Effects of Shiatsu Stimulation on Muscle Pliability

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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. In order to shed light on the effects of shiatsu and the mechanisms involved, the Japan Shiatsu College has investigated the effect of shiatsu stimulation on heart rate[1], blood pressure[2], and peripheral circulation[3], and found that it reduces blood pressure and heart rate while increasing muscle blood volume. These findings were reported at the congress of the Japan College Association of Oriental Medicine.

Building on these past results, this year we report on changes to muscle stiffness due to shiatsu stimulation as detected using a tactile sensor system.

II. Methods

1. Subjects

Research was conducted on 39 healthy adults (29 males, 10 females) aged 20–62 years (mean age: 38.5 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 14 to July 14, 2001

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.

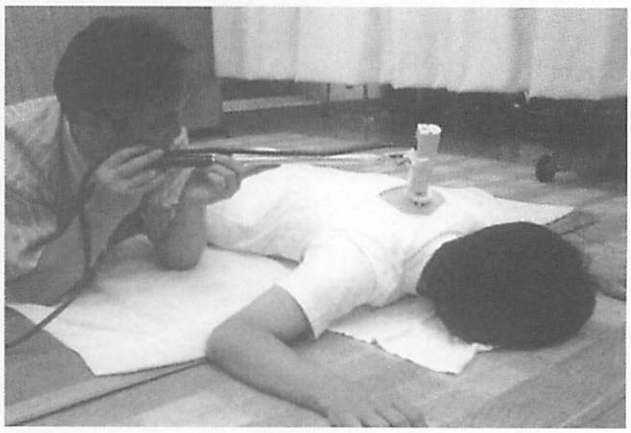
4. Items measured

(1) Standing forward flexion (Finger Floor Distance, or FFD)

(2) Muscle pliability (muscle stiffness)

A tactile sensor system (Venustron mfg. by Axiom Co., Ltd.) was used to derive muscle pliability in the erector spinae muscles. Erector spinae muscles were measured at the height of $Th_{3\text{-}4}$ in the interscapular

Equipment



Example of use

Fig. 1. Tactile sensor system

region, and at the height of L_{3-4} in the infrascapular and lumbar region. Figure 1 shows the testing equipment and an example of its use.

(3) The following items were measured using a polygraph system (Nihon Kohden Corp. model RM-7000):

[1] 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).

[2] 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).

[3] 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

Muscle pliability data was transferred and saved to a personal computer (IBM 2611-456) from the tactile sensor via the control unit.

Items measured above, including heart rate, fingertip pulse wave, and respiratory curve were continuously recorded using a thermal recording device on a polygraph system, 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. Analysis of muscle pliability data

The tactile sensor system uses an internal motor to move the probe tip in the direction of the target, then measures the hardness of the material the tip contacts. The probe tip vibrates at high frequency, and when it contacts a substance its frequency changes under the influence of the natural oscillation of the substance, and the hardness of the substance is expressed numerically. When encountering a soft substance, the frequency of the tip's vibration decreases significantly. The result is expressed as the angle of a line drawn between data points. The angle is inversely proportional to muscle stiffness.

7. Stimulation (Fig. 2)

Full-body treatment is standard for Namikoshi shiatsu[4], but due to the area being measured, shiatsu application was limited to the following areas in the prone position:

(1) 5 points, left and right interscapular region (treatment performed between the scapula and the spine on the erector spinae muscles, along a line parallel to the spine)

(2) 10 points, infrascapular and lumbar regions (10 points along a line parallel to the spine, starting at Point 5 of the interscapular region and ending at the height of the fifth lumbar vertebra)

Standard pressure was applied, 3 seconds per point, repeated 3 times, then 5 seconds of pressure was applied to Point 10, repeated 3 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.

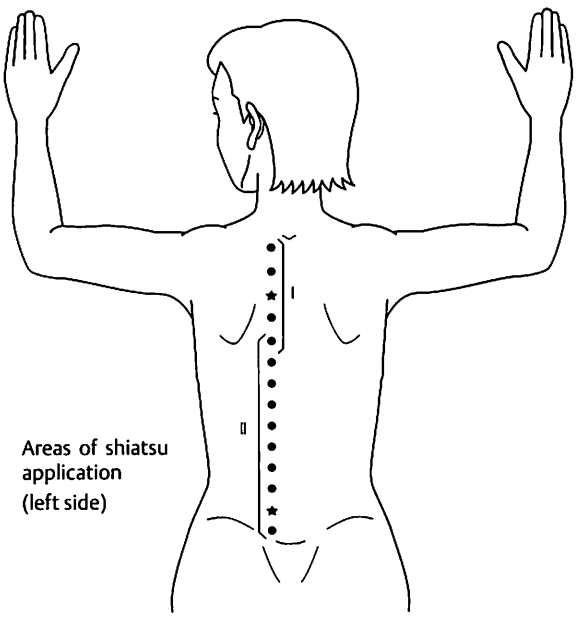
8. Test procedure

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

Stimulation was carried out in the following order:

(1) Pre-treatment standing forward flexion measurement

(2) Left pre-treatment measurements



Shiatsu areas

I. 5 points, interscapular region

II. 10 points, infrascapular and lumbar region

Shiatsu methods

Standard pressure, 3 sec/point × 3 sets

Pressure was also applied to Point 10 (lumbar region) for 5 sec × 3 times

The above operations were performed on the left and right sides (subject in the prone position)

Measurements were taken bilaterally in each region at the points indicated by the '★'.

Fig. 2. Areas and methods of shiatsu application (Namikoshi style)

(3) Treatment of 5 points, left interscapular region and 10 points, left infrascapular and lumbar region
(4) Left post-treatment measurements
(5) Right pre-treatment measurements
(6) Treatment of 5 points, right interscapular region and 10 points, right infrascapular and lumbar region
(7) Right post-treatment measurements
(8) Post-treatment standing forward flexion measurement

In addition, non-stimulation testing was performed on 14 cases, in which the above procedures were followed but with no shiatsu stimulation applied.

9. Statistical processing

Pre-and post-treatment data for standing forward flexion were expressed as mean values ± standard error.

Data for muscle stiffness were converted into the angle of the slope of a straight line connecting the pre- and post-treatment values and expressed as mean values ± standard error.

Statistical verification was carried out using a t-test.

III. Results

1. Standing forward flexion

(1) Stimulation group

Of 39 subjects who received shiatsu stimulation from the interscapular to the lumbar region, 28 (72%) showed an increase in standing forward flexion, 10 (26%) showed a decrease, and 1 was unchanged.

(2) Comparison to non-stimulation group

Non-stimulation testing was performed on 14 of the 28 subjects who showed an increase in standing forward flexion.

Of the 14 subjects in the non-stimulation group, 9 (64%) showed a decrease in standing forward flexion and 5 (36%) showed an increase. The average for all 14 test subjects was +0.4 cm ± 0.4 cm.

The effect for the 14 members of the shiatsu stimulation group corresponding to the subjects in the non-stimulation group were as follows: 3 (21%) showed a decrease and 11 (79%) showed an increase. The mean values for all 14 test subjects was −0.7 cm ± 0.7 cm (Fig. 3).

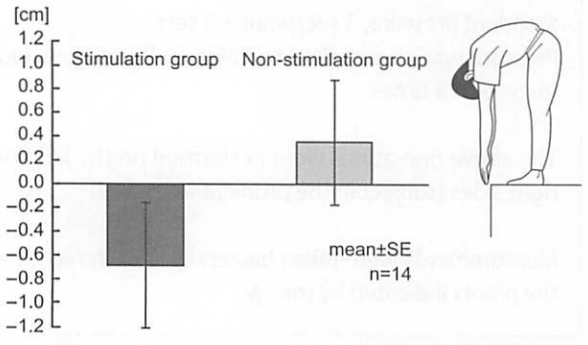


Fig. 3. Effect of shiatsu stimulation on standing forward flexion (FFD)

2. Muscle pliability

Of 39 test subjects, after eliminating cases contaminated with artifacts during measurement, 27 cases were analyzed for the interscapular region and 23 cases for the lumbar region.

(1) Stimulation group

[1] Left interscapular region stimulation

Of 27 subjects, 10 (37%) showed increased pliability of the left erector spinae at the level of Th_{3-4} as a result of shiatsu stimulation to the left interscapular region.

[2] Right interscapular region stimulation

Of 27 subjects, 12 (44%) showed increased pliability of the right erector spinae at the level of Th_{3-4} as a result of shiatsu stimulation to the right interscapular region.

[3] Left infrascapular and lumbar region stimulation

Of 23 subjects, 13 (57%) showed increased pliability of the left erector spinae at the level of L_{3-4} as a result of shiatsu stimulation to the left infrascapular and lumbar region.

[4] Right infrascapular and lumbar region stimulation

Of 23 subjects, 14 (61%) showed increased pliability of the right erector spinae at the level of L_{3-4} as a result of shiatsu stimulation to the right infrascapular and lumbar region.

A significant difference was not confirmed in any of the results from [1] to [4].

(2) Comparison to non-stimulation group

As with standing forward flexion, non-stimulation testing was carried out on 14 subjects (and cases contaminated with artifacts eliminated), and the results of those test subjects were compared to their results as members of the shiatsu stimulation group.

Figure 4 shows the effect of shiatsu stimulation on muscle stiffness for the members of the shiatsu stimulation group corresponding to the subjects in the non-stimulation group. The vertical axis represents the value of post-stimulation angle minus the pre-stimulation angle.

[1] Left interscapular region stimulation

Angle change in the 14 subjects of the non-stimulation group was −0.95 ± 0.25° (mean ± SE). Pre- to post-treatment angle change in the shiatsu stimulation group was −0.68 ± 0.18°.

[2] Right interscapular region stimulation

Angle change in the 14 subjects of the non-stimulation group was +0.51 ± 0.14°. Pre- to post-treatment angle change in the shiatsu stimulation group was +1.49 ± 0.25°.

[3] Left infrascapular and lumbar region stimulation

Angle change in the 12 subjects of the non-stimulation group was +0.27 ± 0.08°. Pre- to post-treatment angle change in the shiatsu stimulation group was +0.92 ± 0.27°.

[4] Right infrascapular and lumbar region stimulation

Angle change in the 13 subjects of the non-stimulation group was −0.89 ± 0.25°. Pre- to post-treatment

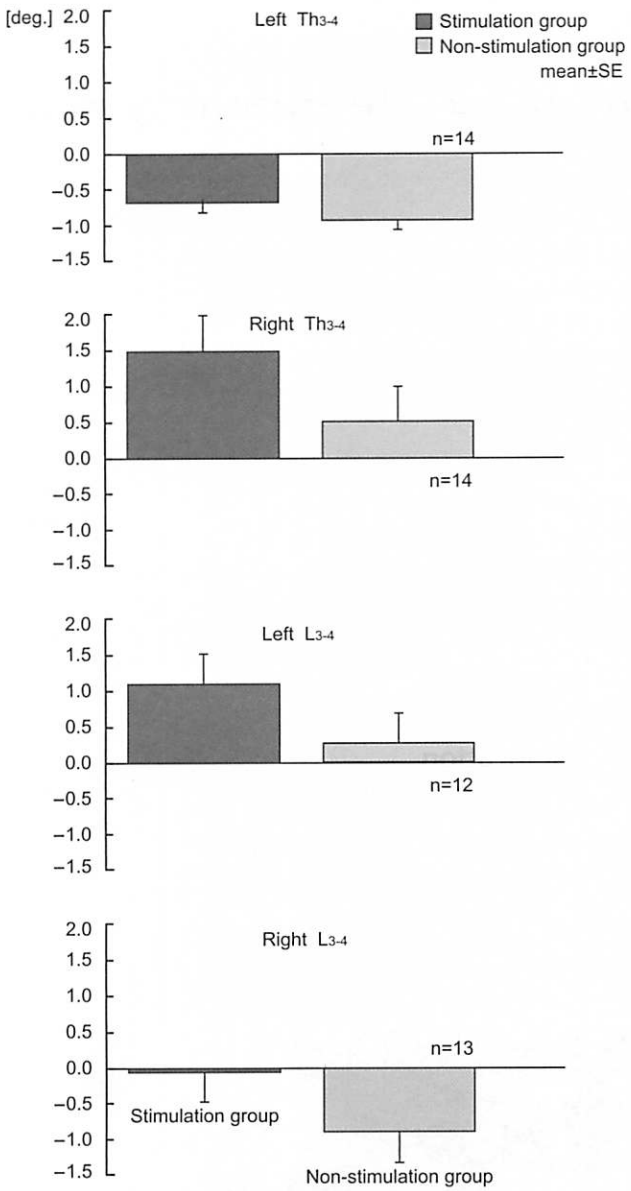


Fig. 4. Effect of shiatsu stimulation on muscle stiffness

angle change in the shiatsu stimulation group was +0.19 ± 0.05°.

A significant difference was not confirmed in any of the results from [1] to [4].

In all of the sections of erector spinae muscle measured bilaterally at the heights of Th_{3-4} and L_{3-4}, a greater tendency toward improvement in muscle pliability was recognized in the stimulation group than in the non-stimulation group.

IV. Discussion

This study showed that muscle became more pliable in the area subject to shiatsu stimulation and, as a result, standing forward flexion was improved.

The Japan Shiatsu College previously reported[3] that muscle blood volume increases due to shiatsu stimulation. Taking into consideration that 1) since blood flow increased locally in the area of stimulation it was possibly due to an axonal reflex[5]; and 2) it was accompanied not by an increase in blood pressure but by a decrease, we suggested the possibility that this increased muscle blood volume reaction was due, not to an increase in blood flow dependent on blood pressure, but to suppression of sympathetic nervous activity regulating the peripheral vascular system.

The increased pliability in muscles subject to shiatsu stimulation in the current study may be due to an increase in muscle blood volume from increased blood flow caused by either axonal reflex or sympathetic nerve suppression, resulting in increased muscle pliability.

It is also possible that shiatsu stimulation caused changes in the tension of the motor nerves supplying the skeletal muscle.

Concerning the effect of shiatsu stimulation on standing forward flexion, in this study stimulation was applied only to the back region, but one may assume that a greater effect would be obtained by combining this with treatment of other areas such as the anterior and posterior femoral regions. This is a topic for future research.

The results obtained in this study confirming improvement in muscle pliability due to shiatsu stimulation suggest that shiatsu can be effective in treating symptoms accompanying muscle tension, such as stiff shoulders and lumbar pain.

V. Conclusions

Study of the effects of shiatsu stimulation on muscle pliability in healthy adult test subjects yielded the following results:

1. Improvement in standing forward flexion was confirmed.
2. Improvement in muscle pliability was confirmed by measurements taken using a tactile sensor system.

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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Effects of Shiatsu Stimulation on Muscle Pliability (Part 2)

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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. To address these issues, the Japan Shiatsu College is conducting ongoing studies into shiatsu and has found that shiatsu stimulation reduces heart rate[1] and blood pressure[2] while increasing peripheral muscle blood volume[3]. These findings were reported at the congress of the Japan College Association of Oriental Medicine.

At last year's conference, we reported on improvements to muscle pliability due to shiatsu stimulation as measured using standing forward flexion and a tactile sensor system[4]. In that study, however, while results using the tactile sensor system showed a tendency toward improvement, they did not confirm a significant difference.

We surmised that data may have been affected by such factors as the fact that, due to the area being measured, subjects were compelled to maintain the same prone position for 40 minutes or longer and that the tactile sensor system was not properly held stationary due to changes in the subjects' position during respiration. We also felt there was room to reexamine the data processing methods used.

For these reasons, for this followup report we have elected to reexamine the effects of shiatsu stimulation on muscle pliability after reconsidering the measurement positions, procedures, and data processing methods.

II. Methods

1. Subjects

Research was conducted on 30 healthy adults (22 males, 8 females) aged 23–61 years (mean age: 39.9 years old).

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

2. Test period

May 11 to July 13, 2002

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.

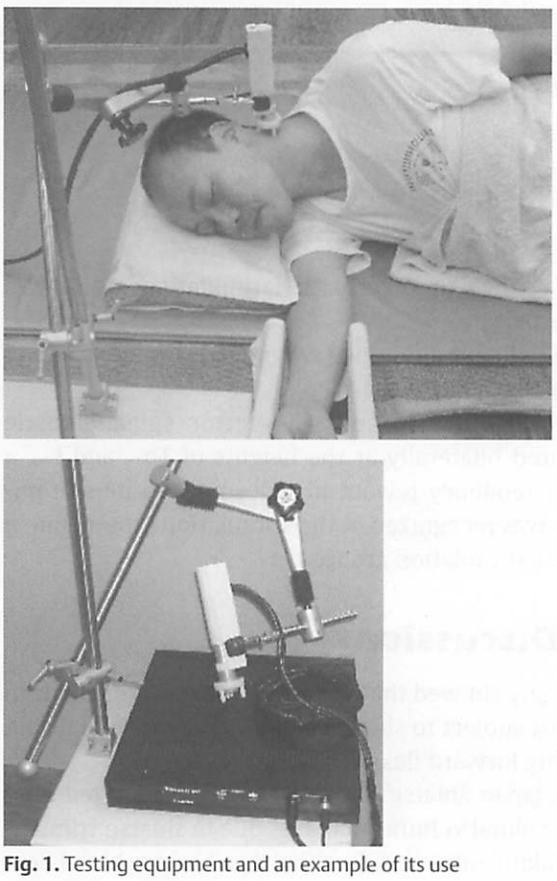

Fig. 1. Testing equipment and an example of its use