

Effects of Shiatsu Stimulation on Peripheral Circulation

Japan Shiatsu College

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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 somatovisceral reflex is thought to be responsible for the therapeutic effectiveness of shiatsu. In order to shed light on the effects of shiatsu and the mechanisms involved, the Japan Shiatsu College has conducted research into the reduction of blood pressure and heart rate due to shiatsu stimulation, which were reported on at the congress of the Japan College Association of Oriental Medicine^{3,4}. Building on these past results, this year we report on changes in peripheral circulation due to shiatsu stimulation, as measured by muscle blood volume and thermography.

II. Methods

1. Subjects

Research was conducted on 33 healthy adults (23 males, 10 females) aged 20–70 years (mean age: 41.0 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 20 to July 19, 1999

3. Test location

Testing was conducted in the shiatsu research lab at the Japan Shiatsu College. Room temperature was 25

± 1.5°C with subdued lighting and silence maintained.

4. Items measured

(1) Muscle blood volume

A tissue SO₂-Hb volume monitor (Bio Medical Science Inc. model PSA-III N) was used to derive muscle blood volume in the tibialis anterior muscle at the midpoint of the right lateral crural region.

(2) Skin temperature

Skin temperature was measured in the right anterior crural region using a thermograph (Nihon Kohden Corp. model Infra-eye 1200).

(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) Blood pressure

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

(5) 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).

(6) 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

Items measured above, including muscle blood volume, fingertip pulse wave, blood pressure, heart rate, and respiratory curve 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).

Thermograms were saved to floppy disc using a floppy drive attached to the thermograph device.

6. Stimulation

Full-body treatment is standard for Namikoshi shiatsu⁵, but because mobility of the test subject was

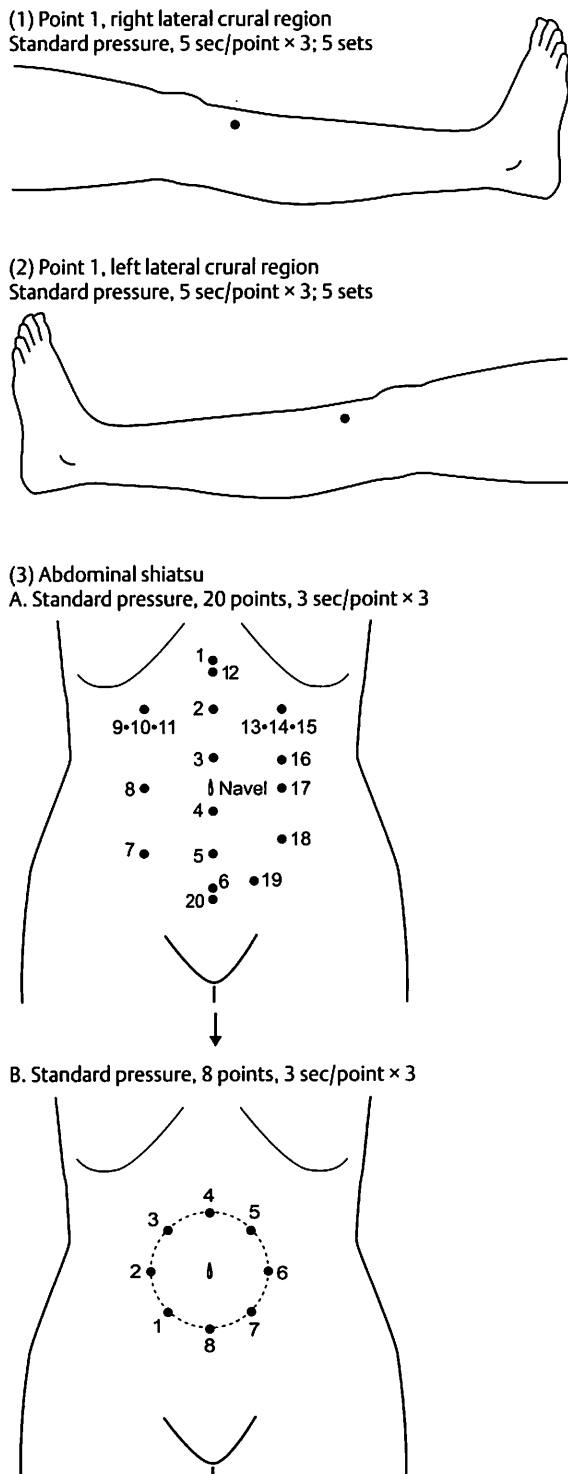


Fig. 1. Areas and methods of shiatsu application (Namikoshi style)

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, right lateral crural region: approximately 3 cm disto-lateral to the tibial tuberosity on the right leg. 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 15 times.

(2) Point 1, left lateral crural region: same region as above, at the tibial tuberosity on the left leg.

(3) Abdominal region (20 points + small intestine region): the 20 abdominal points of Namikoshi shiatsu are arranged along a line that begins at the epigastric fossa, runs down the midline to the bladder, then describes a circle that follows the colon. Standard pressure is applied using two-thumb pressure, 3 seconds per point, repeated 3 times. The small intestine region, consisting of eight points evenly spaced clockwise around the navel with Point 1 located diagonally to the right (patient's right) and inferior to the navel, was also treated with standard pressure applied using two-thumb pressure, 3 seconds per point, repeated 3 times.

Each application of force consisted of 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.

7. 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, right lateral crural region; Point 1, left lateral crural region; abdominal region (20 points + small intestine region). A minimum of 10 minutes was allowed between each shiatsu procedure, and blood pressure, heart rate, and pulse wave allowed to stabilize before the next stimulation was applied.

8. Data analysis

After completion of testing, muscle blood volume, fingertip pulse wave, blood pressure, and heart rate data were analyzed using data analysis software (AcqKnowledge, BIOPAC Systems, Inc.). Analysis was performed from 1 minute prior to stimulation to 7 minutes after stimulation. However, data due to pronounced body motion, artifact, or swallowing was omitted.

For thermograph data, average skin temperature for the right, upper crural region indicated in Figure 3 was analyzed.

9. Statistical processing

Data were analyzed at 1 minute intervals from 1 minute prior to 7 minutes after stimulation. Measurements taken during 10 seconds prior to commencement of stimulation were averaged and used as the control in order to establish a standard value for evaluating response. Other measurements were averaged and expressed as a variation from this standard value, expressed as either amount of change or rate of variability.

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, right lateral crural region

Figure 2 indicates changes to muscle blood volume (right tibialis anterior muscle), right foot pulse wave height value, right upper crural region skin temperature, heart rate, and blood pressure due to stimulation of Point 1 of the right lateral crural region.

Muscle blood volume declined briefly immediately after stimulation before recovering to its immediately pre-stimulation level 1 minute later, then gradually increased, showing a significant increase at 6 minutes after completion of stimulation. Right foot pulse wave increased immediately after stimulation, with a maximum increase of 22.5%, but there was no significant

difference.

Skin temperature showed a significant increase of 0.4°C immediately after stimulation, returning to pre-stimulation values at 3 minutes after completion of stimulation. Figure 3 shows a typical thermogram of skin temperature change due to shiatsu stimulation of Point 1 of the right lateral crural region.

Heart rate showed a significant decrease immediately after stimulation, later returning to pre-stimulation values.

Significant changes to systolic or diastolic blood pressure were not confirmed.

2. Point 1, left lateral crural region

Figure 4 indicates changes to muscle blood volume (right tibialis anterior muscle), right foot pulse wave height value, right upper crural region skin temperature, heart rate, and blood pressure due to stimulation of Point 1 of the left lateral crural region.

Muscle blood volume (in the right tibialis anterior muscle) decreased slightly immediately after stimulation, then showed an upward trend, but a significant difference was not confirmed.

Right foot pulse wave increased after stimulation, with a maximum increase of 22.5%, but a significant difference was not confirmed.

Skin temperature declined significantly between 3 minutes and 7 minutes after stimulation.

Heart rate showed a downward trend immediately after stimulation, but a significant decline was not confirmed.

Systolic blood pressure decreased immediately after

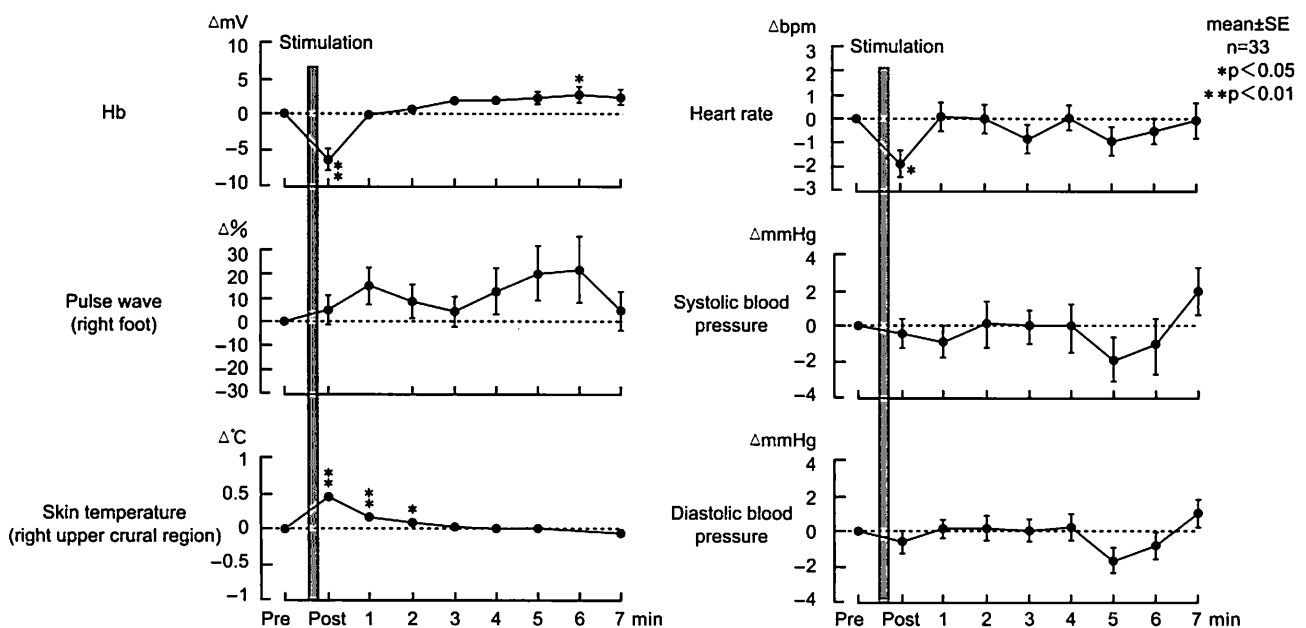


Fig. 2. Effects of shiatsu stimulation of Point 1 of the right lateral crural region. Muscle blood volume (Hb), skin temperature, heart rate, and systolic/diastolic blood pressure show the amount of change compared to the 10 seconds prior to stimulation. Pulse wave is expressed as the rate of variability compared to the 10 seconds prior to stimulation.

stimulation, with a significant decrease of 3.4 mmHg confirmed at 3 minutes after stimulation. Diastolic blood pressure showed a downward trend immediately after stimulation, but a significant difference was not confirmed.

3. Abdominal region (20 points + small intestine region)

Figure 5 indicates changes to muscle blood volume

(right tibialis anterior muscle), right foot pulse wave height value, right upper crural region skin temperature, heart rate, and blood pressure due to stimulation of the abdominal region (20 points + small intestine region).

Muscle blood volume began to increase immediately after stimulation, with a significant increase confirmed between 2 minutes and 7 minutes after stimulation. A maximum increase of 3.6 mV was

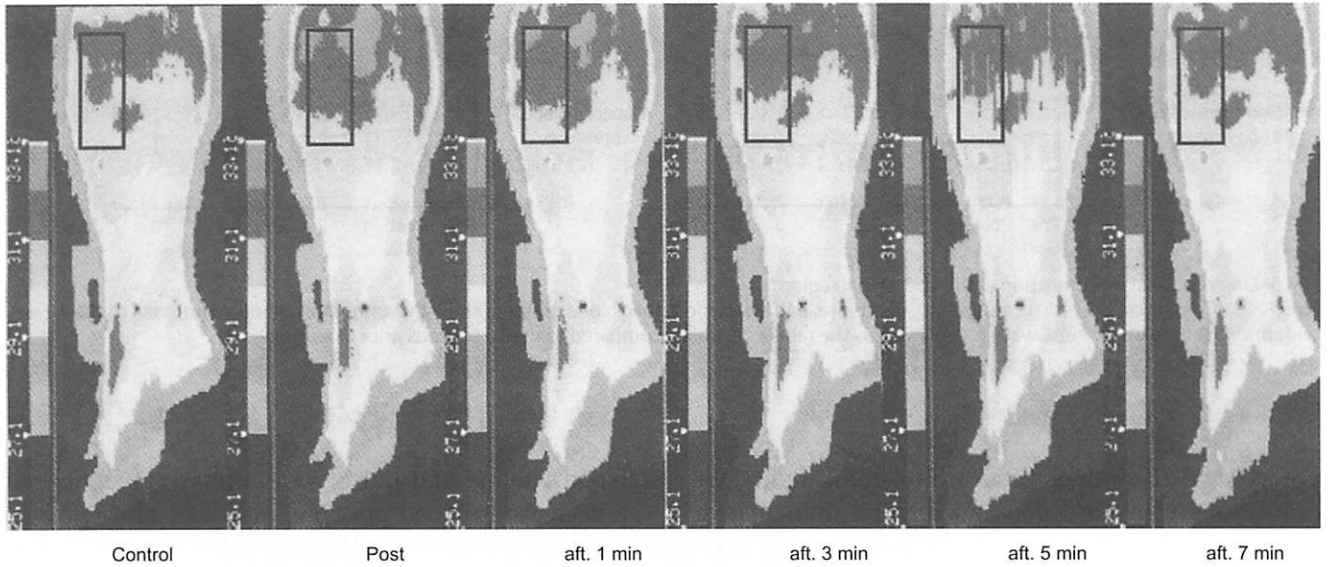


Fig. 3. Changes to skin temperature in crural region due to shiatsu stimulation of right lateral crural region. A thermogram of the lower leg is shown. The box indicates the area measured.

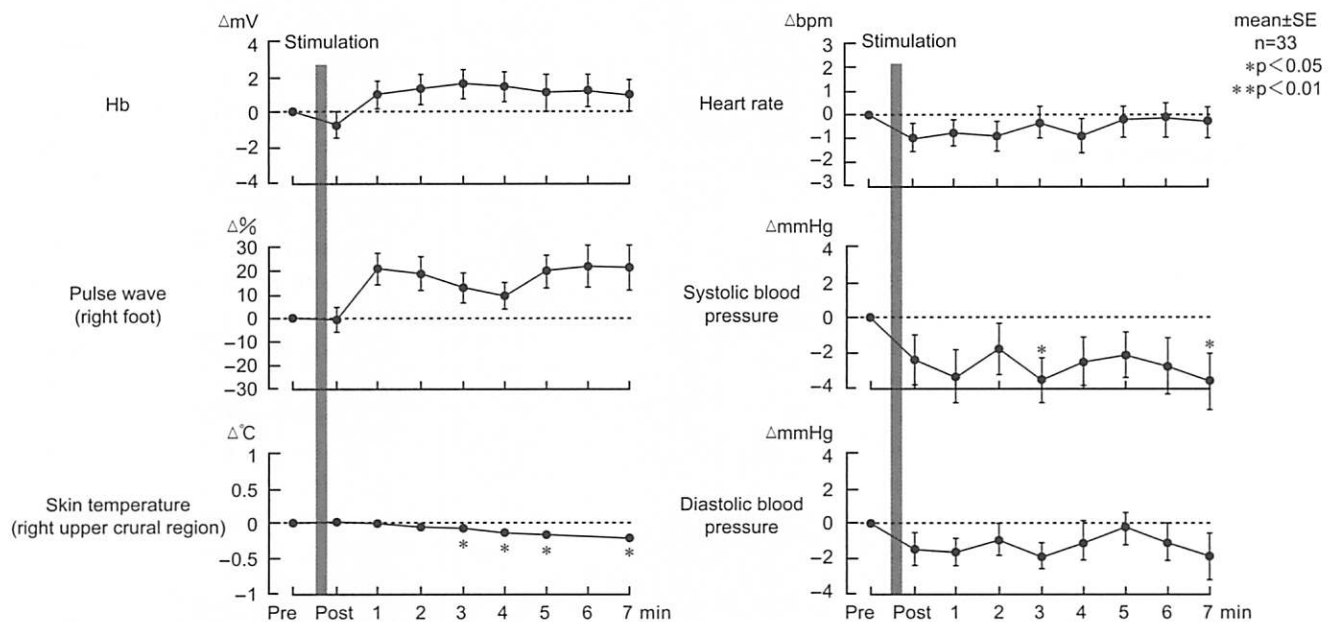


Fig. 4. Effects of shiatsu stimulation of Point 1 of the left lateral crural region. Muscle blood volume (Hb), skin temperature, heart rate, and systolic/diastolic blood pressure show the amount of change compared to the 10 seconds prior to stimulation. Pulse wave is expressed as the rate of variability compared to the 10 seconds prior to stimulation.

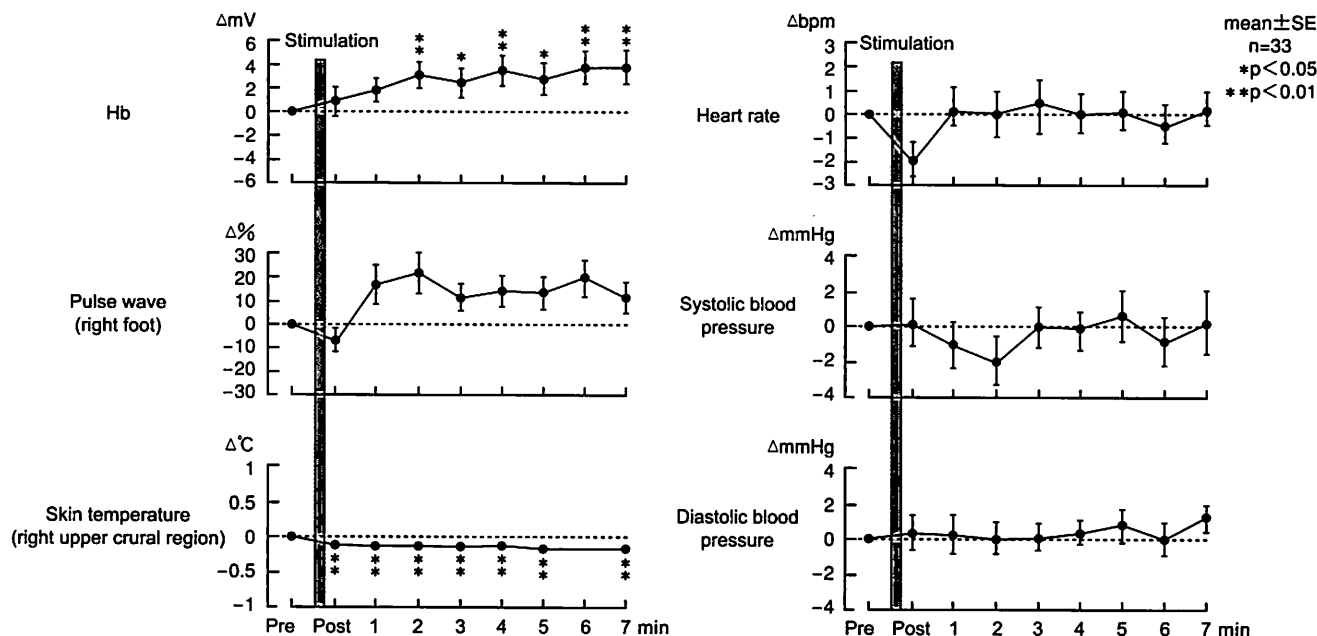


Fig. 5. Effects of shiatsu stimulation of the abdominal region. Muscle blood volume (Hb), skin temperature, heart rate, and systolic/diastolic blood pressure show the amount of change compared to the 10 seconds prior to stimulation. Pulse wave is expressed as the rate of variability compared to the 10 seconds prior to stimulation.

observed at 6 minutes after stimulation. Right foot pulse wave showed a downward trend immediately after stimulation, then began to increase, with a maximum increase of 20.5% at 2 minutes after stimulation.

Skin temperature showed a significant decline between immediately after and 7 minutes after stimulation.

Systolic blood pressure showed a downward trend 2 minutes after stimulation, but a significant difference was not confirmed. Diastolic blood pressure did not change significantly.

IV. Discussion

Reports by Koyata et al³ and Ide et al⁴ confirmed that shiatsu stimulation using standard pressure lowered blood pressure and heart rate during and after stimulation (observation continued until 1 minute after stimulation). In this study, in addition to indicators of circulatory function, we also examined peripheral circulatory functions including muscle blood volume and skin temperature. Also, previous reports^{3,4} analyzed data from during stimulation and 1 minute after stimulation, but in this report analysis was extended to 7 minutes after stimulation. Because there is a possibility of muscle blood volume readings taken during stimulation being adulterated by artifacts, analysis was not carried out for data taken during stimulation for this study.

This study confirmed an increase in both muscle

blood volume and pulse wave after stimulation and a decrease in blood pressure and heart rate immediately after stimulation. Also, a trend was observed that, when immediately after stimulation skin temperature increased, muscle blood volume decreased, and when skin temperature decreased, muscle blood volume increased.

Both muscle blood volume and pulse wave height value increased due to shiatsu stimulation. This case, the fact that the increase in muscle blood volume and pulse wave height was not accompanied by an increase in blood pressure would appear to indicate that the reaction was not a blood pressure dependent response, but due instead to suppression of sympathetic nervous activity governing peripheral blood vessels. Also, the fact that muscle blood volume and pulse wave height increased on the leg opposite to the one being stimulated suggests that the increase was due to dilation of blood vessels on the opposite side due not to axon reflex alone, but also to a spinal or brainstem mediated reflex. Increase in muscle blood volume due to abdominal stimulation may have been due to suppression of sympathetic nervous activity, which resulted in an increase in muscle blood volume and pulse wave in the lower limb.

The test results obtained here indicating an increase in muscle blood flow in response to shiatsu stimulation imply that shiatsu stimulation would have a positive effect on muscle tension and muscle pain.

V. Conclusions

Study of the effects of shiatsu stimulation on the peripheral circulation of healthy adult test subjects yielded the following results:

1. When immediately after stimulation skin temperature increased, muscle blood volume decreased, and when skin temperature decreased, muscle blood volume increased.
2. Muscle blood volume and pulse wave height increased immediately after stimulation.
3. Blood pressure and heart rate decreased immediately after stimulation.

In closing, we would like to express our appreciation to the instructors and students of the Japan Shiatsu College who participated in this research.

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