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.

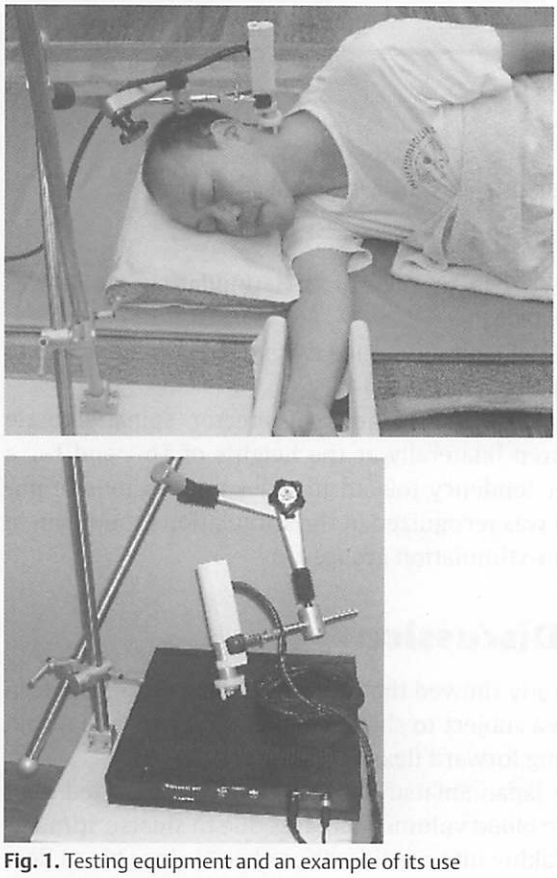


Fig. 1. Testing equipment and an example of its use

4. Items measured

A tactile sensor system (Venustron mfg. by Axiom Co., Ltd.) was used to measure muscle pliability (stiffness) in the muscles of the lateral cervical and suprascapular regions. Figure 1 shows the testing equipment and an example of its use.

5. Data recording

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

6. Stimulation (Fig. 2)

Full-body treatment is standard for Namikoshi shiatsu[5], but due to the area being measured, shiatsu application was limited to the following areas in the lateral position:

[1] 4 points, left and right lateral cervical regions

(From immediately inferior to the mastoid process to immediately above the suprascapular region)

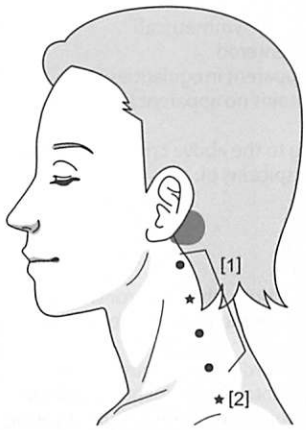
[2] 1 point, left and right suprascapular regions

For the lateral cervical region, pressure was applied, in order, for 3 seconds per point from immediately inferior to the mastoid process to immediately above the suprascapular region, taking care to apply approximately even pressure to each point. For the suprascapular region, pressure was applied repeatedly for 5 seconds per application. Treatment was performed to each region for one minute.

Treatment was carried out by 2 therapists on their own respective test subjects after measures were taken to ensure that they applied similar amounts of pressure.

Approximately 5–15 kg pressure was applied, depending on the comfort level of the test recipient.

Standard pressure application methods were employed (pressure gradually increased, sustained, and gradually decreased).



[1] 4 points, lateral cervical region
[2] 1 point, suprascapular region
Treatment was performed bilaterally on [1] and [2] for 1 minute each region (subject in lateral position)

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

Areas of shiatsu stimulation (Namikoshi style)

Fig. 2. Areas of stimulation and measurement locations

7. Test procedure (Fig. 3)

Test subjects filled out a questionnaire prior to the test day containing information on smoking habits, everyday symptoms, and other information, and a brief interview was conducted on test day to determine their physical condition.

The measurement areas were marked and the following stimulation was carried out after the subject had been resting in the supine position for 5 minutes on a mat laid out on the floor.

(1) 5 minutes rest in the left lateral position (left side up)
(2) Pre-treatment measurement, left lateral cervical region
(3) 4 points treated for 1 minute, same region
(4) Post-treatment measurement, same region
(5) Pre-treatment measurement, left suprascapular region
(6) 1 point treated for one minute, same region
(7) Post-treatment measurement, same region
(8) Measurement 5 minutes post-treatment, left lateral cervical region
(9) Same, left suprascapular region
(10) 5 minutes rest in the right lateral position (right side up)
(11) Same operations applied as in (2) to (9) above, to the right lateral cervical and suprascapular regions.

On completion of the above testing, subjects were re-interviewed to determine treatment comfort levels, subjective changes, and other information. Also, on 15 of the 30 subjects, testing was performed in which they were subject to no shiatsu stimulation for the same period of time as if shiatsu were applied (referred to as 'non-stimulation' below).

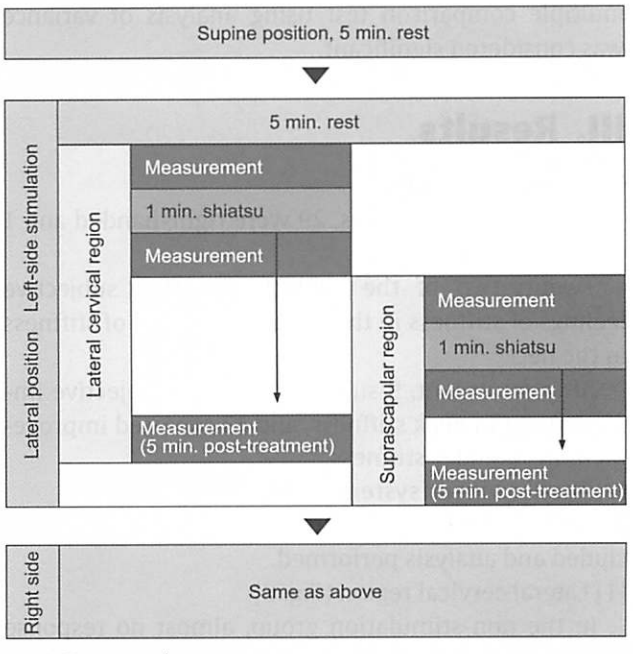


Fig. 3. Test procedure

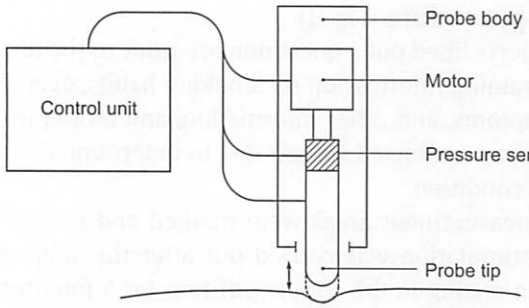


Fig. 4. Schematic diagram of tactile sensor system

8. Data processing

(1) Tactile sensor system (Fig. 4)

The tactile sensor system uses an internal motor to move the probe tip in the direction indicate by the arrow, 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.

For each measurement, 3 types of data can be obtained: travel distance of probe tip (hereafter, push distance); pressure generated during travel (hereafter, push pressure); and change in frequency.

(2) data processing

The ratio of the change in push pressure to the change in frequency ($\Delta f/\Delta P$ [Hz/g]) when push distance is varied from 7–8mm is determined, and the mean values ± standard error shown for before and after stimulation.

For statistical processing, <5% according to Dunnett's multiple comparison test using analysis of variance was considered significant.

III. Results

(1) Interview results

Of the 30 test subjects, 29 were right-handed and 1 was left-handed.

Twenty-two of the subjects reported subjective feelings of stiffness in the shoulders and 11 of stiffness in the neck.

After treatment, 9 subjects reported subjective improvement in neck stiffness, and 13 reported improvement in shoulder stiffness.

(2) Tactile sensor system results

Data in which errors were detected (Fig. 5) were excluded and analysis performed.

[1] Lateral cervical region (Fig. 6)

In the non-stimulation group, almost no response was detected on either side.

With shiatsu stimulation, a mild tendency toward increased pliability was observed on both sides, but a significant difference was not confirmed.

Using pre-stimulation values as the control, the differences immediately post-stimulation and 5 minutes post-stimulation were determined. In the stimulation group, the differences were as follows. Immediately post-stimulation: −0.16 ± 0.23 (Hz/g) left, 0.28 ± 0.26 right; 5 minutes post-stimulation: 0.43 ± 0.24 left, 0.43 ± 0.24 right.

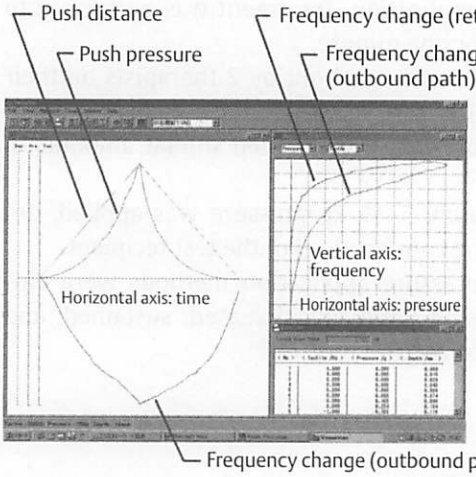
In the non-stimulation group, the differences were as follows. No stimulation (after the same amount of time lapsed as for immediately post-stimulation in the shiatsu stimulation group): −0.07 ± 0.19 left, −0.04 ± 0.25 right; 5 minutes post non-stimulation: −0.01 ± 0.15 left, −0.07 ± 0.48 right.

[2] Suprascapular region (Fig. 7)

In the non-stimulation group, as with the lateral cervical region almost no response was detected.

With shiatsu stimulation, a tendency toward increased pliability was confirmed bilaterally and, in the right suprascapular region, a significant difference was recognized both immediately and 5 minutes post-stimulation.

Using pre-stimulation values as the control, the



[1] Pressure waveform approx. bilaterally symmetrical
[2] Pressure waveform peak approx. centered
[3] Pressure waveform contains no apparent irregularities
[4] Frequency change waveform contains no apparent irregularities on outbound path

Errors were determined according to the above criteria, as failure to conform to these criteria raised suspicions of:
a. Change in posture of test subject
b. Change in muscle tension
c. Improper fixation of the sensor body
d. (rarely) improper sensor operation

A numerical standard was not used, but rather an error was determined if 2 or more students were in agreement of error for a given case.

In addition to exclusion of errors according to the above criteria, there were also several cases in which data was accidentally deleted (overwritten) during data recording due to computer operating error, resulting in a lower n value.

Fig. 5. Measurement screen and error determination

differences post-stimulation and 5 minutes post-stimulation were determined. In the stimulation group, the differences were as follows. Immediately post-stimulation: 0.67 ± 0.42 left, 0.88 ± 0.23 right; 5 minutes post-stimulation: 0.20 ± 0.37 left, 1.11 ± 0.36 right.

In the non-stimulation group, the differences were as follows. No stimulation (after the same amount of time lapsed as for immediately post-stimulation in the shiatsu stimulation group): 0.31 ± 0.27 left, 0.03 ± 0.50 right; 5 minutes post non-stimulation: 0.00 ± 0.43 left, 0.28 ± 0.70 right.

IV. Discussion

The increased pliability in muscles subject to shiatsu stimulation in the current study may be due to an

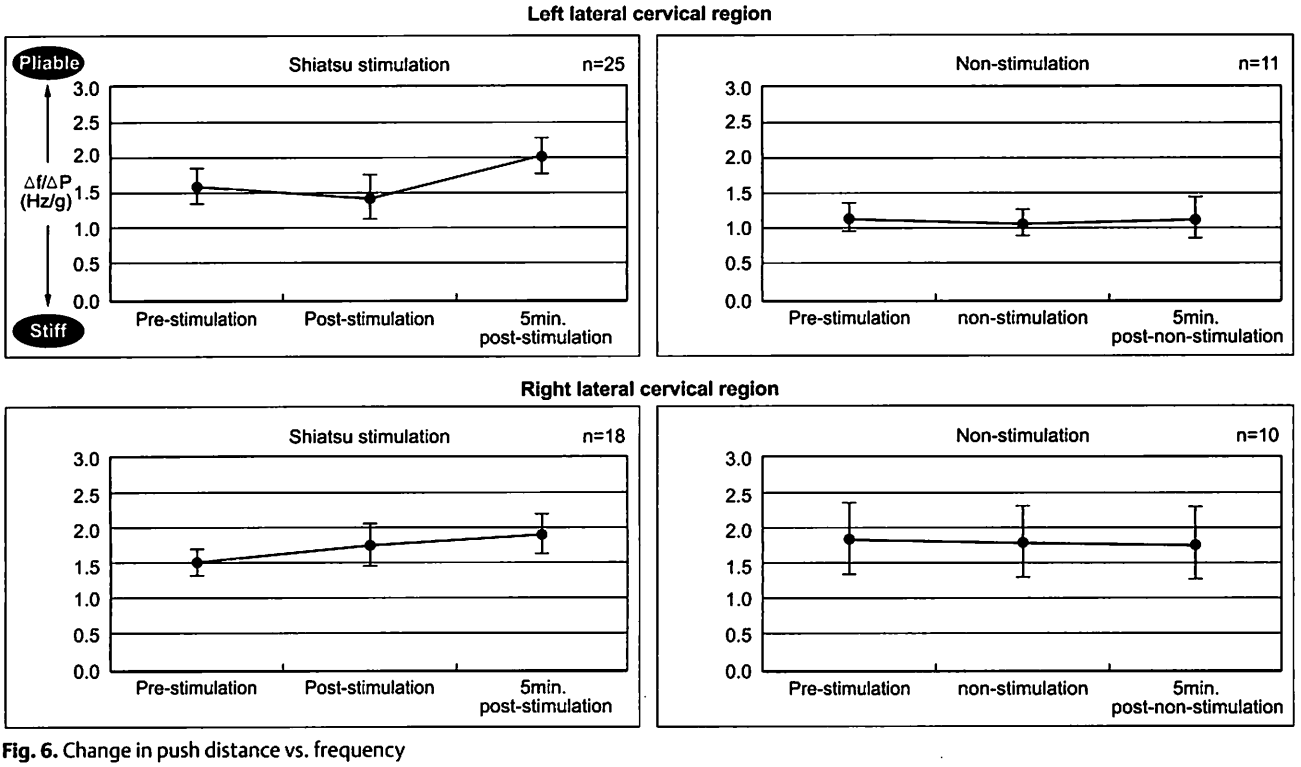


Fig. 6. Change in push distance vs. frequency

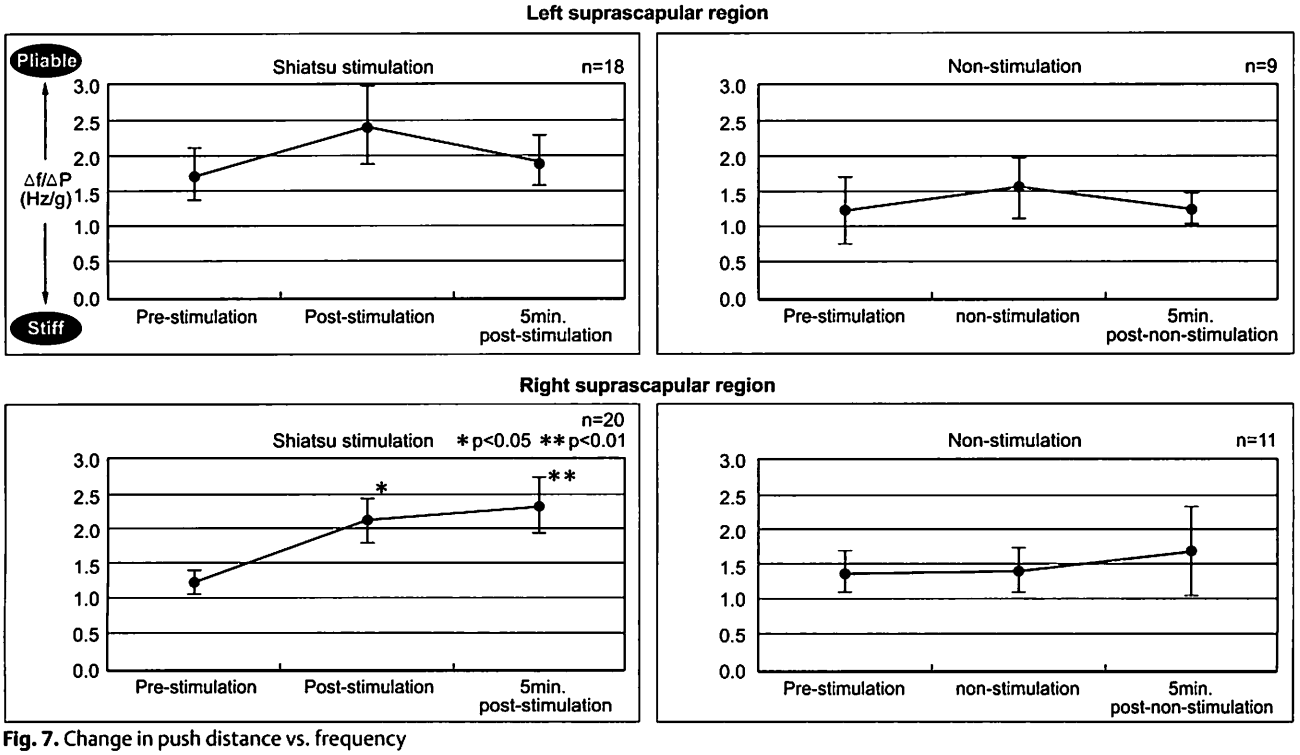


Fig. 7. Change in push distance vs. frequency

increase in muscle blood volume from increased blood flow caused by either axonal reflex[6] or sympathetic nerve suppression[3], 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.

The outcome that increased pliability in the right suprascapular region was significant compared to other regions. This may have been influenced by treatment of the left side and the right lateral cervical region. Whether local stimulation exerts an influence on other areas 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 (to the lateral cervical and suprascapular regions) on muscle pliability in healthy adult test subjects yielded the following results:

Muscle pliability tended to improve with shiatsu stimulation, with a significant difference in the right suprascapular region.

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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