Effects of Shiatsu Stimulation on Muscle Pliability (Part 3)

Japan Shiatsu College
Students: Tomochika Eto, Tomoko Koizumi, Noriko Sakai, Kazuhiro Takahashi, Takako Hasegawa, Kazuo Yamaguchi, Suguru Ota, Akira Okano, Isao Komine, Shiro Komuro, Motoharu Shimizu, Masamitsu Tazuke, Yoshinobu Yamada, Mitsuhiro Wakasa, Yoji Ashikawa, Hiroko Sueoka, Manami Miyachi
Supervisors: Jun'ichi Kurosawa, Hiroshi Ishizuka, Matsuko Namikoshi
Hideo Ohsawa (Tsukuba College of Technology), Hidetoshi Mori (Tsukuba College of Technology)

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 the effects of shiatsu stimulation on physiological functions and has found that shiatsu stimulation reduces heart rate[1] and blood pressure[2] while increasing peripheral muscle blood volume[3] and improving muscle pliability[4,5]. 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 further research into shiatsu's effect on muscle pliability, this time using a Spinal Mouse® to make detailed observations on intervertebral range of motion, in addition to measurements of standing forward flexion and muscle stiffness.

II. Methods

1. Subjects

Research was conducted on 40 healthy adults (22 males, 18 females) aged 19–62 years (mean age: 37.4 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

April 19 to July 19, 2003

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

Standing forward flexion was measured using a standing forward flexion gauge (Yagami Co., Ltd); muscle pliability was measured using a Venustron (Axiom Co., Ltd.) muscle stiffness sensor; and spinal range of motion was measured using a Spinal Mouse® (Index Co., Ltd.) spinal measurement device. Figure 1 shows the testing equipment and an example of its use.

5. Data storage

Data from the muscle stiffness sensor was transferred via the control unit and stored on a personal computer (IBM 2611-456). Data from the Spinal Mouse® was transferred via the base station and stored on a personal computer (IBM 2655-P3J).

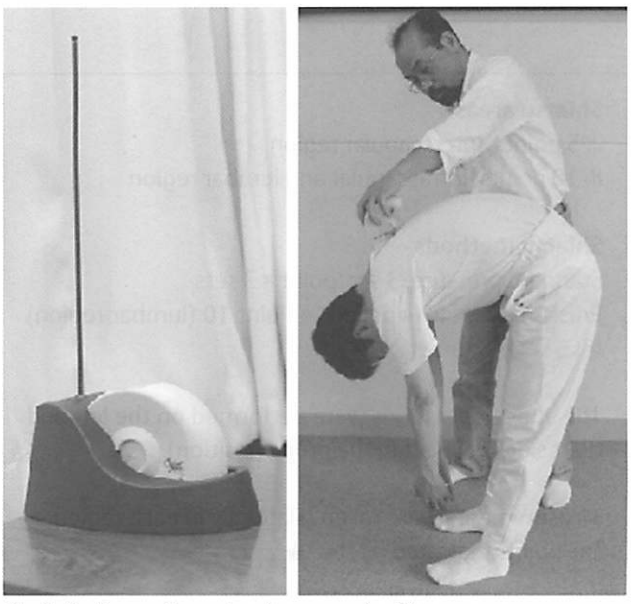


Fig. 1. Testing equipment and an example of its use

6. Stimulation (Fig. 2)

Full-body treatment is standard for Namikoshi shiatsu[6], but due to the area being measured, shiatsu application was limited to the following regions in the prone position:

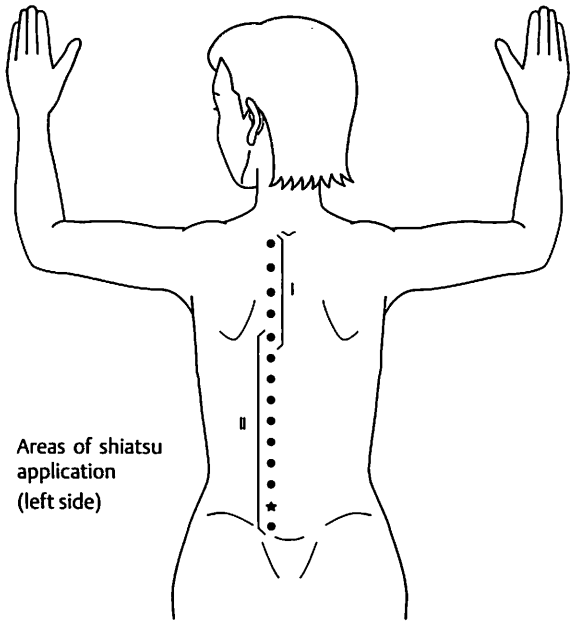
(1) 5 points, left and right interscapular region (treatment performed between the scapula and the spine along the erector spinae muscles, parallel to the spine)
(2) 10 points, left and right infrascapular and lumbar regions (along the erector spinae muscles, parallel to the spine, starting at Point 5 of the interscapular region and ending at the height of the fifth lumbar vertebra)

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

Treatment was carried out by 2 therapists after measures were taken to ensure that they applied similar amounts of pressure. In principle, male test subjects were treated by the male therapist and female subjects treated by the female therapist.

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).



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 of shiatsu application and pliability measurement points

7. Test procedure

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

Markings for measurements using the Spinal Mouse® were applied over the right erector spinae muscles at the heights of C_7 and S_3; markings for measurements of muscle pliability were applied over the left and right erector spinae at the height of the area between L_4 and L_5.

Measurements for standing forward flexion and spinal range of motion were carried out on a 45cm platform. Rest periods, measurement of muscle pliability, and treatment were carried out on a futon mattress laid out on a tatami-matted floor.

Stimulation was carried out in the following order:
(1) Pre-treatment standing forward flexion and spinal range of motion measurements
(2) 5 minutes rest (supine position)
(3) Pre-treatment muscle pliability measurement, left side
(4) Treatment of 5 points, left interscapular region, and 10 points, left infrascapular and lumbar region
(5) Post-treatment muscle pliability measurement, left side
(6) Pre-treatment muscle pliability measurement, right side
(7) Treatment of 5 points, right interscapular region and 10 points, right infrascapular and lumbar region
(8) Post-treatment muscle pliability measurement, right side
(9) Post-treatment standing forward flexion and spinal range of motion measurements

Test subjects were re-interviewed post-treatment to determine comfort or discomfort during treatment, subjective changes, and other information. In addition, non-stimulation testing was performed on 11 of the 40 test subjects, in which the above procedures were followed but with no shiatsu stimulation applied.

8. Data processing

Changes in before and after measurements for standing forward flexion, muscle pliability, and spinal range of motion were subject to statistical processing using a t-test.

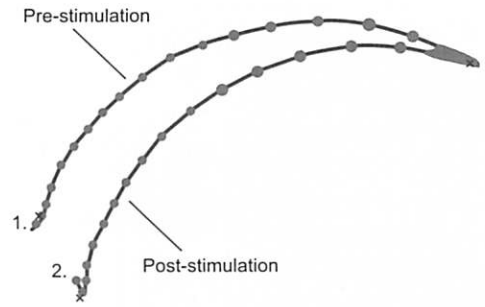


Fig. 3. Image showing results of measurements taken using Spinal Mouse®

For muscle pliability, the value used was the ratio of the change in push pressure to the change in frequency ($\Delta f/\Delta P$ [Hz/g]) when push distance was varied from 7–8 mm .

For spinal range of motion, the value used was the angle between a straight line through the averaged intervertebral angles from C_7 to S_3 and a straight line projected perpendicularly from the base point at S_3 (Fig. 3).

III. Results

1. Standing forward flexion (Fig. 4)

(1) Stimulation group

Of the 40 subjects who received shiatsu stimulation, 30 showed improvement and 10 showed no improvement. The average difference between pre- and post-treatment measurements was −1.80 ± 1.76 cm, which was confirmed as a significant difference.

(2) Non-stimulation group

Of the 11 subjects in the non-stimulation group, 7 became worse and 4 improved. The average before-after difference was 0.20 ± 1.92 cm. A significant difference was not confirmed.

2. Muscle pliability (Figs. 5, 6)

(1) Stimulation group

After eliminating data tainted by measurement device malfunction, of 37 measurements taken on the left side, 19 showed improvement and 18 did not. The average before-after difference was 0.50 ± 2.23 Hz/g, which was not a significant difference. Of 37 measurements taken on the right side, 22 showed improvement and 15 did not. The average before-after difference was −2.30 ± 2.58 Hz/g, which was not a significant difference.

(2) Non-stimulation group

Of 11 measurements taken on the left side, 7 became worse and 4 showed improvement. The average before-after difference was 0.60 ± 1.58 Hz/g. Of 11 measurements taken on the right side, 8 became worse and 3 showed improvement. The average before-after difference was 4.97 ± 3.89 Hz/g. A significant difference was not confirmed.

3. Spinal range of motion (Fig. 7)

(1) Stimulation group

After eliminating data tainted by measurement device malfunction, of 38 measurements taken, 17 showed improvement, 5 showed no change, and 16 showed no improvement. The average before-after difference was −1.11 ± 2.23°, which was not a significant difference.

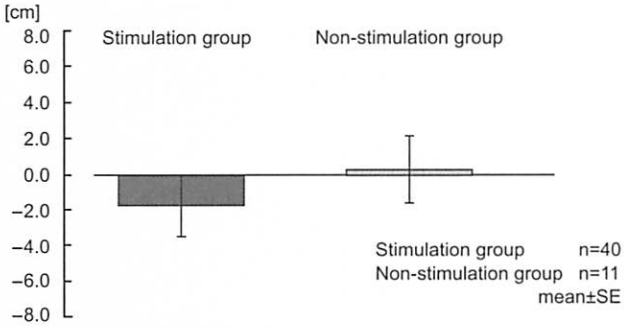


Fig. 4. Effect of shiatsu stimulation on standing forward flexibility

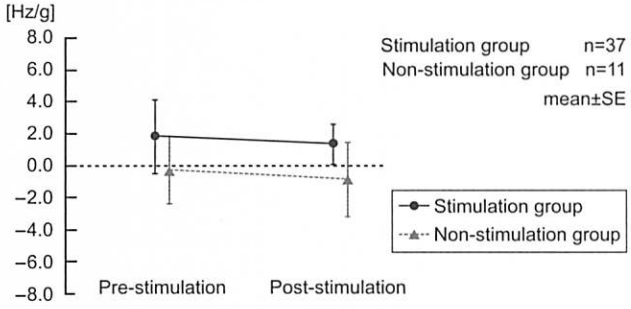


Fig. 5. Effect of shiatsu stimulation on muscle pliability (left)

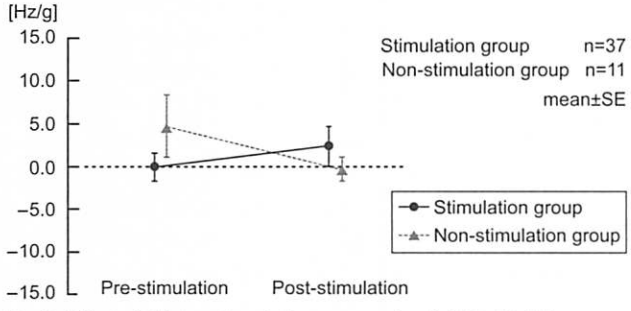


Fig. 6. Effect of shiatsu stimulation on muscle pliability (right)

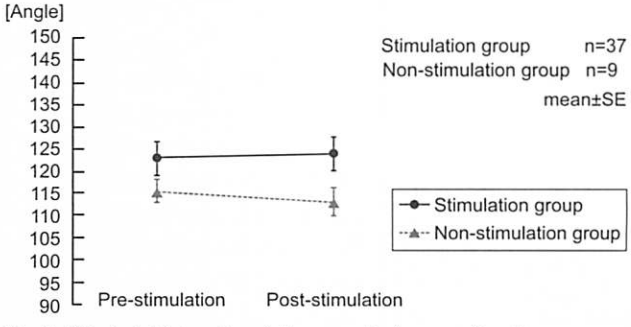


Fig. 7. Effect of shiatsu stimulation on spinal range of motion

(2) Non-stimulation group

After eliminating data tainted by measurement device malfunction, of 9 measurements taken, 8 became worse and 1 showed improvement. The average before-after difference was 2.40 ± 2.33°, which was not a significant difference.

4. Before-after difference in intervertebral range of motion

Results from statistical analysis of standing forward flexion, muscle pliability, and spinal range of motion indicate that a significant before-after difference was obtained in standing forward flexion. In the 30 cases in which standing forward flexion improved, a pre/post-treatment difference was observed in the range of motion between individual vertebrae. The most notable change in angle (average increase: 1.11 ± 1.76°) occurred between Th_{11} and Th_{12}. Results of the t-test did not confirm a significant difference ($p<0.1$).

IV. Discussion

The results of this study indicating a significant improvement in standing forward flexion due to shiatsu stimulation corresponds to that of Asai et al[4], indicating a phenomenon of high reproducibility.

The fact that a significant change in muscle pliability could not be confirmed may be due to the following two points: [1] that the measurement point was located between two vertebrae where the resulting change in intervertebral range of motion was small; and [2] that, as opposed to research conducted by Sugata et al[5], in which pressure was applied for 5 seconds to one point and continued for 1 minute, this time pressure was applied for 3 seconds per point and repeated 3 times, due to factors such as test subjects' limb positions and the area being stimulated.

The fact that a significant change in spinal range of motion was not observed may be because results of improved intervertebral range of motion obtained in the thoracic vertebrae were counteracted by the physiological lordosis of the lumbar vertebrae, while results of improved intervertebral range of motion in the lumbar vertebrae were counteracted by the physiological kyphosis in the thoracic vertebrae. This is being considered as a topic for future study.

Among reasons for the notable change in Th_{11-12} intervertebral flexion among the 30 subjects who showed improvement in standing forward flexion, aside from improved pliability of the erector spinae muscles, the possible influence of tension in the psoas major muscle and even the strong mechanical load placed on Th_{11-12} by the posture adopted in standing forward flexion itself cannot be discounted. This is being considered as a topic for future study.

Improvements in muscle pliability and joint range of motion due to shiatsu stimulation may be due to an increase in muscle blood volume[3] from increased blood flow caused by either axonal reflex[7] 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.

The results obtained in this study confirming a tendency toward improvement in muscle pliability and joint range of motion in the spine due to shiatsu stimulation suggest that shiatsu can be effective in treating symptoms accompanying muscle tension, such as back and lumbar pain.

V. Conclusions

Study of the effects of shiatsu stimulation (to the interscapular, infrascapular, and lumbar regions) on muscle pliability in healthy adult test subjects yielded the following results:

Spinal range of motion, as indicated by standing forward flexion, showed significant improvement due to shiatsu stimulation, particularly with a notable increase in range of motion between Th_{11} and Th_{12}.

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

References

1 Koyata S et al: Shiatsu shigeki ni yoru shinjunkankei ni oyobosu koka ni tsuite. Toyo ryohogakko kyokai gakkaishi 22: 40-45, 1998 (in Japanese)
2 Ide Y et al: Ketsuatsu ni oyobosu shiatsu shigeki no koka. Toyo ryoho gakko kyokai gakkaishi 23: 77-82, 1999 (in Japanese)
3 Kamohara H et al: Massho junkan ni oyobosu shiatsu shigeki no koka. Toyo ryoho gakko kyokai gakkaishi 24: 51-56, 2000 (in Japanese)
4 Asai S et al: Shiatsu shigeki ni yoru kin no junansei ni taisuru koka. Toyo ryoho gakko kyokai gakkaishi 25: 125-129, 2001 (in Japanese)
5 Sugata N et al: Shiatsu shigeki ni yoru kin no junansei ni taisuru koka (dai 2 ho). Toyo ryoho gakko kyokai gakkaishi, 26: 35-39, 2002 (in Japanese)
6 Namikoshi T: Kanzen zukai shiatsu ryoho fukyuban, Japan Publications, Inc., Tokyo, 1992 (in Japanese)
7 Sato A, Sato Y, Schmidt RF: The impact of somatosensory input on autonomic functions. Reviews of Physiology Biochemistry and Pharmacology 130: 1-328, 1997