

The Immediate Effects of Laser Acupuncture on Static Balance in Healthy Female Older Adults

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Abstract

There is debate regarding the effect of laser acupuncture on static balance in healthy elderly women, and, research conducted to date has not shown evidence of benefit. The present study was designed to determine whether laser acupuncture has an immediate effect on improving balance in healthy elderly women. Twenty five subjects who were screened at the welfare center participated in the immediate laser acupuncture treatment. They were treated using laser acupuncture stimulation of balance area acupuncture points on scalp. Needles were contacted at a 90-degree angle, and participants wore a hair net band. Laser acupuncture was applied for 20 min with participants sitting with eyes closed. The Good Balance System was used to assess static balance before and after the intervention. After the intervention, postural sway increased, but it was not statistically significantly different compared to pre-test values. Only anteroposterior postural sway was significantly increased ($p < 0.05$). In healthy elderly women, scalp laser acupuncture does not affect static balance. This study provides a plan for future research.

Keywords: *Acupuncture, Laser, Postural Balance, Elderly*

1. Introduction

The cerebellum plays in an important role in controlling movement for balance and walking [1]. The elderly show a reduced cerebral and cerebellar volume compared to the young, which leads to a decline in balance control [2]. As the average life span and life expectancy are extended, disorders caused by balance problems will occur more frequently and may be more serious.

Falling accidents account for 14% of emergency hospitalizations of the elderly. These accidents lead to a loss of mobility, dysfunction, a lowered quality of life, and fear of falling and are a cause of injury-related deaths [3]. Femoral Fractures are a frequently occurring injury caused by falling accidents and some patients die within 12 months [4]. The treatment period is long and expensive [5]. Therefore, balance control for the elderly is one of the most important physical factors that directly affect their daily lives.

Generally, acupuncture has been used to reduce pain and to treat musculoskeletal system disorders [6], but its application is now being expanded to various fields. In previous studies, surface acupuncture using electrical stimulation was reported to have a significant effect on improving balance control among subacute stroke patients [7, 8], and needle acupuncture using electrical stimulation had a significant effect on walking ability, range of motion and postural control among acute and subacute stroke patients [9]. Acupuncture has also been applied as a treatment method for improving postural control in patients with dizziness and vertigo [7, 10].

Laser acupuncture has been suggested as an effective alternative to acupuncture therapy using metal needles [11, 12]. Because laser acupuncture is easy to use and non-invasive, it can be applied to patients who have needle phobia [13, 14]. Laser acupuncture provides a physiological effect at the cellular level by supplying sufficient energy based on photobiomodulation as well as stimulation by needles [15]. In a recent study, postural control of senior-aged participants was improved with the application of laser acupuncture and auriculotherapy [16].

Laser acupuncture studies have been performed in various fields, but there has been no study on scalp acupuncture. This study aimed to determine if laser acupuncture has an immediate effect on static balance among healthy elderly women.

2. Methods

2.1. Subjects

Elderly women over 65 years old were recruited through an ad-poster in the M welfare center of Seoul. All applicants received a thorough explanation of the study. Physical therapists of the institute evaluated the basic health status of the participants. Participants who had stability and were able to stand independently without the help of aids and who had no history of falling accidents were included. Applicants with vestibular, cerebellar and musculoskeletal disorders which could affect balance or a neurological medical history of disorders such as stroke or Parkinson's disease were excluded. Applicants who used ambulatory devices were also excluded. The general characteristics of the selected participants including height, weight, and age were recorded.

2.2. Apparatus

In this study, laser needles (Laser needle GmbH, Original Laser needle, Berlin, Germany) were applied to the scalp to stimulate the cerebellum to improve the balance of the participants. This 3B class laser device has a wavelength of 658 nm, distal output of 40 mW, frequency of 1~10,000 Hz and power density of 20 W/cm². At each point, a total of 120 J of energy was administered if 0.5 J was applied for 5 s (Figure 1).

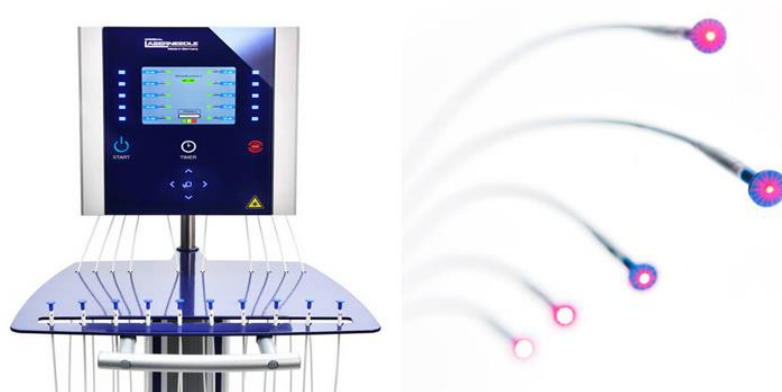


Figure 1. Laser Needle Device

During application, the laser contacted the designated areas vertically without twisted lines. Rubber tubes were inserted at the tip and fixed with tape, so that light could be applied to these areas vertically.

To estimate static balance, the Good Balance System (Good Balance System, Metitur Ltd., Jyväskylä, Finland) was used. When participants step onto the triangle force plate quietly, data are transmitted to a notebook computer through a wireless bluetooth[®]. Mediolateral postural sway (x-speed), anteroposterior postural sway (y-speed), and velocity moment are measured and the result is transmitted at a 50Hz sampling rate. To evaluate static balance, the participants were educated to keep their forward balance and to maintain a static posture as long as possible while standing on the force plate. Later, evaluation is performed again with their eyes closed in the same posture.

2.3. Procedures

The selected subjects agreed to participate in the study. The Good balance system was used to estimate baseline static balance. The laser needle was applied for 20 min in the balance area on scalp acupuncture point (Figure 2), and then static balance was estimated again after a 1 min break. The subjects who received the treatment sat comfortably on a chair with their eyes closed during the laser needle application. It is difficult to apply laser needles vertically because of the hair, so the subjects wore hair nets to fix the laser needle while assistants continuously supervise. Static balance was estimated 3 times each under open eyes and closed eyes conditions, and the average values were recorded (Figure 3). The study design was approved by the Sahmyook University Institutional Review Board.

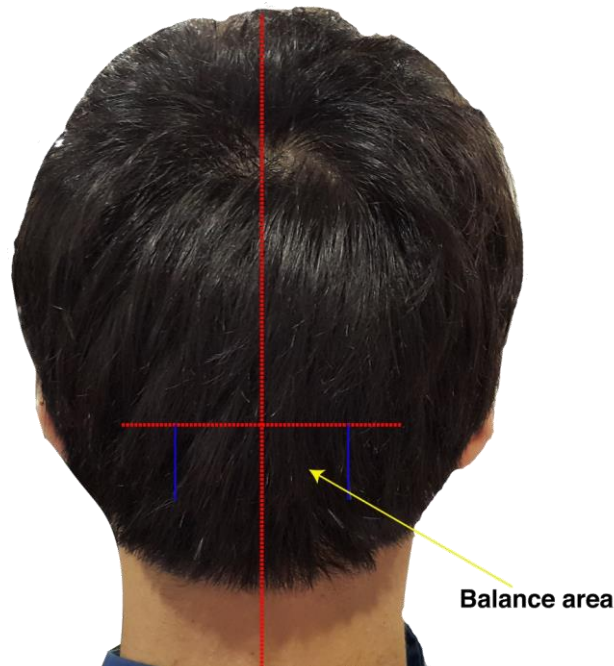


Figure 2. Balance Area of Scalp Acupuncture Point

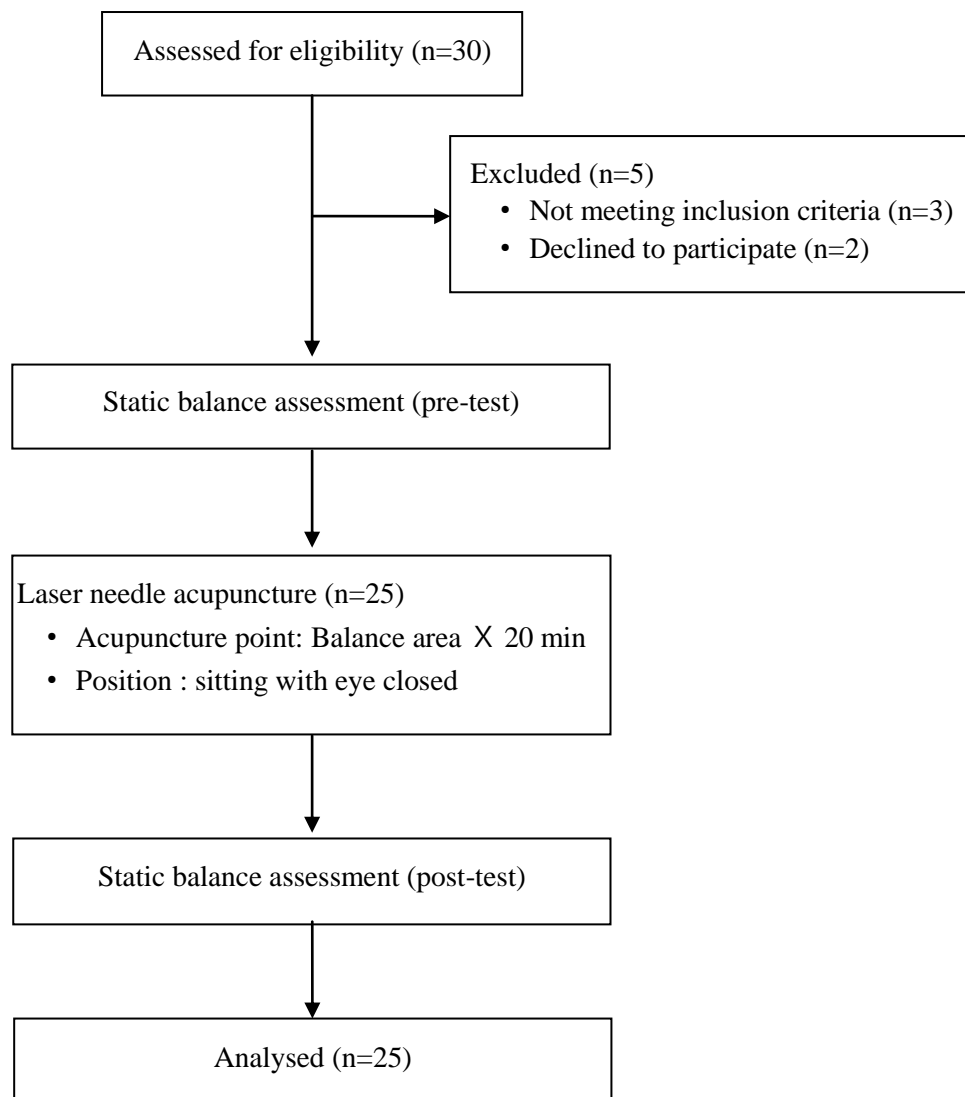


Figure 3. Experimental Flower Chart

2.3. Data Analysis

All statistical analyses were performed using SPSS 19.0 software (SPSS Inc., Chicago, IL, USA). Data are presented as the mean and standard deviation as indicated in the text and tables. The general characteristics of the subjects were evaluated using descriptive statistics, and the Shapiro-Wilk test was used to assess the normal distribution. To check changes by arbitration, the repeated Analysis of Variance (ANOVA) was used. The significance level was $p < 0.5$.

3. Results

Twenty-five elderly women (average age 77.32 years) participated in this cohort study. Their mean body mass index (BMI) was 22.55 kg/cm^2 and they reported falling 0~2 times (mean 0.56 times). The characteristics of the subjects are presented in Table 1.

Table 1. Baseline Demographic Characteristics Of Subjects

	Laser needle acupuncture (n=25)
Age (years)	77.32 ± 5.41
Body weight (kg)	54.08 ± 6.49
Height (cm)	154.92 ± 5.52
Body mass index (kg/cm ²)	22.55 ± 2.57
Experience of falls (times)	0.56 ± 0.58

Note. Values are presented as mean ± SD

There was no significant improvement in static balance after the laser needle intervention (Table 2). Only the anteroposterior postural sway (y-speed) was statistically significant in the eyes open condition ($p < 0.05$). However, the mean value was increased so this finding cannot be considered desirable.

4. Discussion

In this study, laser acupuncture had no significant effect on balance among elderly participants. Acupuncture has been practiced in China based on the existence of meridians and energy flow and is currently an alternative medicine modality in many countries. Since 1970, many studies have been performed to identify the basis of acupuncture's pain relief effect and acupuncture is now broadly applied to the treatment of various diseases [17]. The neurophysiological mechanisms of acupuncture are not yet clear, but stimulation of the cerebrum and the cerebellum have been confirmed in human and animal studies [2].

The effectiveness of laser acupuncture has been demonstrated [18-20], however, it has not been effective for some conditions [21, 22]. Further research is required. Scalp acupuncture is largely utilized to treat children with attention deficit disorders and stroke patients [23, 24]. According to the research of Tang and others [24], when scalp- and body-acupuncture points were stimulated in subacute stroke patients for 20 sequential days, the Fugl-Meyer assessment scores increased significantly and the United States National Institutes of Health Stroke Scale decreased significantly ($p < 0.01$).

The effects on patients in the acupuncture group were obviously superior to those of the patients in the control group ($p < 0.05$). In Zhu's research [25], acupuncture combined with conventional physical therapy was applied to subacute stroke patients. After the intervention was applied for 3 months, there were no significant differences in the Fugl-Meyer assessment and Barthel Index between those who were treated using acupuncture combined with conventional physical therapy and those who received only physical therapy.

In China and globally, acupuncture is widely used but it does not provide any immediate benefit to elderly women as shown in this study. One potential limitation of this study was that all the subjects were healthy, which may explain the lack of large changes in postural sway. There were several research reported that there is no significant difference between real and sham acupuncture [26-28]. In a previous study, strong laser acupuncture applied for a long treatment showed effective results [19]. In this study, strong laser energy was used [29]. However, the duration was short and there was only one session, so the effect may have been insufficient because a suitable laser wavelength

wasn't found. Whittaker has mentioned that effective application of laser is not easy due to the variety of wave-lengths, irradiance, and beam profiles [12].

Table 2. Change of Static Balance In According To Laser Radiation

		Laserneedle acupuncture (n=25)	F(p)
Eye open			
ML (mm/s)	Pre-test	5.51 ± 2.67	1.459 (0.239)
	Post-test	5.92 ± 3.00	
	Changes	0.41 ± 1.70	
AP (mm/s)	Pre-test	7.61 ± 2.52	6.469 (0.018)
	Post-test	8.48 ± 2.92	
	Changes	0.87 ± 1.71	
VM (mm ² /s)	Pre-test	17.72 ± 10.87	0.352 (0.559)
	Post-test	18.82 ± 13.08	
	Changes	1.10 ± 9.27	
Eye closed			
ML (mm/s)	Pre-test	6.48 ± 4.26	1.050 (0.239)
	Post-test	6.91 ± 4.25	
	Changes	0.44 ± 2.17	
AP (mm/s)	Pre-test	11.62 ± 5.58	1.252 (0.274)
	Post-test	12.39 ± 5.04	
	Changes	0.77 ± 3.43	
VM (mm ² /s)	Pre-test	27.37 ± 25.34	0.869 (0.361)
	Post-test	31.97 ± 30.96	
	Changes	4.60 ± 24.68	

Note. Values are presented as mean ± SD, Abbreviation. ML=mediolateral postural sway; AP=anterioposterior postural sway; VM=velocity moment

In traditional acupuncture, the depth at each meridian point varies, so treatment should be performed using magnetic needles inserted at different depths. The amount of energy that reaches the median point also differs when treatment is performed at different depths [30].

Acupuncture is effective when it is applied to the precise points. Even though hair was fixed with a hair net, there is possibility that the needles were not fixed precisely on the meridian point, or that enough energy to stimulate the points was not received.

In future research of scalp acupuncture the strength of the laser should be adjusted to account for energy loss caused by hair, and the application time should be divided by stages to confirm effective duration. Future studies should include men and patients with balance disorders and the effect of long-term application should also be evaluated.

5. Conclusion

Unlike previous research, this study aimed to determine whether laser acupuncture is effective on static balance in healthy elderly women. However, no

immediate effect was shown. This study presents guidelines and considerations for future researches.

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