. Table 2 presents the difference of sleep quality between before and after acupressure interventions. There were significant differences (p < .001) among the four indices of subjective sleep quality, sleep latency (including time spent before falling asleep and the frequency of “cannot get to sleep within 30 minutes”), sleep duration, and habitual sleep efficiency across the three groups. Scheffe’s post hoc comparison indicated that the score of improvement in the acupressure group was significantly greater than those of the other two groups. Although a significant difference (p < .05) was observed in the improvements of sleep disturbances of the three groups, Scheffe’s post hoc comparison demonstrated no significant difference in these improvements among three groups. Data from the daily sleep status record forms obtained in the first week showed that there were significant differences (p < .01) among some indices, such as the time required for falling asleep, hours of total bed time (including daytime naps), and frequency of nocturnal awakenings.

**Table 1. Comparisons of Preintervention of Sleep Qualities Among the Three Groups**

<table>
<thead>
<tr>
<th>Indices of Sleep Qualities</th>
<th>Acupressure (n = 28)</th>
<th>Sham Acupressure (n = 28)</th>
<th>Control (n = 28)</th>
<th>Total (n = 84)</th>
<th>F(2,81)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
</tr>
<tr>
<td>Subjective sleep quality</td>
<td>2.07</td>
<td>.77</td>
<td>2.00</td>
<td>.67</td>
<td>1.86</td>
</tr>
<tr>
<td>Sleep latency</td>
<td>2.71</td>
<td>.71</td>
<td>2.93</td>
<td>.38</td>
<td>2.64</td>
</tr>
<tr>
<td>Sleep duration</td>
<td>2.07</td>
<td>.86</td>
<td>2.07</td>
<td>.94</td>
<td>2.29</td>
</tr>
<tr>
<td>Habitual sleep efficiency</td>
<td>2.64</td>
<td>.68</td>
<td>2.46</td>
<td>.88</td>
<td>2.50</td>
</tr>
<tr>
<td>Sleep disturbances</td>
<td>1.39</td>
<td>.57</td>
<td>1.39</td>
<td>.57</td>
<td>1.36</td>
</tr>
<tr>
<td>Sleep efficiency</td>
<td>1.32</td>
<td>.77</td>
<td>1.50</td>
<td>1.04</td>
<td>1.46</td>
</tr>
<tr>
<td>Use of sleeping medication</td>
<td>.57</td>
<td>1.17</td>
<td>.39</td>
<td>.96</td>
<td>.61</td>
</tr>
<tr>
<td>Global PSQI Score</td>
<td>12.79</td>
<td>2.62</td>
<td>12.75</td>
<td>2.46</td>
<td>12.71</td>
</tr>
<tr>
<td>Range</td>
<td>8–18</td>
<td></td>
<td>7–17</td>
<td></td>
<td>8–17</td>
</tr>
</tbody>
</table>
expressed improvements in sleeping quality; and 9.2% showed changes in gastrointestinal function. Regarding the increase in the level of body comfort, the acupressure group had a higher positive effect response rate of 41% compared with the sham acupressure and sham acupressure groups, as follows: in order to understand the body change after the acupressure. The results of the interview, responded to by 56 subjects from frequent the nocturnal awakenings, the less wakeful time was controlled. We found that the longer total bed time and the more during night sleep after interventions.

ANCOVA analysis showed that improvements were greater in the acupressure group than in the control group. A significant difference \( F(2,81) = 14.32, \ p < .001 \) was observed in improvements of postintervention frequencies of nocturnal awakenings. Scheffe’s post hoc comparison demonstrated that improvements were greater in the acupressure group than in the control group. After comparison with data of frequencies of nocturnal awakenings in the first week, significant improvements after interventions were confirmed (\( \beta = .40, t = 10.23, p < .001 \)) by using ANCOVA to control falling asleep, hours of total bed time, and frequency of nocturnal awakenings. These data indicated that the more frequent the nocturnal awakenings were, the greater the reduction in nocturnal awakening frequency was after the interventions. Interventions significantly decreased wakeful time during nocturnal sleep (mean: 60.93 minutes) in the acupressure group compared to the other two groups \( F(2,80) = 14.32, p < .001 \).

ANOVA analysis showed that there were significant improvements of sleep in those with longer duration of bed time including daytime naps in the first week, and more frequency the nocturnal awakenings in the first week (\( \beta = -.12, t = -3.388, p < .001; \beta = -.59, t = -2.45, p < .05 \)) after these variables were controlled. We found that the longer total bed time and the more frequent the nocturnal awakenings, the less wakeful time was during night sleep after interventions.

This study also conducted an interview after the acupressure of both the acupressure group and the sham acupressure group in order to understand the body change after the acupressure. The results of the interview, responded to by 56 subjects from acupressure and sham acupressure groups, are as follows: 67.8% reported an increase in the level of body comfort; 23% expressed improvements in sleeping quality; and 9.2% showed changes in gastrointestinal function. Regarding the increase in the level of body comfort, the acupressure group had a higher positive effect response rate of 41% compared with the sham acupressure group of 26.8%. Increased moving activities of the head, feeling relief from headaches, decreases in shoulder sores and pain, and increased flexibility of hand movements are the top four items mentioned. Meanwhile, these items also showed a higher percentage of satisfaction in the sham acupressure group. The acupressure group had a higher increase rate (19.2%) than the sham acupressure group (3.8%) in the self-reported increase of sleeping quality. Falling asleep faster had the highest rank in measuring increasing sleep quality for both groups. In changing gastrointestinal function, the acupressure group also reported having a higher increase rate (6.3%) than the sham acupressure group (2.9%).

**DISCUSSION**

This study found that there were significant differences in improvements of sleep among those elderly people in three groups after acupressure interventions. Scheffe’s post hoc comparison pointed out that the improvements in the acupressure group were significantly greater than those in the sham acupressure and control groups. This difference in improvements may be mainly due to the effect of acupressure on various points, such as the Baihui, Fengchi, and Anmian points, which enhanced sleep (5,16–18). The stimulation of Baihui and Shenmen promote a release of serotonin and the relaxation of an individual’s body (19). It was assumed that improvements in the sham acupressure group should not be as good as those in the acupressure group because the sham acupressure points were selected 1 cm to 3 cm away from true acupressure points in this group, although manual techniques were the same. Improvements in the sham acupressure were not significantly greater than those in the control group. However, a paired \( t \) test suggested that significant improvements were found in several indices, such as subjective sleep quality, sleep latency, sleep sufficiency, sleep efficiency, sleep duration, nocturnal awakenings, and administration of sleeping medications in the sham acupressure group \( ps < .05 \). The only improvement found in the control group was for latency of sleep \( (p < .05) \).

Although there were some improvements in the sham acupressure group, the improvements were the greatest in the acupressure group. Acupressure on nonacupoints by clinical workers who can identify neither acupoints nor massage acupoints

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Table 2. Comparisons of Mean Score Differences in Pre- and Postintervention of Sleep Qualities Among the Three Groups (\( n = 84 \))

<table>
<thead>
<tr>
<th>Indices of Sleep Qualities</th>
<th>Acupressure (( n = 28 ))</th>
<th>Sham Acupressure (( n = 28 ))</th>
<th>Control (( n = 28 ))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean( \Delta )</td>
<td>SD</td>
<td>Mean( \Delta )</td>
<td>SD</td>
</tr>
<tr>
<td>Subjective sleep quality</td>
<td>1.32</td>
<td>.61</td>
<td>.36</td>
</tr>
<tr>
<td>Sleep latency</td>
<td>.82</td>
<td>.90</td>
<td>.29</td>
</tr>
<tr>
<td>Sleep duration</td>
<td>1.36</td>
<td>.87</td>
<td>.32</td>
</tr>
<tr>
<td>Habitual sleep efficiency</td>
<td>1.57</td>
<td>.88</td>
<td>.18</td>
</tr>
<tr>
<td>Sleep disturbances</td>
<td>.36</td>
<td>.49</td>
<td>.07</td>
</tr>
<tr>
<td>Sleep sufficiency</td>
<td>.39</td>
<td>.63</td>
<td>.32</td>
</tr>
<tr>
<td>Use of sleeping medication</td>
<td>.11</td>
<td>.57</td>
<td>.14</td>
</tr>
<tr>
<td>Global PSQI Score</td>
<td>5.93</td>
<td>2.36</td>
<td>1.68</td>
</tr>
</tbody>
</table>

\( F(2,81) \) Scheffe

\( *p < .05; **p < .001 \)}
correctly may produce some improvements in sleep. This may be the result of physiological and psychological effects of massage itself (6,7,10–13,20). The results of this study found that acupressure can improve the accumulated total score of the PSQI measurements. In the acupressure group, we found that the mean score difference between before and after acupressure was 5.93; also, the daily average frequency of nocturnal awakening decreased by 0.91 time. Such findings are comparable to Wang’s study (21), which revealed that the mean score difference between before and after acupressure was 3.8, and the decreased daily average midnight wake-up frequency was 0.99 time. Accordingly, we found that acupressure could lead to an improvement in sleep quality to a certain degree.

The overall participants in the true and sham groups reported increased satisfaction in body comfort. This might be the result of using the same massage techniques in both groups: rubbing and kneading of the shoulder, grasping in neck, rubbing and effleurage with pressure of the head, and holding hands for one minute each. Therefore, the results in both groups were similar. Increased appetite was reported to be the most significant effect in the changing of gastrointestinal function. The relation of such an effect might be the impact that massage can have in giving a higher level of comfort, improvement in sleep quality, or the intervention by this study in providing psychological support and caring. These relationships, however, need further study. This study used sham and control groups to avoid potential placebo effects of the acupressure. The results revealed, through statistical testing procedures, that acupressure was effective. Thus, no placebo effect existed. This result implied that the effectiveness of acupressure hinges on the proper application of acupoint.

Although the acupressure time period in this study was from 1:00 PM to 10:00 PM, the time sequence arrangement of acupressure conducted was in accordance with the subjects’ bedtimes. Subjects who had an earlier bedtime could thus have higher priority and be manipulated first. The acupressure was given to every subject 4 hours before his or her bedtime. Another study (22) showed that acupressure effects could last 8 to 12 hours; thus, the results of this study should not be affected by the acupressure time span used.

Strength and Limitations of This Study

The strengths of this study were (a) providing nursing professionals with a research-based nursing intervention and enhancing independent nursing function; (b) demonstrating the efficacy of acupressure and promoting a clinical application of a culturally based nursing intervention; and (c) offering a nonpharmacological treatment for elderly people with sleep disturbances.

Due to the restraints on availability of time, personnel, and budget in this study, limitations are recognized. As the sample was from a public living-assisted facility, the generalizations made in this study are limited to such residents. However, we feel that results from this study do have potential for broad application outside of such facilities, believing that it is the intervention, and not the living situation per se, that influences the observed results. All data collected from residents before and after intervention were subjective and may be subject to memory recall and interpretive biases. This was a single-blind study; thus, subjects did not know what intervention they were receiving, and the treatment of manipulating order for subjects was randomly selected, which may reduce errors of the study (23). However, the principal investigator knew who was given which intervention. Because the public living-assisted facility in this study admitted only low-income elders and those with no sons, the subjects were reluctant to be interviewed by researchers who had no prior contacts with them. The principal investigator, therefore, collected the outcome data. The authors recognized this limitation, which could possibly influence the validity of this study’s findings. Although ANCOVA was used to correct regression to the mean, employing a crossover design in the future—a more convincing correction—is suggested. Moreover, because a self-report measure is subjective, the use of actigraphic monitoring to obtain objective data in the future is recommended.

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