Effect on Pelvic Angle of Shiatsu Stimulation to the Gluteal Region

Japan Shiatsu College
Students: Tetsuya Hirota, Yosuke Motoki, Ryo Kato, Masanori Tatebe, Mitsuru Iwai, Kazutaka Iso, Michiko Miyashita, Nono Sakai, Reiko Miyashita, Kojiro Kurihara, Takae Kanda, Shingo Takamata, Masahiro Kato, Hiroshi Ishida
Supervisors: Kazuo Watanabe, Tomoko Tanaka, Hiroshi Kanda, Hiroshi Ishizuka
Hideo Ohsawa (Tsukuba University of Technology), Hidetoshi Mori (Tsukuba University of Technology)

I. Introduction

The Japan Shiatsu College has previously conducted research into the effects of shiatsu stimulation on heart rate, peripheral circulation (pulse wave height, skin temperature, muscle blood volume), blood pressure, and spinal mobility. We reported responses including reduction in heart rate post-stimulation and reduced pulse wave height values in fingertip pulse wave during stimulation[1]; reduction in blood pressure during and after stimulation[2]; increase in heel pad skin temperature post-stimulation[3]; and increased skin temperature accompanied by decreased muscle blood volume and decreased skin temperature accompanied by increased muscle blood volume immediately post-stimulation[4]. Concerning spinal flexibility, finger-floor distance (FFD) improved due to shiatsu stimulation of the dorsal region[5], as did standing forward flexion due to shiatsu stimulation of the abdominal and inguinal regions[6]. We have shown that shiatsu stimulation acts on the circulatory system, affects standing forward flexion, and increases spinal range of motion by alleviating muscle tension[5-10].

Tazuke et al[6] reported that shiatsu stimulation to the gluteal region and posterior lower limb significantly improved spinal mobility, standing forward flexion, and sacral angle of inclination. In this study, we investigate whether spinal mobility is affected when the area of shiatsu stimulation is limited to the gluteal region alone. Furthermore, because a human being's center of gravity is located slightly anterior to the second sacral vertebra[11], it can be hypothesized that, when the incline of the sacrum is changed due to shiatsu stimulation, this also affects the line of gravity. We investigate this issue as well in this report.

II. Methods

1. Subjects

Research was conducted on 20 male students of the Japan Shiatsu College (average age: 35.55 ± 3.31 years old). Test procedures were fully explained to each test subject and their consent obtained.

2. Test period and location

Testing was conducted in the basic medicine research lab at the Japan Shiatsu College between May 16 and September 19, 2009. Room temperature was 25.0 ± 2.0°C and humidity was 68 ± 12.0%.

3. Measurement procedures

Spinal mobility and spinal inclination angle in the standing position were measured using a Spinal Mouse® (Index Co., Ltd.). The line of gravity was measured using photographs taken using a digital camera (Canon IXY Digital 920 IS) (Figs. 1, 2).

(1) Measurement of spinal mobility (Spinal Mouse®)

The Spinal Mouse® enabled measurement of angle and range of motion of each intervertebral space on

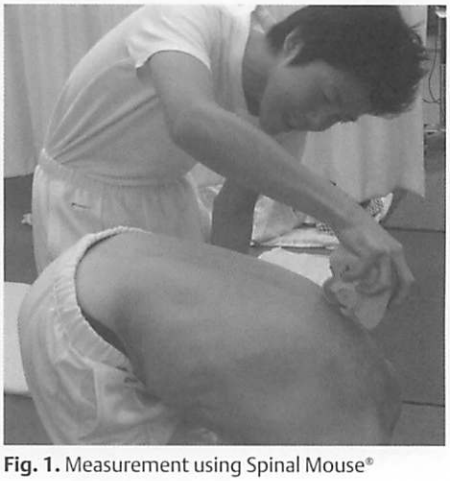

Fig. 1. Measurement using Spinal Mouse®

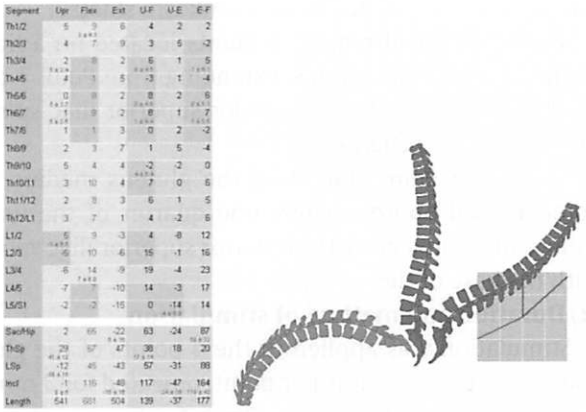

Fig. 2. Spinal ROM measurement screen

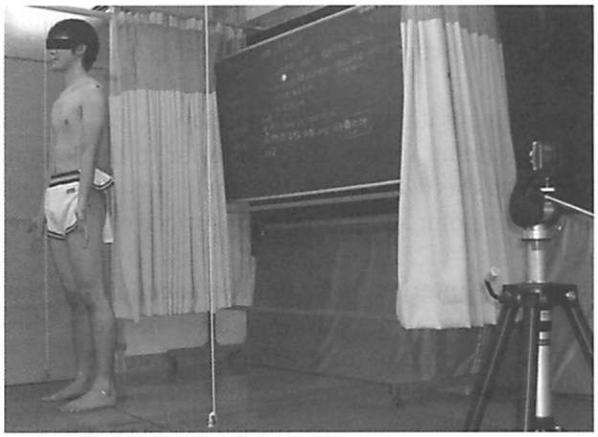

Fig. 4. Photography with digital camera

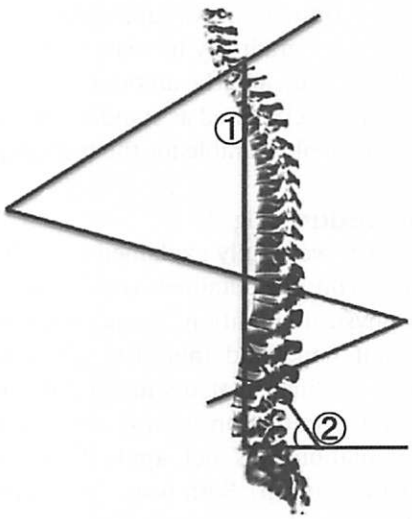

Fig. 3. Measurement items: ① Spinal inclination angle and ② Sacral/pelvic inclination angle

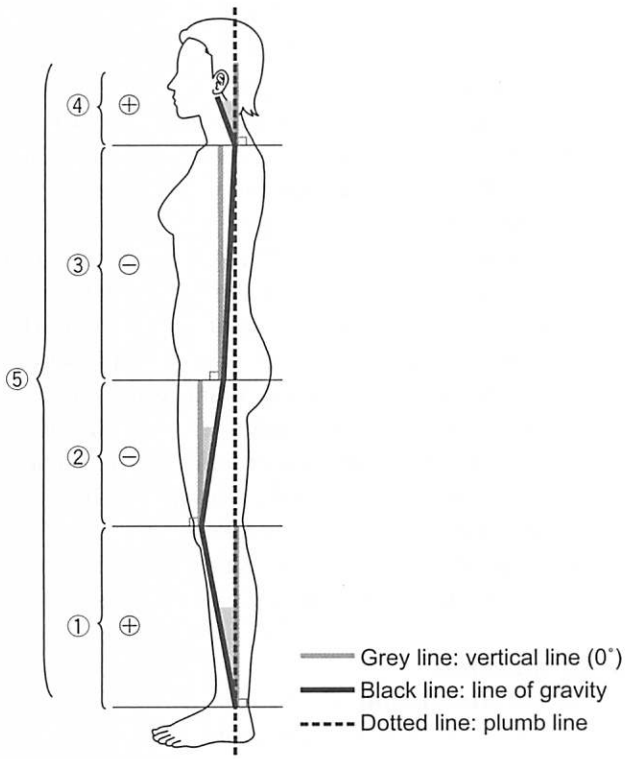

Fig. 5. Measurement items: line of gravity

both the sagittal and coronal planes from the body surface.

In this study, we assessed spinal ROM on the sagittal plane using spinal inclination angle and sacral/pelvic inclination angle measured in anteflexion and dorsiflexion (Fig. 3). Anteflexion ROM is the difference between measurement values in the neutral standing and maximum anteflexion positions, and dorsiflexion ROM is the difference between measurement values in the neutral standing and maximum dorsiflexion positions. For the line of gravity, we measured the spinal inclination angle in the neutral standing position.

Measurement items are shown below.

① Spinal inclination angle: Indicates the measure of overall ROM using a straight line between the 1st thoracic vertebra and the 1st sacral vertebra. Expressed as the angle between that line and a vertical line.

② Sacral/pelvic inclination angle: The sacral inclination angle is the angle which is measured, but because the sacrum is joined to the pelvis via the sacroiliac joints, it corresponds to the pelvic inclination angle.

(2) Measurement of line of gravity (photography using digital camera)

In order to measure the line of gravity, photographs were taken using a digital camera according to the following procedure (Figs. 4, 5). Landmark stickers were applied to the acromial process, the center of the greater trochanter, the anterior surface of the knee joint, and a point approx. 2 cm anterior to the lateral malleolus, which mark the passage of the line of gravity on the sagittal plane[12]. Two strings with weights attached (hereafter, plumb lines) were hung from the ceiling and subjects were photographed using a digital camera while standing between these lines with their limbs in the anatomical position. At this time, the plumb line was aligned using the lateral malleolus as the reference point. This is because we felt that, since

other points not in contact with the floor were capable of motion, they could not be relied on as a reference point[13].

Measurement items are shown below.

① Taking a point approx. 2 cm anterior to the lateral malleolus as the fixed point, the angle was measured between this point and the anterior surface of the knee joint.

② Taking the anterior surface of the knee joint as the fixed point, the angle was measured between this point and the center of the greater trochanter.

③ Taking the center of the greater trochanter as the fixed point, the angle was measured between this point and the acromial process.

④ Taking the acromial process as the fixed point, the angle was measured between this point and the ear lobe.

⑤ The angle consisting of the sum of all angles from the lateral malleolus to the ear lobe (①, ②, ③, ④) was calculated (hereafter, malleolus-to-lobe angle). Each of these landmarks was connected with a line and the angles measured.

Measurements were taken using fixed points at a point approx. 2 cm anterior to the lateral malleolus, the anterior surface of the knee joint, the center of the greater trochanter, the acromial process, and the ear lobe. At each fixed point a vertical line and a horizontal line were drawn intersecting at right angles, with angles in which the body was anterior to the vertical line taken as positive and angles in which the body was posterior to the vertical line taken as negative. The vertical line, 90° to horizontal, was taken as 0°. For evaluation, the malleolus-to-lobe angle (⑤) was used.

4. Stimulation

(1) Area of stimulation (Fig. 6)

With the test subject in the prone position, stimulation was applied using thumb-on-thumb pressure to the 4 points of the gluteal region and the single Namikoshi Point, as per basic Namikoshi shiatsu.

4 points, gluteal region: 4 points located on a line along the gluteus maximus, extending from Point 1 on the lateral border of the posterior superior iliac spine to the greater trochanter.

Namikoshi Point: Targeting the gluteus medius, 1 point located approximately one quarter of the way along a line connecting the anterior superior iliac spine with the base of the sacrum[8].

(2) Duration and method of stimulation

Stimulation was applied to the 4 points of the gluteal region for 3 seconds per point, repeated for 3 minutes, then to the Namikoshi Point for 5 seconds per application, repeated for 2 minutes. This was repeated bilaterally for a total stimulation period of 10 minutes duration. Stimulation was applied using standard pressure (pressure gradually increased, sustained, and gradually decreased), and the amount of pressure used in stimulation was classified as standard (pressure regulated so as to be pleasurable for the test subject).

5. Test procedure (Fig. 7)

Test procedures were fully explained to each test subject and their consent obtained. They were also questioned on physical condition, regular exercise habits, and dominant hand and foot. Two tests were performed, one in which shiatsu stimulation was applied (hereafter, the stimulation group) and one in which shiatsu stimulation was not applied (hereafter, the non-stimulation group). Both tests were applied to all 20 test subjects on different days.

(1) Stimulation group

Test subjects rested with eyes closed for 10 minutes in the supine position. The Spinal Mouse® was used to measure spinal range of motion in anteflexion and dorsiflexion, along with spinal angle of inclination in the neutral standing position. Photographs were taken using a digital camera showing side views from both sides. After measurement, shiatsu stimulation was

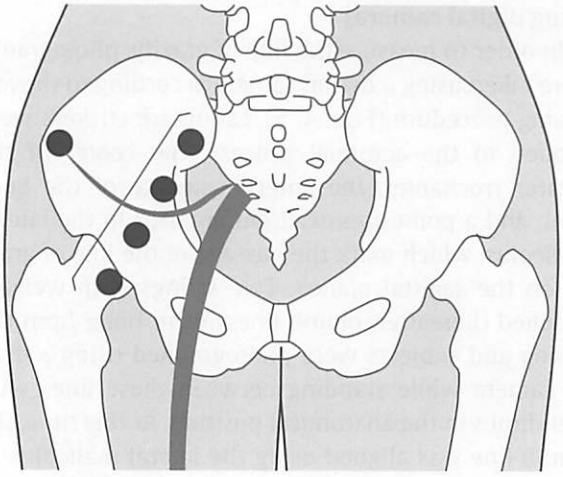

Fig. 6. Area of stimulation

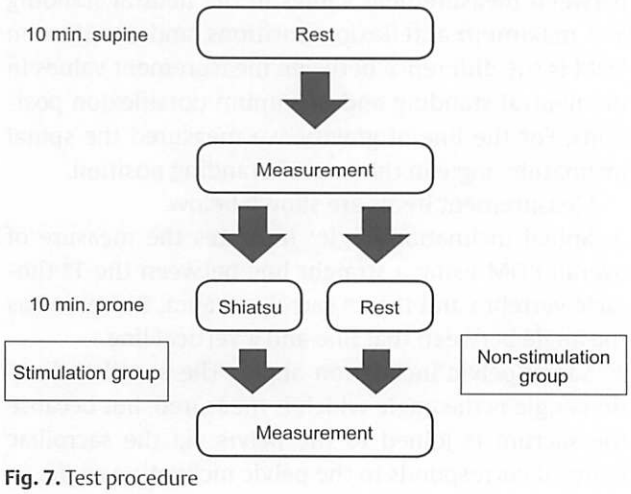

Fig. 7. Test procedure

applied for a total of 10 minutes in the prone position, consisting of 3 minutes to the left gluteal region, 2 minutes to the left Namikoshi Point, 3 minutes to the right gluteal region, and 2 minutes to the right Namikoshi Point. After stimulation, the same measurements were taken using the Spinal Mouse® and digital camera.

(2) Non-stimulation group

For the non-stimulation group, instead of shiatsu stimulation, test subjects rested for 10 minutes in the prone position. All other procedures were the same as for the stimulation group.

6. Statistical processing

Using SPSS Ver.15 software, pre/post-stimulation measurement values from the Spinal Mouse® and digital camera were analyzed using Fisher multiple comparison and two-way analysis of variance using a general linear model. Each pre/post-stimulation comparison was also compared using Fisher multiple comparison and one-way analysis of variance. A significance level of ≤5% was determined to be significant.

III. Results

1. Spinal ROM in anteflexion (Fig. 8)

(1) Changes to sacral/pelvic inclination angle in anteflexion

In the non-stimulation group, anteflexion was almost unchanged, measuring 57.32 ± 3.01° (mean ± SE) pre-stimulation vs. 57.16 ± 3.28° post-stimulation. In the stimulation group, there was a trend toward an increase, measuring 58.50 ± 3.72° pre-stimulation vs. 59.70 ± 4.30° post-stimulation, but a statistically significant variation was not observed.

(2) Changes to spinal inclination angle in anteflexion

In the non-stimulation group, anteflexion was almost unchanged, measuring 107.95 ± 3.48° pre-stimulation vs. 108.00 ± 3.31° post-stimulation. In the stimulation group, there was a trend toward a decrease, measuring 109.40 ± 3.38° pre-stimulation vs. 108.50 ± 3.23° post-stimulation, but a significant variation was not ascertained.

2. Spinal ROM in dorsiflexion (Fig. 9)

(1) Changes to sacral/pelvic inclination angle in dorsiflexion

In the non-stimulation group, dorsiflexion was almost unchanged, measuring 21.37 ± 2.83° pre-stimulation vs. 21.95 ± 2.94° post-stimulation. In the stimulation group, dorsiflexion was almost unchanged, measuring 22.10 ± 2.28° pre-stimulation vs. 22.10 ± 2.37° post-stimulation.

(2) Changes to spinal inclination angle in dorsiflexion

In the non-stimulation group, there was a trend toward a decrease, measuring 39.21 ± 2.69° pre-stimulation vs. 38.05 ± 3.04° post-stimulation, but a significant

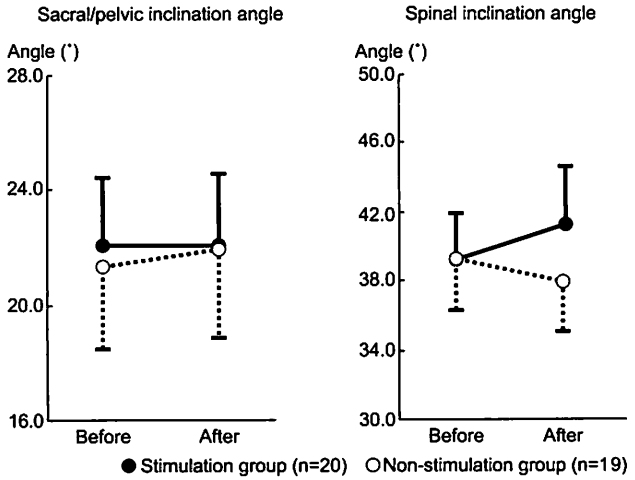

Fig. 9. Dorsiflexion ROM sacral/pelvic inclination angle and spinal inclination angle for non-stimulation and shiatsu stimulation groups

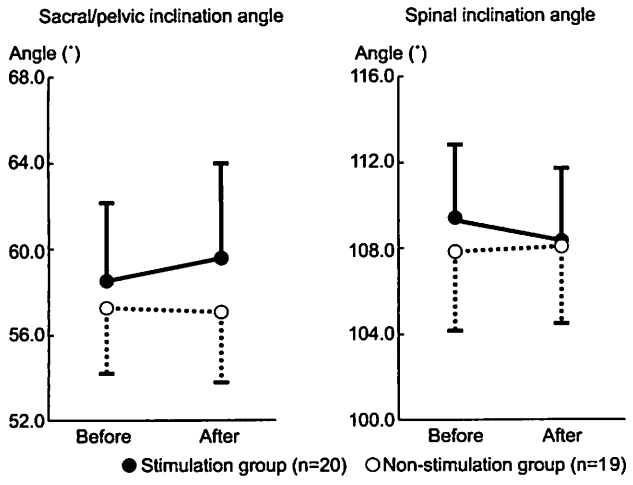

Fig. 8. Anteflexion ROM sacral/pelvic inclination angle and spinal inclination angle for non-stimulation and shiatsu stimulation groups

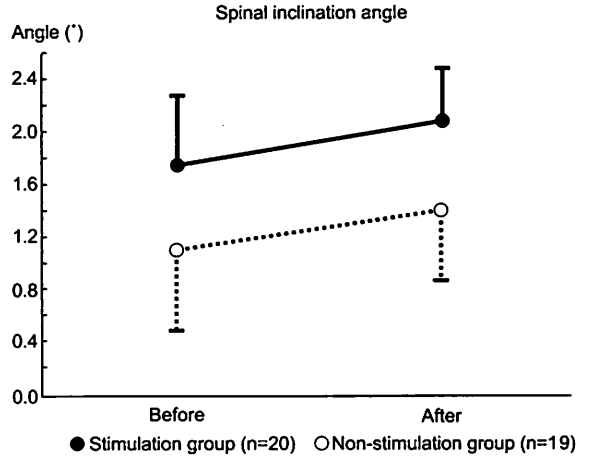

Fig. 10. Neutral standing spinal inclination angle for non-stimulation and shiatsu stimulation groups

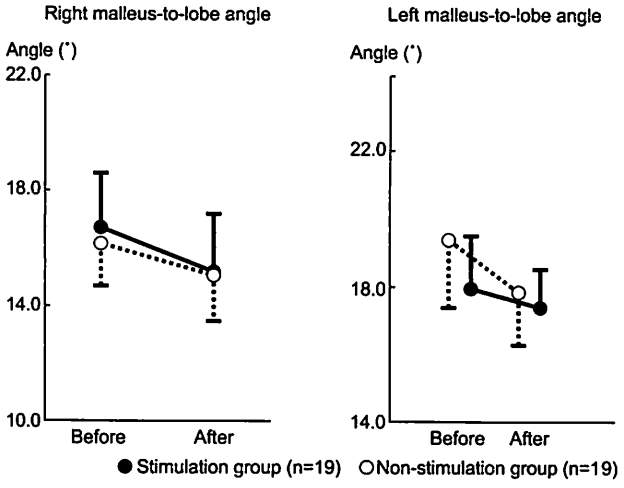

Fig. 11. Neutral standing left and right lateral lines of gravity for non-stimulation and shiatsu stimulation groups

variation was not ascertained. In the stimulation group, there was a trend toward an increase, measuring 39.10 ± 2.78° pre-stimulation vs. 41.35 ± 3.17° post-stimulation, but a significant variation was not ascertained.

3. Line of gravity

(1) Changes to spinal inclination angle in neutral standing position (Fig. 10)

In the non-stimulation group, there was a trend toward an increase, measuring 1.11 ± 0.58° pre-stimulation vs. 1.42 ± 0.50° post-stimulation, but a significant variation was not ascertained. In the stimulation group, there was a trend toward an increase, measuring 1.75 ± 0.49° pre-stimulation vs. 2.10 ± 0.36° post-stimulation, but a significant variation was not ascertained.

(2) Changes to right malleus-to-lobe angle (Fig. 11)

In the non-stimulation group in the neutral standing position, there was a trend toward a decrease, measuring 16.16 ± 1.34° pre-stimulation vs. 15.11 ± 1.64° post-stimulation, but a significant variation was not ascertained. In the stimulation group, there was a trend toward a decrease, measuring 16.74 ± 1.86° pre-stimulation vs. 15.32 ± 1.86° post-stimulation, but a significant variation was not ascertained.

(3) Changes to left malleolus-to-lobe angle (Fig. 11)

In the non-stimulation group in the neutral standing position, there was a trend toward a decrease, measuring 19.21 ± 1.89° pre-stimulation vs. 17.63 ± 1.44° post-stimulation, but a significant variation was not ascertained. In the stimulation group, there was almost no change, measuring 17.72 ± 1.54° pre-stimulation vs. 17.28 ± 1.08° post-stimulation.

IV. Discussion

At the Japan Shiatsu College, we are conducting ongoing research into the effects of shiatsu stimulation on spinal mobility, reporting on which regions of the body produce improved mobility in response to shiatsu stimulation and which have no effect. Tazuke et al[6] reported that shiatsu stimulation of the gluteal region and posterior lower limb resulted in significant improvement of spinal mobility, standing forward flexion, and sacral inclination angle, while Eto et al[5] reported that improved spinal mobility was not observed with shiatsu stimulation of the interscapular and subscapular regions.

In this study, shiatsu stimulation of the gluteal region did not result in significant change, either in the stimulation group or the non-stimulation group, to any of the measurement items, including ROM in anteflexion, ROM in dorsiflexion, and spinal inclination angle and bilateral line of gravity in the neutral standing position.

Whereas the gluteus maximus—the muscle stimulated during shiatsu stimulation of the gluteal region—is employed in large motions such as climbing stairs, the hamstrings work to support the hip joints when the trunk is leaning forward in activities such as washing one's face over a sink, so it is thought that the hamstrings are under tension more frequently in everyday use[9]. Therefore, the hamstrings should be more actively involved as a factor influencing spinal mobility. This may be the reason why shiatsu stimulation to the gluteal region had no effect on spinal mobility.

The fact that shiatsu stimulation to the posterior lower limb effects changes in spinal mobility[6] suggests that, not only the hamstrings, but also the triceps surae may be involved. Further research is required to determine the relationships of the hamstrings and triceps surae to spinal mobility.

Concerning the line of gravity, ideally a person's balance in the neutral standing position is maintained by tension in tendons and the triceps surae, but in reality, maintaining balance in response to gravity and other external forces requires the interaction of the anti-gravity muscles (erector spinae, gluteals, biceps femoris, semimembranosus, semitendinosus, etc.) and a variety of other muscles[12], and this may be why an effect was not observed with stimulation of the gluteal muscles alone. Future study of the effect of shiatsu stimulation on the line of gravity must be multifaceted, involving stimulation of not just individual muscles, but antagonists (extensor groups and flexor groups), with changes observed not only over the whole body, but in specific areas, including the anterior surface of the knee joint, center of the greater trochanter, acromial process, and ear lobe.

By clarifying that shiatsu stimulation of the gluteal region has no effect on spinal mobility, the results of this study suggest that shiatsu stimulation to the posterior lower limb plays an important role in affecting spinal mobility.

V. Conclusions

Shiatsu stimulation to the gluteal region performed on 20 healthy, adult male test subjects yielded the following results:

1. No significant change was observed to sacral/pelvic inclination angle or spinal inclination angle in anteflexion or dorsiflexion.
2. No significant change was observed in spinal inclination angle or bilateral line of gravity in the neutral standing position.

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 ryoho gakko 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 Eto T et al: Shiatsu shigeki ni yoru kin no junansei ni taisuru koka (dai 3 ho). Toyo ryoho gakko kyokai gakkaishi 27: 97-100, 2003 (in Japanese)
6 Tazuke M et al: Shiatsu shigeki ni yoru sekichu no kadosei oyobi kin no katasa ni taisuru koka. Toyo ryoho gakko kyokai gakkaishi 28: 29-32, 2004 (in Japanese)
7 Miyachi M et al: Fukubu shiatsu shigeki ni yoru sekichu no kadosei ni taisuru koka. Toyo ryoho gakko kyokai gakkaishi 29: 60-64, 2005 (in Japanese)
8 Ishizuka H et al: Shiatsu ryohogaku: 40-102, International Medical Publishers, Ltd. Tokyo, 2008 (in Japanese)
9 Neumann D A; Shimada T, Hirata S (tr. supervision): Kinkokkakukei no kineshioroji. Ishiyaku Publishers, Inc.: 432-440, Tokyo, 2006 (in Japanese)
10 Iwakura H: Rigakuryohoshi no tame no undoryoho. Kanehara & Co., Ltd.: 25-26, 1991 (in Japanese)
11 Yoshinari K et al: Sokeibu shiatsu shigeki ga sekichu kadosei ni oyobosu koka. Toyo ryoho gakko kyokai gakkaishi 32: 18-22, 2008 (in Japanese)
12 Dohi N; Shadanhojin toyoryohogakko kyokai (ed.): Rihabiriteshon igaku: 141-143, Ishiyaku Publishers, Inc. 2008 (in Japanese)
13 Kendall, McCreary, Provance; Kayamori R (tr. supervision): Kin kino to tesuto—shisei to itami—: 70-74, Tokyo, Nishimura Co., Ltd. 2006 (in Japanese)