Effects of Shiatsu Stimulation on Blood Pressure

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I. Introduction

Shiatsu therapy produces a variety of therapeutic effects, including alleviation of pain and regulation of autonomic functions; however, many questions remain to be answered about these effects and their mechanisms. It is recognized that somatosensory stimulation of an organism using manual pressure stimulation evokes a reflex response in the various internal organs via the autonomic nervous system[1,2]. This somatoviscerал reflex is thought to be responsible for the therapeutic effectiveness of shiatsu.

In order to clarify the effects of shiatsu and the mechanisms involved, the Japan Shiatsu College has been conducting research into the effects of shiatsu on the cardiovascular system. Last year, we reported on reduction in heart rate due to shiatsu stimulation[3].

Building on last year's results, this year we report on changes in blood pressure due to shiatsu stimulation, as measured using a noninvasive continuous blood pressure manometer.

II. Methods

1. Subjects

Research was conducted on 37 healthy adults (22 males, 15 females) aged 22–65 years (mean age: 40.7 years old).

Test procedures were fully explained to each test subject and their consent obtained. They were also asked to abstain from eating, smoking, ingestion of stimulants, or vigorous exercise for two hours prior to testing.

2. Test period

April 11 to July 17, 1999

3. Test location

Testing was conducted in the basic medical research lab at the Japan Shiatsu College. Room temperature was 25 ± 1.5°C with subdued lighting and silence maintained.

4. Items measured

(1) Blood pressure

A continuous blood pressure manometer (Japan Colin Jentow-7700) was used to derive blood pressure from the left radial artery using tonometry.

(2) Heart rate

A pulse tachometer (Nihon Kohden Corp. model AT-601G) was used to calculate the momentary heart rate (hereafter, 'heart rate') as triggered by the ECG's R wave (the second deflection on the ECG).

(3) Fingertip pulse wave

The fingertip volume pulse wave (hereafter, 'pulse wave') was measured on the second digits of the right hand and foot using a reflex pickup (Nihon Kohden Corp. model MPP-3A).

(4) Respiratory curve

The respiratory curve was measured using a thermistor breathing pickup (Nihon Kohden Corp. model TR-712T) inserted into the nasal cavity.

5. Data recording

The items measured in (1) to (4) above were continuously recorded using a thermal recording device on a polygraph system (Nihon Kohden Corp. model RM-7000), as well as being transferred and saved to a personal computer (IBM 300GL) via an A/D convertor (BIOPAC Systems, Inc. model MP-100). The data were also recorded on magnetic tape using a data recorder (Sony model PC208AX).

6. Data analysis

After completion of testing, data was analyzed using data analysis software (AcqKnowledge, BIOPAC Systems, Inc.). Analysis was performed on blood pressure, heart rate, and pulse wave data from one minute prior to stimulation to one minute after stimulation. However, data due to pronounced body motion,

artifact, or swallowing was omitted.

7. Stimulation

Full-body treatment is standard for Namikoshi shiatsu[4], but because mobility of the test subject was limited due to attachment of the ECG electrodes and other constraints, the areas to which shiatsu was applied were limited to the following three regions (Fig. 1):

(1) Point 1, left lateral crural region: approximately 3 cm disto-lateral to the tibial tuberosity. This is the point where the common peroneal nerve emerges from the popliteal region to the lateral lower leg and divides into the deep and superficial peroneal nerves. Standard pressure was applied using thumb-on-thumb pressure for 5 seconds, repeated 10 times.

(2) Abdominal region (small intestine region): referred to as the small intestine region in Namikoshi shiatsu, consisting of 8 points located clockwise around the navel, with Point 1 located diagonally to the right (test recipient's right) and inferior to the navel. Standard pressure was applied using two-thumb pressure, 3 seconds per point, repeated 3 times.

(3) Point 1, left anterior cervical region: located on the medial margin of the sternocleidomastoid muscle, near the carotid artery in the carotid triangle. Positioned behind the test recipient's head, the therapist applied standard pressure using one-thumb pressure with the left hand for 3 seconds, repeated 6 times.

All treatment was carried out by the same therapist, applying approximately 5–15 kg pressure, depending on the comfort level of the test recipient. All standard pressure was applied using gradual increase and decrease of pressure.

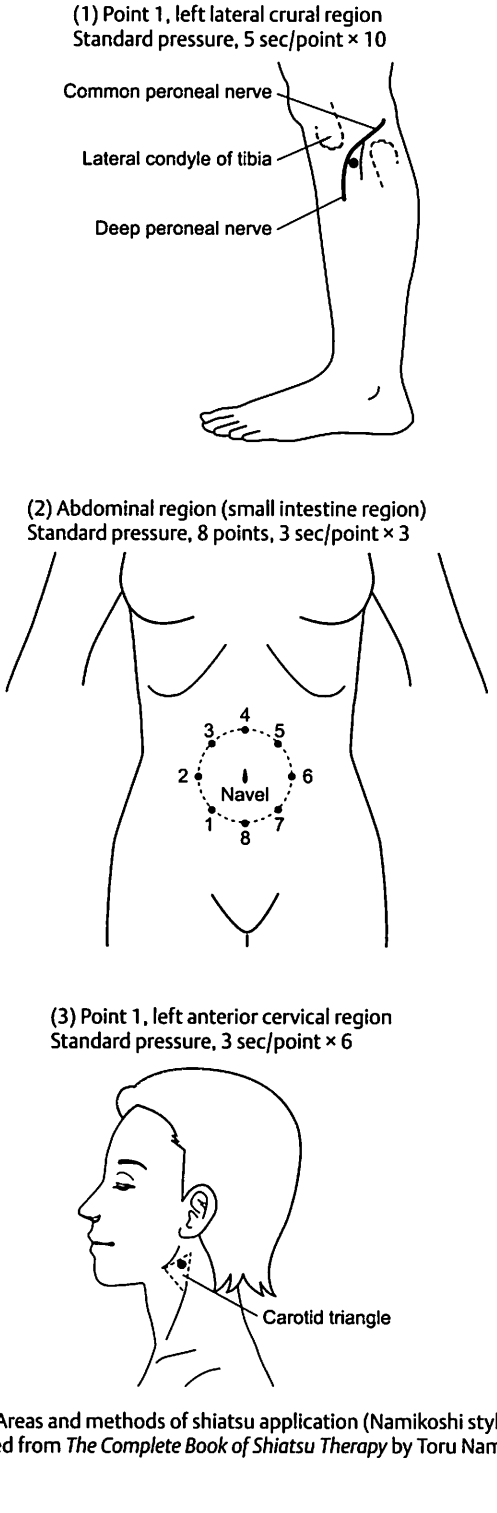

Fig.1. Areas and methods of shiatsu application (Namikoshi style)
Adapted from *The Complete Book of Shiatsu Therapy* by Toru Namikoshi

8. Test procedure

Testing commenced after the subject had been lying quietly for a minimum of 20 minutes in the supine position.

Stimulation was carried out in the following order: Point 1, left lateral crural region; abdominal region (small intestine region); Point 1, left anterior cervical region. A minimum of 5 minutes was allowed between each shiatsu procedure, and blood pressure, heart rate, and pulse wave allowed to stabilize before the next stimulation was applied.

9. Statistical processing

Data were analyzed at 10 second intervals from 1 minute prior to 1 minute after stimulation. Measurements taken during 1 minute prior to commencement of stimulation were averaged and used as the control in order to establish a standard value for evaluating response, shown as 100%. Other measurements were converted to percentage and expressed as mean ± SE.

Statistical verification was carried out using analysis of variance according to Dunnett's multiple comparison test, with <5% considered significant.

III. Results

During testing there were no instances requiring cessation of treatment due to pain or discomfort.

1. Point 1, left lateral crural region

Figure 2 indicates changes to blood pressure, heart rate, and pulse wave due to stimulation of Point 1 of the left lateral crural region. Systolic blood pressure

rose briefly at 10 seconds after commencement of stimulation, then gradually declined, showing a significant drop between 10 seconds and 30 seconds after commencement of stimulation. A maximum decline of 3.0% was observed at 10 seconds after completion of stimulation. Diastolic blood pressure rose briefly 10 seconds after commencement of stimulation, showing a more or less significant decline between 20 seconds after commencement and 60 seconds after completion of stimulation. A maximum decline of

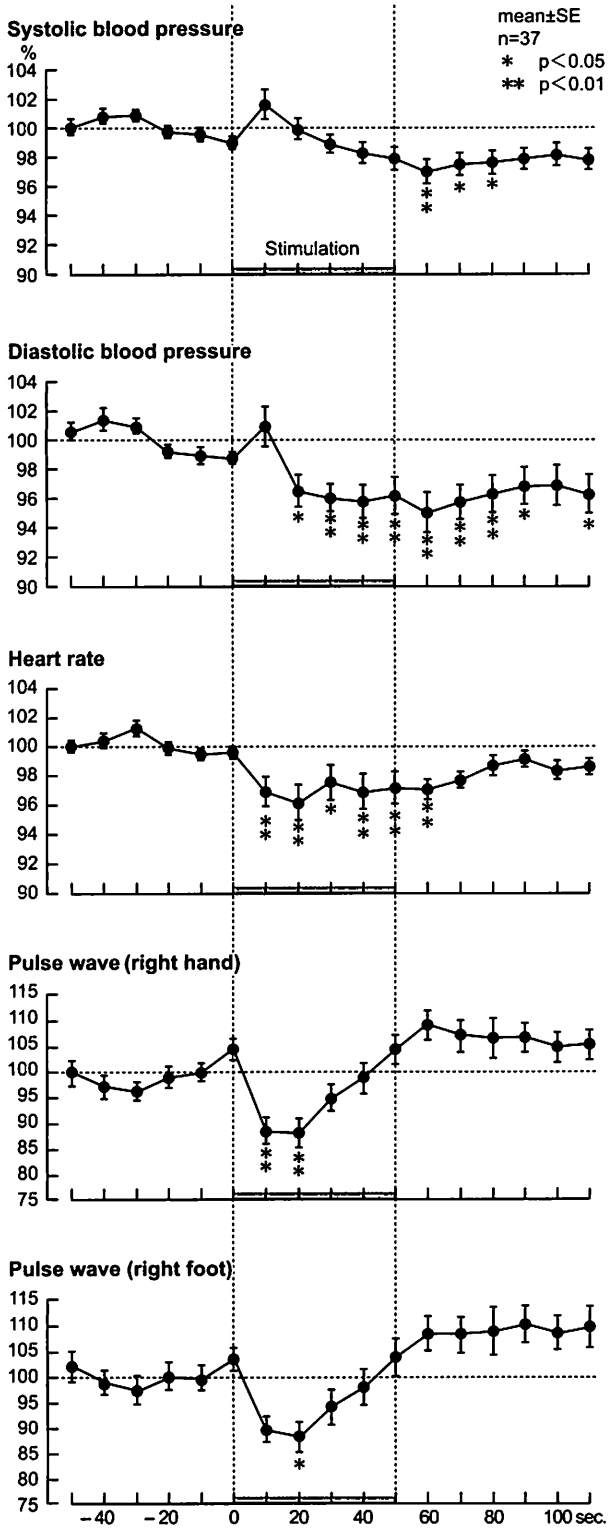

Fig. 2. Effects of shiatsu stimulation of Point 1 of the left lateral crural region
Horizontal axis indicates lapsed time; vertical axis indicates percentage change, with 100% equalling the average value during 1 minute prior to stimulation.

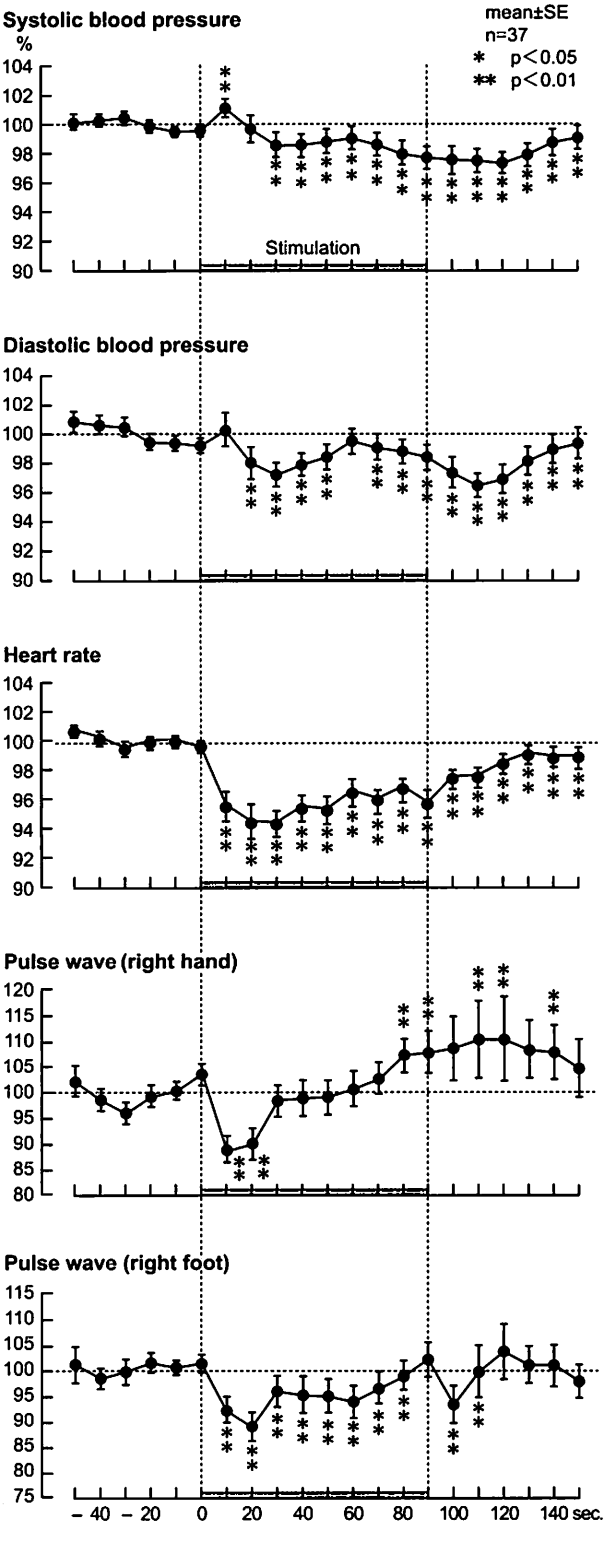

Fig. 3. Effects of shiatsu stimulation of the abdominal region
Horizontal axis indicates lapsed time; vertical axis indicates percentage change, with 100% equalling the average value during 1 minute prior to stimulation.

4.9% was observed at 10 seconds after completion of stimulation. Heart rate showed a significant reduction between 10 seconds after commencement of stimulation and 10 seconds after completion of stimulation. A maximum reduction of 3.9% was observed at 20 seconds after commencement of stimulation. Right-hand pulse wave showed significant reduction between 10 and 20 seconds after commencement of stimulation. A maximum reduction of 11.9% was observed at 20 seconds after commencement of stimulation, after which it promptly returned to pre-stimulation values. After completion of stimulation, it displayed an upward trend. Right-foot pulse wave showed a maximum reduction of 11.9% at 20 seconds after commencement of stimulation, which was significant, after which it promptly returned to pre-stimulation values. After completion of stimulation, it displayed an upward trend.

2. Abdominal region (small intestine region)

Figure 3 indicates changes to blood pressure, heart rate, and pulse wave due to stimulation of the abdominal region (small intestine region). Systolic blood pressure rose briefly at 10 seconds after commencement of stimulation, then showed a more or less significant drop between 30 seconds and 60 seconds after commencement of stimulation. A maximum decline of 2.7% was observed at 30 seconds after completion of stimulation. Diastolic blood pressure showed a more or less significant decline between 20 seconds after commencement and 60 seconds after completion of stimulation. A maximum decline of 3.5% was observed 20 seconds after completion of stimulation. Heart rate showed a significant reduction between 10 seconds after commencement of stimulation and 60 seconds after completion of stimulation. A maximum reduction of 5.6% was observed at 30 seconds after commencement of stimulation. Right-hand pulse wave showed significant reduction between 10 and 20 seconds after commencement of stimulation. A maximum reduction of 10.8% was observed at 10 seconds after commencement of stimulation, after which it gradually increased. Significant increase was observed in the latter half of the stimulation period and post-stimulation. Right-foot pulse wave showed more or less significant reduction between 10 seconds after commencement of stimulation and 20 seconds after completion. A maximum reduction of 11.4% was observed at 20 seconds after commencement of stimulation, before promptly returning to pre-stimulation values after completion of stimulation.

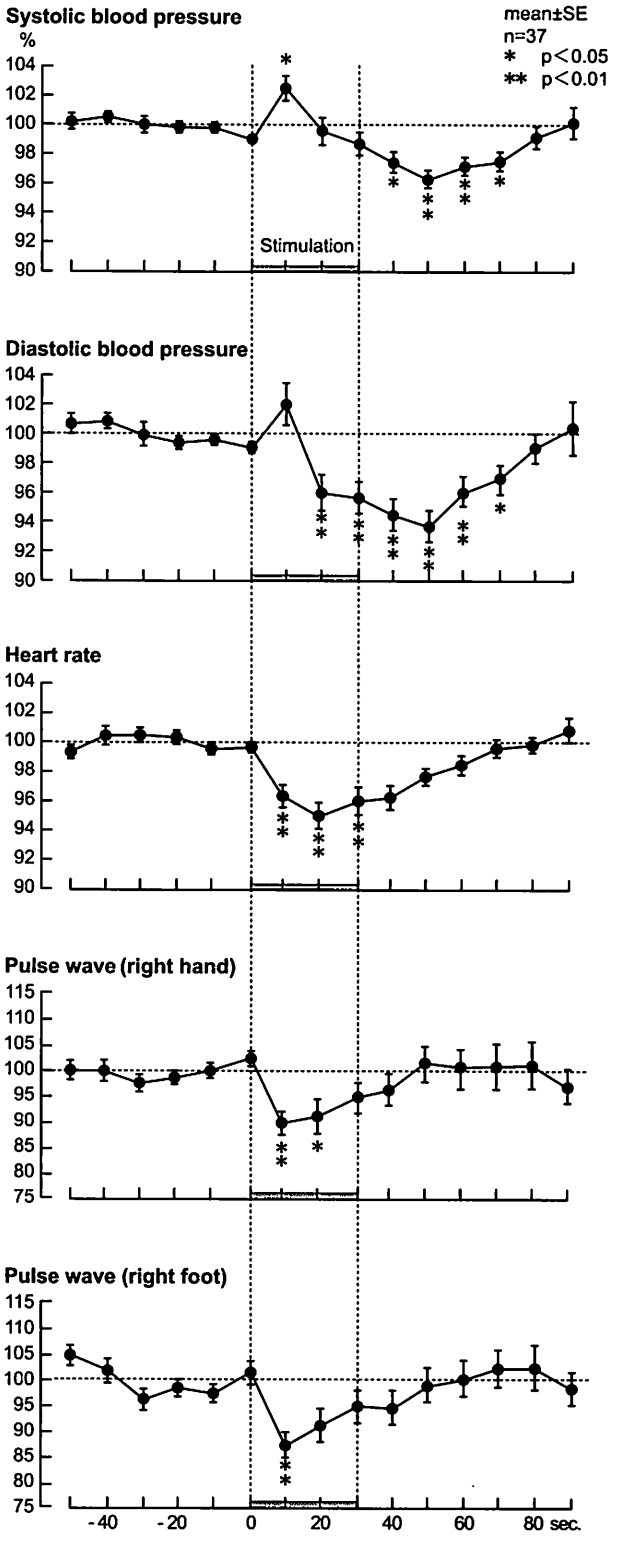

Fig. 4. Effects of shiatsu stimulation of Point 1 of the left anterior cervical region
Horizontal axis indicates lapsed time; vertical axis indicates percentage change, with 100% equalling the average value during 1 minute prior to stimulation.

3. Point 1, left anterior cervical region

Figure 4 indicates changes to blood pressure, heart rate, and pulse wave due to stimulation of Point 1 of the left anterior cervical region. Systolic blood pressure rose briefly at 10 seconds after commencement of stimulation, then gradually declined, showing a significant drop between 10 seconds and 40 seconds after completion of stimulation. A maximum decline of 3.6% was observed at 20 seconds after completion

of stimulation. Diastolic blood pressure rose briefly at 10 seconds after commencement of stimulation, then showed a significant decline between 20 seconds after commencement and 40 seconds after completion of stimulation. A maximum decline of 6.2% was observed at 20 seconds after completion of stimulation. Heart rate showed a significant reduction between 10 and 30 seconds after commencement of stimulation. A maximum reduction of 5.0% was observed at 20 seconds after commencement of stimulation. Right-hand pulse wave showed significant reduction between 10 and 20 seconds after commencement of stimulation. A maximum reduction of 10.4% was observed at 10 seconds after commencement of stimulation, after which it promptly returned to pre-stimulation values. Right-foot pulse wave showed a maximum reduction of 12.4% at 10 seconds after commencement of stimulation, which was significant, before promptly returning to pre-stimulation values.

IV. Discussion

In the previous study, we confirmed that heart rate and pulse wave were reduced through application of shiatsu stimulation using standard pressure[3]. In this study, we also confirmed that blood pressure is significantly lowered.

It was observed that, immediately after commencement of shiatsu stimulation, blood pressure underwent a transient rise, then lowered during the latter half of stimulation and after completion. From the fact that the transient rise in blood pressure immediately after commencement of stimulation coincided with the reduction response in fingertip pulse wave in the hand and foot, we may assume that it was due to dermovascular constriction in the hands and feet due to stimulation of the alpha-mediated sympathetic nervous system. The drop in blood pressure during the latter half of stimulation and after completion may have been due to vasodilation arising subsequent to dermovascular constriction. It is known based on numerous studies that nociceptive mechanical stimulation causes a rise in blood pressure[1, 2], but the effect of shiatsu on blood pressure has been shown here to differ from that of nociceptive stimulation.

The pulse wave response to stimulation of both Point 1 of the left lateral crural region and Point 1 of the left anterior cervical region were consistent. Pulse wave fluctuations in the right foot observed during stimulation of the abdominal region (small intestine region) may have been due to the effect of pressure on the abdominal aorta during abdominal shiatsu.

This research confirmed a reduction in blood pressure due to shiatsu stimulation of all regions studied, including Point 1 of the lateral crural region, supplied by the L_5 segment; the abdominal region (small intestine region), supplied by the T_{10-12} segments; and Point 1 of the anterior cervical region, supplied by the C_3 segment. Kimura et al reported that in anesthetized rats nociceptive mechanical stimulation produced a universal response of increased blood pressure, caused by a supraspinal reflex mediated in the brain stem[5]. Although the direction of the response differs between nociceptive mechanical stimulation and shiatsu stimulation, it is highly probable that the blood pressure reduction response due to shiatsu stimulation is also universal. Further research is required involving stimulation of additional regions using standardized stimulation techniques.

The hypotensive response due to shiatsu stimulation observed here may also be related to reduced heart rate and vasodilation in internal organs, but it would be difficult to confirm this with the current research.

In the future, we hope to build on the current study results to clarify the effect of shiatsu stimulation on circulatory functions such as blood-flow volume in cutaneous and muscular tissues.

V. Conclusions

Study of the effects of shiatsu stimulation on the blood pressure of healthy adult test subjects yielded the following results:

1. Blood pressure was significantly reduced during and after stimulation.
2. Heart rate was significantly reduced during stimulation.
3. Pulse wave was significantly reduced immediately after commencement of stimulation.

Based on the above findings, it is apparent that shiatsu stimulation results in lower blood pressure, lower heart rate, and transitory reduction in pulse wave.

In closing, we would like to express our appreciation to the instructors and students of the Japan Shiatsu College who participated in this research. This research was carried out as a dying wish of Toru Namikoshi, former Principal of the college.

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