Electrogastrogram Changes Due to Shiatsu Stimulation of the Abdominal Region

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I. Introduction

The Japan Shiatsu College has been conducting ongoing research into the effects of shiatsu stimulation on physiological functions. In the 22nd through 24th congresses of the Japan College Association of Oriental Medicine, we reported that shiatsu stimulation of the abdominal region reduced heart rate[1] and blood pressure[2], and increased peripheral muscle blood volume[3].

As a follow-up to our study conducted last year, "Electrogastrogram changes due to shiatsu stimulation of the lower leg,"[4] this year we report on electrogastrogram changes due to shiatsu stimulation of the abdominal region, in order to confirm the effects of shiatsu stimulation on gastrointestinal motility.

II. Methods

1. Subjects

Research was conducted on 27 healthy adult students from this college, including 13 males and 14 females (average age: 36.8 years old). Test procedures were fully explained to each test subject and their consent obtained. They were also asked to refrain from receiving shiatsu or other stimulation on the day of testing.

2. Test period

April 1 to September 22, 2007

3. Test location

Testing was conducted in the shiatsu research lab at the Japan Shiatsu College. Room temperature was 25.0 ± 2.0°C and humidity was 63.0 ± 12.0%.

4. Measurement

Measurement was carried out using an electrogastrograph (NIPRO), with measurement electrodes applied to the following areas (Fig. 1).

Center electrode: midway between the xiphoid process of the sternum and the navel

CH1: at the intersection of a line running horizontally through the point midway between the xiphoid process of the sternum and the center electrode and the right midclavicular line

CH2: at the intersection of a line running horizontally through the point midway between the xiphoid process of the sternum and the center electrode and the left midclavicular line

CH3: at the intersection of a line running horizontally through the point midway between the center electrode and the navel and the right midclavicular line

CH4: at the intersection of a line running horizontally through the point midway between the center electrode and the navel and the left midclavicular line

5. Stimulation

Stimulation was carried out according to standard Namikoshi procedure[5], as indicated below.

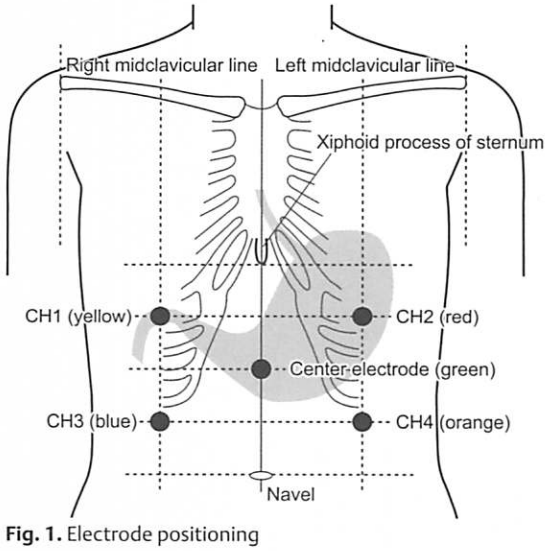

Fig. 1. Electrode positioning

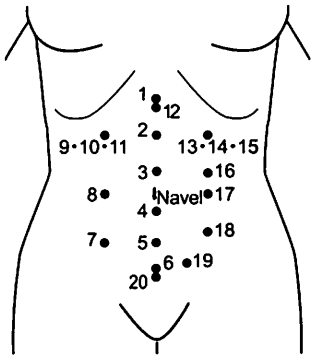

Fig. 2. 20 points, abdominal region

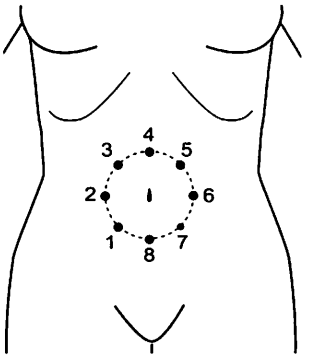

Fig. 3. 8 points, circumference of navel region

(1) Area of stimulation

[1] 9 points, palm pressure, abdominal region

Palm pressure combined with palpation was applied in the following order: solar plexus, small intestine, bladder, cecum, liver, spleen, descending colon, sigmoid colon, rectum.

[2] 20 points, 2-thumb pressure, abdominal region (Fig. 2)

[3] 8 points, 2-thumb pressure, circumference of navel region (Fig. 3)

(2) Method of stimulation

The respective areas were treated using standard pressure (pressure gradually increased, sustained, and gradually decreased), with pressure applied for 3 seconds per point, repeated 3 times.

Pressure was regulated so as to be pleasurable for the test subject (standard pressure).

6. Test procedure

Testing was carried out on two groups: one on which shiatsu stimulation was performed in the supine position (hereafter, the stimulation group); and one that lay in the same supine position without shiatsu stimulation being performed (hereafter, the non-stimulation group).

The stimulation group was treated in the following order: 15 minutes rest → 10 minutes stimulation → 15 minutes post-stimulation rest. The non-stimulation group rested for 40 minutes, the same amount of time as the test period for the stimulation group.

(1) The overall condition of the test subjects was determined by asking them to fill out a survey including questions on physical condition, meal times, and usual abdominal condition. After measurement was completed, test subjects completed a survey to determine their feelings on the experimental environment, amount of shiatsu pressure, and changes in abdominal condition due to treatment.

(2) Test precautions

The following items were monitored and recorded during testing for test subjects in both groups:

[1] that they remained alert

[2] that they remained motionless

[3] that the surroundings were quiet

(3) Other

Regarding test subjects' meals on the day of testing, no limitations on meal times were established.

7. Outcome measures

[1] Dominant power (hereafter, DP)

Indicator of the size of electrical response activity (ERA) in gastric smooth muscle cells accompanying peristalsis. Raw data measured using the electrogastrograph is subject to spectral analysis using MBFA and classified as slow-wave (0–2 cpm), normal-wave (2–4 cpm), and fast-wave (4–9 cpm)[4], to express changes in the electric potentials of their respective frequency bands.

[2] Frequency

The frequency of the highest amplitude taken from the 0–9 pm waveforms each minute

8. Data analysis

[1] Data taken during the 10-minute periods pre- and post-stimulation (hereafter, 10-minute interval average value) were analyzed.

[2] Data were also analyzed chronologically every 5 minutes (hereafter, 5-minute spot average value).

Data gathered during stimulation were treated with caution, as there was a probability of artifact contamination.

9. Statistical processing

Bonferroni multiple comparisons and one-way analysis of variance using a linear mixed model. The significance level was <5%.

III. Results

1. DP before and after shiatsu stimulation

There were three test segments (15 minutes rest pre-stimulation, 10 minutes shiatsu stimulation, and 15 minutes rest post-stimulation). The pre-stimulation 10-minute interval average value was established as the control value and compared to the post-stimulation 10-minute interval average value.

(1) DP comparison between stimulation and non-stimulation groups

In the non-stimulation group, DP was more or less unchanged in all 3 cases, whereas in the stimulation group an increase in DP was confirmed in 26 of 27 cases.

Because the non-stimulation group consisted of 3 subjects, we were unable to conduct a pre-post-stimulation comparison with the stimulation group. In the stimulation group, the post-stimulation DP value increased ($p<0.001$) (Fig. 4).

(2) DP comparison for each frequency band

Post-stimulation DP increased significantly ($p<0.001$)

compared to pre-stimulation DP for slow-wave, normal-wave, and fast-wave frequency bands. There was no interaction between the electrogastrograph's slow-, normal-, and fast-wave bands due to shiatsu stimulation. Normal-wave values were higher than those for either slow-wave or fast-wave ($p<0.001$) (Fig. 5).

(3) DP comparison for each channel

Post-stimulation values increased for all channels ($p<0.001$).

There was no interaction between channels (hereafter, CH) due to shiatsu stimulation. There was a trend ($p<0.09$) for CH2 values to be lower than CH3 and CH4; there was a trend ($p<0.09$) for CH2 values to be lower than CH3 and CH4 (Fig. 6).

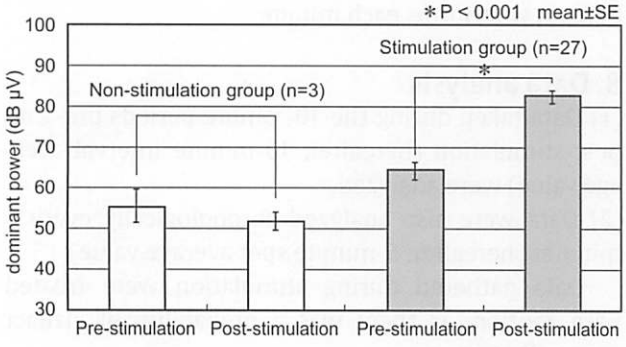

Fig. 4. DP comparison for shiatsu stimulation and non-stimulation groups

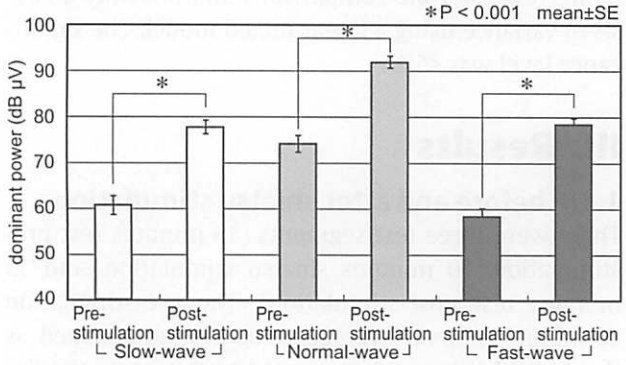

Fig. 5. DP comparison for each frequency band

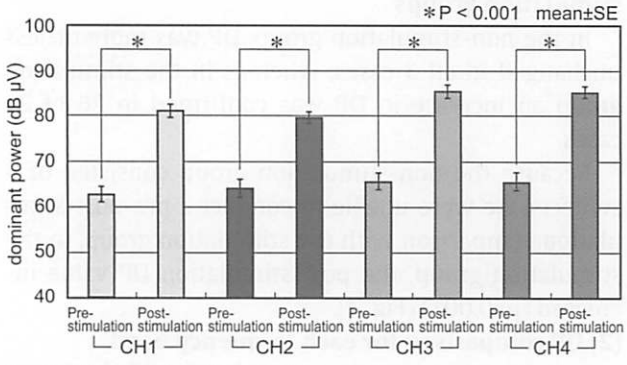

Fig. 6. DP comparison for each channel

2. Chronological changes to DP

DP rose in response to shiatsu stimulation then fell post-stimulation, returning to pre-stimulation levels 15 minutes post-stimulation (Fig. 7).

3. Comparison of frequency

(1) Comparison of average frequencies before and after treatment

Comparison of pre-and post-stimulation 10-minute interval average values for all channels revealed no change (Fig. 8).

(2) Chronological changes to frequencies

A trend was observed for frequencies to gradually increase, then stabilize in the 2.5–3.0 cpm range

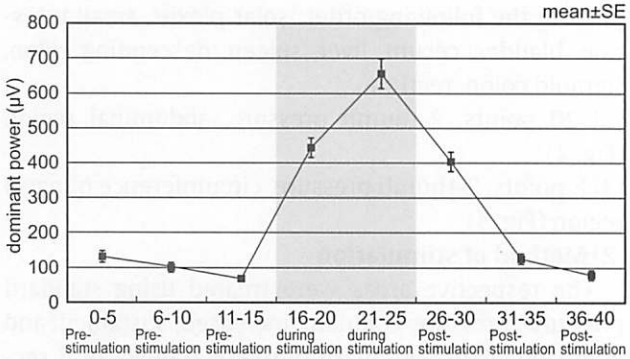

Fig. 7. Changes to dominant power

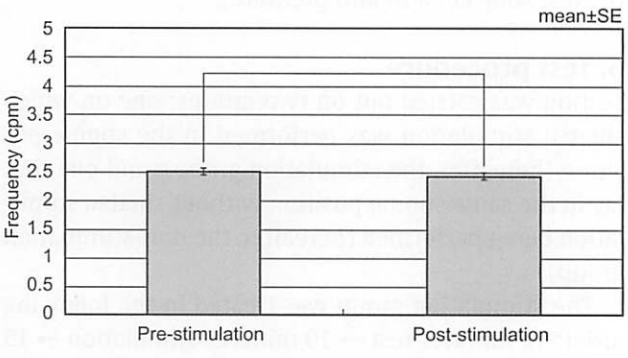

Fig. 8. Comparison of pre- and post-stimulation average frequencies

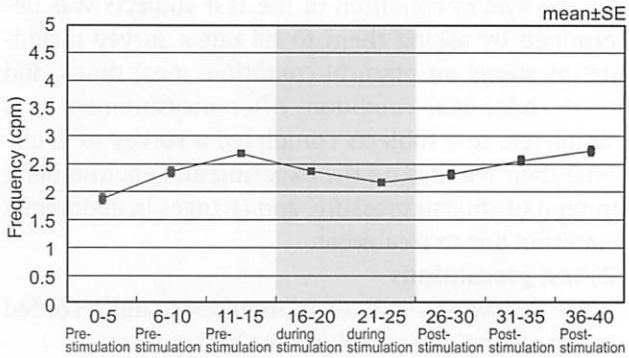

Fig. 9. Chronological changes to frequencies

during minutes 11–15 of the rest period. Frequency dropped slightly on all channels during shiatsu stimulation, then tended to once again rise gradually during post-treatment. These chronological changes occurred within the normal frequency range (Fig. 9).

4. Comparison of DP depending on presence of abdominal symptoms

(1) Comparison of 10-minute intervals before and after shiatsu stimulation

Subjects were divided into those with abdominal symptoms (9 cases) and without (18 cases), based on medical histories (survey forms).

In comparison of the 10-minute intervals before and after shiatsu, a large increase in DP from 93 to 304 was observed in subjects with feelings of abdominal bloating and a small increase in DP from 111 to 188 in subjects with constipation (Fig. 10).

(2) Changes in DP depending on presence of symptoms

DP rose during treatment, regardless of whether or not symptoms were present.

Although the number of cases was small, among the 3 subjects who reported abdominal bloating the rise in DP tended to continue after shiatsu stimulation ended, while among the 6 subjects who reported constipation a lower rise in DP due to shiatsu stimulation was observed (Fig. 11).

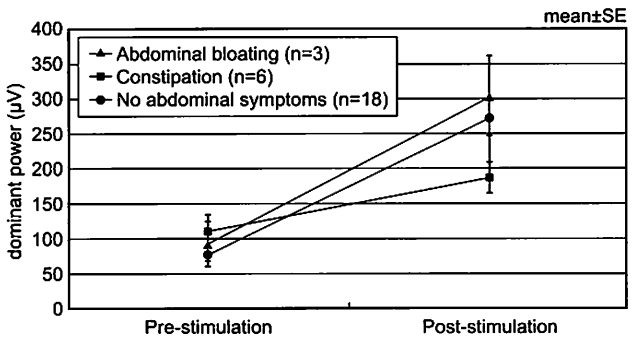

Fig. 10. Comparison of 10-minute intervals before and after shiatsu stimulation

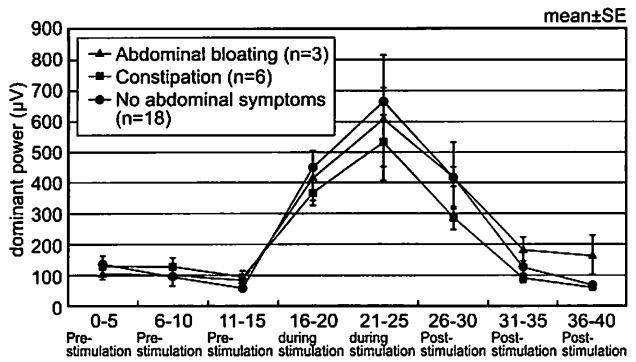

Fig. 11. Changes in DP depending on presence of symptoms

IV. Discussion

As with the results of last year's study on shiatsu stimulation of the lateral crural region, a rise in DP due to shiatsu stimulation of the abdominal region was confirmed. This is probably because abdominal shiatsu promotes peristalsis of the gastrointestinal tract.

It has been reported that pinch stimulation[6] and acupuncture stimulation[7] of the abdominal region in anesthetized rats suppressed stomach motility via a spinal segment reflex that stimulated the portion of the sympathetic nervous system supplying the stomach. Also, Imai et al[8] reported a decrease in DP due to acupuncture stimulation of the abdominal region and, since this also occurs when the parasympathetic blocking agent atropine is administered, concluded that the mechanism occurs via the sympathetic nerves.

The results obtained from shiatsu stimulation of the abdominal region in this study confirm a rise in DP, with the opposite effect of acupuncture stimulation of the human abdomen reported by Imai et al.

Because the depth of needle insertion is normally regulated so as not to pierce the peritoneum, it is difficult to conceive that the needle tip would reach the intramural plexus of the gastrointestinal tract or the abdominal organs, so the reaction to acupuncture stimulation of the abdominal region is probably due to stimulation of sympathetic nerve function via a somatovisceral reflex.

On the other hand, the shiatsu stimulation of the abdominal region conducted in this study involved deep pressure stimulation of the abdomen while observing the subject's response, and it is possible that the abdominal organs or intramural plexus were directly stimulated. Therefore, the stimulation response of gastrointestinal peristalsis due to abdominal shiatsu observed here may have been due to a viscero-visceral reflex mechanism in which the abdominal organs or the intramural plexus were stimulated and visceral afferent nerves formed the afferent path.

V. Conclusions

From this study performed on healthy adults, the following is evident:

Shiatsu stimulation to the abdominal region resulted in increased dominant power (DP). Frequency varied within the normal frequency range and the effect was limited.

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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