Clinical Observation

The influence of different methods of acupuncture on skin surface perfusion

HUANG Tao, WANG Rui-hong, ZHANG Wei-bo, HAN Bin, WANG Guang-jun, TIAN Yu-ying, ZHANG Yu-qin

Institute of Acupuncture and Moxibustion, China Academy of Chinese Medical Sciences, Beijing 100700, China

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Correspondence to: HUANG Tao. Institute of Acupuncture and Moxibustion, China Academy of Chinese Medical Sciences, Beijing 100700, China. dr_huangtao@sina.com

Telephone: +86-13521122206

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Abstract

OBJECTIVE: To compare the effects on the body surface of different kinds of placebo/sham acupuncture with that of traditional needling sensation acupuncture.

METHODS: Point Neiguan (PC 6) of 29 healthy subjects, 19 males and 10 females, was stimulated with needling sensation, shallow, placebo and deep acupuncture at the non-acupoint. After stimulation with different methods of acupuncture, the change in perfusion of the micrangium in the skin surface around the elbow joint, with Point Quze (PC 3) as its center, was observed with laser Doppler blood-flow imaging.

RESULTS: Judging from the absolute value of perfusion of the skin surface micrangium, several methods of acupuncture can cause change in blood flow. The ratio of blood-flow perfusion in the meridian area in and around Quze declined before and after needling insertion in needling sensation acupuncture and shallow acupuncture. This observation did not occur in placebo and non-acupoint acupuncture. Needling sensation acupuncture at an acupoint can relatively reduce the perfusion of the micrangium in the projective area of the meridian where the acupoint is located on the body surface (\(\beta<0.05\)), indicating the specificity of meridians.

CONCLUSIONS: Stimulation of an acupoint or a point on the body surface with any type of acupuncture can cause change in blood flow in the skin near the needling point. However, the biological mechanism underlying this phenomenon needs to be further explored.

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Key words: Skin surface perfusion; Acupuncture

INTRODUCTION

Many internationally published articles researching acupuncture affirm its effects, but doubt the existence of acupoints and meridians. This may be because conclusions are derived according to the principle of control and placebo group acupuncture, an indispensable link in research into acupuncture and moxibustion. This principle, however, often deviates from the traditional theories surrounding acupuncture and moxibustion\(^1\). Sham acupuncture is divided into acupuncture at the non-acupoint and acupuncture at an acupoint with no effect of treatment. Acupuncture at non-acupoints is performed at a point near a treatment acupoint with its manipulation and depth basically the same as in needling sensation acupuncture\(^2\). Placebo acupuncture is divided into simple acupuncture into the skin surface and "Streitberger" acupuncture\(^3\) in which needles with blunt tips\(^4\) or other tools (such as a toothpick or plastic needle\(^5\)) are tapped on the skin to produce a stinging sensation. The above methods have been widely
used in research into acupuncture; however, at present, there is no unified standard on how to select a control group. Traditional theory on acupuncture and moxibustion, as well as the authors’ long-term clinical experience, illustrate that needling sensation acupuncture can more effectively produce acupuncture, meridian and clinical effects[6].

Laser Doppler blood-flow imaging technology is a new method for displaying the state of the microcirculation in a large area of tissue surface. This technique can measure the microcirculation at any site of the body surface, and has been previously applied to study the change in microcirculation produced by acupuncture, moxibustion and cupping[7,8,9]. We have now taken laser Doppler blood-flow imaging to observe the change in perfusion of the micrangium in the skin surface in order to compare the effects on the body surface of different kinds of placebo/sham acupuncture with that of traditional needling sensation acupuncture. This study was approved by the appropriate ethics committees and was performed in accordance with the ethical standards laid down in the Declaration of Helsinki. All persons signed their informed consent prior to their inclusion in the study.

MATERIALS AND METHODS

Research subjects
Twenty-nine subjects, 19 males and 10 females, aged 26.8 years on average, came from the postgraduate department of China Academy of Chinese Medical Sciences (CACMS) and other institutions. All subjects had not been hospitalized within the last year. All voluntarily took part in this research approved by the Scientific Research Section, CACMS and the Moral and Ethical Committee, CACMS, following the acquisition of informed consent.

Methods of acupuncture
Four different methods of acupuncture were performed, one after another, on each of the subjects, with Neiguan (PC 6) as the main stimulated acupoint. Stainless steel needles, 25 mm in length and 0.25 mm in diameter, (Hwato brand, Suzhou Medical Instruments Co. Ltd., Suzhou, China) were used for acupuncture. Acupuncture was performed by a special TCM practitioner and an assistant recorded needling sensation. Order of acupuncture was determined by drawing lots, subjects wore eyeshades and those recording the laser imaging and needling sensation did not know the acupuncture order.

Needling sensation acupuncture: the needle was rapidly inserted into an acupoint with lifting, thrusting and twirling manipulation (lifting-thrusting amplitude 0.2 – 0.5 cm, twirling frequency 60 – 90/min and angle 90 – 180°). The manipulation was stopped as soon as needling sensation was achieved. Types of needling sensation, such as aching, numbness, distension and painful sensation were recorded. The VAS (visual analogue score) method was used to record strength of sensation, with 0 as no sensation and 10 as intolerable sensation.

Shallow acupuncture method: the needle was rapidly inserted into an acupoint without lifting, thrusting or twirling manipulation. Sensation and strength were recorded.

Sham acupuncture method: an empty tube without a needle was used to tap an acupoint, and sensation and strength were recorded.

Non-acupoint acupuncture: the needle was rapidly inserted into a point 1 cm from Neiguan (PC 6) on the ulnar side with a lifting, thrusting and twirling manipulation (the same as with the needling sensation acupuncture method). Manipulation was stopped as soon as some sensation was achieved. The sensation and strength were recorded.

Method of detection
A PeriScan PIM II laser Doppler blood perfusion imager (PERIMED Inc. Stockholm, Sweden) with laser wavelength 670 nm, NR scan mode and 3 cm step length was used to scan the elbow joint, with Point Quze (PC 3) being the center of the scan. The scanned area was 64 × 64, with a minimum scanning precision and picture element of 0.75 × 0.75 mm².

The instrument was manipulated by an assigned professional. Laboratory temperature was maintained at approximately 26°C and humidity at 40% – 60%. Subjects were asked to arrive at the laboratory 10 minutes before the study and calmly lie down to keep blood pressure and respiration stable. Subjects exposed their left arms and were scanned with the laser Doppler instrument before acupuncture (2 images), during acupuncture (3 images), immediately after needle withdrawal, and 10 minutes after needle withdrawal. Each scan generally took 4 minutes 6 seconds. The whole detection process lasted about 40 minutes during which the subject was asked to maintain a stable position as possible.

The type and strength of needling sensation were recorded onto a special form by assigned staff. This form was based on the MGH Acupuncture Sensation Scale by Kathleen KS Hui and others of Harvard University[10].

Data analysis
A Laser Doppler Perfusion Imager LDP1 Lisca 2.5 (Lisca Development AB, Linkoping, Sweden) was used to record, analyze, process and store blood flow images.
At the same time, laser blood flow and ocular figures were recorded in order to analyze the relationship of blood flow distribution to actual position on the body surface. After data collection, LDP1 software was used to analyze blood flow images, which were divided into area 1 [projective area of the meridian on body surface where Points Neiguan (PC 6) and Quze (PC 3) are located], area 2 ([PC 3] area, the central area of the scan) and area 3 (control area, a point selected near the acupoint on the radial side of upper limb). Image processing software (PERIMED Inc. Stockholm, Sweden) was used to integrate figures scanned at different times and to also change them into Microsoft EXCEL and IMAGE formats (LDI, JPG). Paired t tests were conducted on the resulting quotient.

**RESULTS**

**Absolute changes in perfusion of the micrangium before and after acupuncture.**

After image data were changed into measurement data, comparison of the perfusion of the micrangium on the body surface before and after acupuncture in the 3 areas showed that different methods of acupuncture all manifested highest perfusion of the micrangium in area 2 [Point Quze (PC 3) area], followed by area 1 and 3. The change in blood flow of the 29 subjects was different before and after receiving needleling sensation acupuncture in the 3 areas. In area 1 and 2, perfusion of the micrangium declined after needle insertion and kept increasing with time. In area 3, the sustainable increase in perfusion of the micrangium with time was not statistically different. Perfusion fluctuated in the 3 areas after shallow acupuncture or sham acupuncture. Blood flow kept increasing with time in the 3 areas before and after acupuncture at the non-acupoint, and paired t test showed that the change before and after acupuncture had no statistical significance.

**Table 1 Change in perfusion in 3 areas before and after different methods of acupuncture**

<table>
<thead>
<tr>
<th>Meridian area</th>
<th>Before needle insertion</th>
<th>After needle insertion</th>
<th>5 minutes after needle insertion</th>
<th>10 minutes after needle insertion</th>
<th>After needle withdrawal</th>
<th>10 minutes after needle withdrawal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Needling sensation acupuncture</td>
<td>0.66±0.15</td>
<td>0.65±0.15</td>
<td>0.65±0.14</td>
<td>0.65±0.14</td>
<td>0.66±0.13</td>
<td>0.67±0.13</td>
</tr>
<tr>
<td>Quze area</td>
<td>0.70±0.16</td>
<td>0.70±0.16</td>
<td>0.71±0.16</td>
<td>0.71±0.15</td>
<td>0.71±0.14</td>
<td>0.72±0.15</td>
</tr>
<tr>
<td>Control area</td>
<td>0.59±0.15</td>
<td>0.61±0.13</td>
<td>0.62±0.12</td>
<td>0.62±0.14</td>
<td>0.64±0.11</td>
<td>0.64±0.11</td>
</tr>
<tr>
<td>Meridian area</td>
<td>0.67±0.15</td>
<td>0.67±0.14</td>
<td>0.67±0.14</td>
<td>0.67±0.13</td>
<td>0.68±0.12</td>
<td>0.69±0.13</td>
</tr>
<tr>
<td>Quze area</td>
<td>0.75±0.18</td>
<td>0.74±0.16</td>
<td>0.75±0.17</td>
<td>0.74±0.15</td>
<td>0.75±0.15</td>
<td>0.76±0.15</td>
</tr>
<tr>
<td>Control area</td>
<td>0.60±0.11</td>
<td>0.62±0.13</td>
<td>0.62±0.12</td>
<td>0.62±0.11</td>
<td>0.62±0.11</td>
<td>0.63±0.10</td>
</tr>
<tr>
<td>Sham acupuncture with empty tube</td>
<td>0.67±0.13</td>
<td>0.67±0.11</td>
<td>0.66±0.11</td>
<td>0.67±0.11</td>
<td>0.67±0.11</td>
<td>0.68±0.11</td>
</tr>
<tr>
<td>Meridian area</td>
<td>0.73±0.15</td>
<td>0.73±0.13</td>
<td>0.72±0.14</td>
<td>0.73±0.14</td>
<td>0.74±0.13</td>
<td>0.76±0.13</td>
</tr>
<tr>
<td>Quze area</td>
<td>0.61±0.08</td>
<td>0.60±0.11</td>
<td>0.61±0.14</td>
<td>0.61±0.16</td>
<td>0.61±0.05</td>
<td>0.62±0.08</td>
</tr>
<tr>
<td>Control area</td>
<td>0.65±0.13</td>
<td>0.67±0.13</td>
<td>0.67±0.13</td>
<td>0.67±0.13</td>
<td>0.68±0.13</td>
<td>0.69±0.12</td>
</tr>
<tr>
<td>Acupuncture at non-acupoint</td>
<td>0.70±0.14</td>
<td>0.72±0.14</td>
<td>0.73±0.15</td>
<td>0.74±0.15</td>
<td>0.75±0.15</td>
<td>0.76±0.14</td>
</tr>
<tr>
<td>Meridian area</td>
<td>0.58±0.08</td>
<td>0.61±0.11</td>
<td>0.61±0.05</td>
<td>0.62±0.09</td>
<td>0.63±0.12</td>
<td>0.63±0.04</td>
</tr>
</tbody>
</table>

**Relative change in perfusion of the micrangium before and after different acupuncture in the 3 areas**

Data of area 1 and 2 were divided by data of area 3 in order to normalize the readings. Needling sensation acupuncture relatively reduced perfusion of the micrangium at Point Quze (PC 3) and the projective area of the meridian where the acupoint is located in body surface (P<0.05). Shallow acupuncture also produced a similar effect.

**Types and strength of needling sensation caused by different methods of acupuncture**

Needling sensations caused by the 4 different methods of acupuncture were distention, pain, numbness, aching and heaviness. Needling sensation acupuncture caused the strongest needling sensation, followed by acupuncture at non-acupoints and shallow acupuncture. Although no needle is inserted in sham acupuncture, subjects still felt similar needle sensation.

**Overall findings**

Different methods of acupuncture caused changes in whole blood flow in meridian areas where an acupoint was located, but this change had no statistical significance. Needling sensation acupuncture can effectively reduce...
relative perfusion of the skin micrangium in the meridian area where the stimulated acupoint is located, while empty tube acupuncture and acupuncture at non-acupoints cannot do so. Needle insertion and withdrawal in shallow acupuncture can also cause the same reduction in perfusion.

![Figure 1 Change in perfusion of micrangium before and after different methods of acupuncture at different times.](image)

**Table 2 Ratio of skin micrangium perfusion in area 1 and 2 to that in control area, before and after different methods of acupuncture**

<table>
<thead>
<tr>
<th>Method</th>
<th>Before needle insertion</th>
<th>After needle insertion</th>
<th>5 minutes after needle insertion</th>
<th>10 minutes after needle insertion</th>
<th>After needle withdrawal</th>
<th>10 minutes after needle withdrawal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Needling sensation acupuncture</td>
<td>Meridian area</td>
<td>1.11±0.15</td>
<td>1.07±0.14*</td>
<td>1.06±0.14**</td>
<td>1.07±0.13*</td>
<td>1.03±0.12**</td>
</tr>
<tr>
<td></td>
<td>Quze area 2</td>
<td>1.20±0.16</td>
<td>1.15±0.13**</td>
<td>1.15±0.14*</td>
<td>1.16±0.14*</td>
<td>1.12±0.13**</td>
</tr>
<tr>
<td>Shallow acupuncture</td>
<td>Meridian area</td>
<td>1.12±0.12</td>
<td>1.10±0.09</td>
<td>1.10±0.10</td>
<td>1.09±0.13</td>
<td>1.09±0.10</td>
</tr>
<tr>
<td></td>
<td>Quze area</td>
<td>1.25±0.16</td>
<td>1.21±0.14</td>
<td>1.21±0.15*</td>
<td>1.20±0.14</td>
<td>1.21±0.15</td>
</tr>
<tr>
<td>Empty tube acupuncture</td>
<td>Meridian area</td>
<td>1.10±0.14</td>
<td>1.11±0.11</td>
<td>1.08±0.09</td>
<td>1.10±0.10</td>
<td>1.09±0.09</td>
</tr>
<tr>
<td></td>
<td>Quze area</td>
<td>1.20±0.16</td>
<td>1.21±0.14</td>
<td>1.18±0.12</td>
<td>1.20±0.12</td>
<td>1.19±0.12</td>
</tr>
<tr>
<td>Acupuncture at non-acupoint</td>
<td>Meridian area</td>
<td>1.12±0.12</td>
<td>1.10±0.10</td>
<td>1.10±0.09</td>
<td>1.10±0.10</td>
<td>1.09±0.09</td>
</tr>
<tr>
<td></td>
<td>Quze area</td>
<td>1.21±0.14</td>
<td>1.19±0.14</td>
<td>1.21±0.13</td>
<td>1.20±0.15</td>
<td>1.20±0.13</td>
</tr>
</tbody>
</table>

Note: *P<0.05, **P<0.01.

![Figure 2 Types and strength of needling sensation caused by different methods of acupuncture.](image)

**DISCUSSION**

Control and placebo acupuncture are indispensable in acupuncture research. The authors have found in their previous research into placebo acupuncture[11] that needling sensation acupuncture can effectively change the release of CO_{2}, namely metabolism of energy, at acupoints on meridians. Other methods of acupuncture can also enhance energy metabolism on the local body surface. The result of comparing traditional needling sensation acupuncture with the other 3 acupuncture methods has shown that no specific change was found in causing alteration of blood flow in the observed area.

Acupuncture has obvious curative effects on many diseases, but its neurophysiological mechanism is still unclear. Based on experiments, researchers have raised various hypotheses on the mechanism of acupuncture.
The popular opinion that the effect of acupuncture may be related to the neuroendocrine system,[15] now also gives way to the recent notion that the microcirculation could be involved.[18] The result of research carried out by Weibo Zhang,[6], Dong Zhang[17], Tao Huang[5] and others into the effect of acupuncture using laser Doppler technology has shown that the laser Doppler imaging instrument can dynamically express increases in the microcirculation in the skin as caused by acupuncture, electroacupuncture and moxibustion. These authors have also categorized the effect produced by acupuncture into the whole effect, local effect and the meridian effect[6]. Acupuncture has been shown to obviously increase local blood flow in the brain after acute cerebral hemorrhage. This increased blood flow then inhibited a series of pathological phenomena induced by reduction in blood flow in the brain, playing an active role in protecting cerebral cells and avoiding their damage[14].

Point Neiguan (PC 6), an important acupoint for treating diseases of the heart, chest and stomach in TCM and a commonly used acupoint in basic research, is widely used clinically.

In previous studies, the Anhui College of Traditional Chinese Medicine and other institutions have found that acupuncture can immediately lower blood flow [15]. Using moxibustion to stimulate Point Neiguan (PC 6) and laser Doppler to display images, Dong Zhang and others have discovered that increased palmar blood flow was mainly at Points Yuji (LU 10) and Neiguan (PC 6) [17]. The same instrument and acupoints have been used in this study with different stimulative methods and observational sites. Superficially, blood flow increased in scanning areas, with the most obvious increase at Point Quze (PC 3). However, through processing to remove the influence of the whole effect, it can be seen that at the time of needle insertion or needle withdrawal in needling sensation acupuncture, shallow acupuncture and acupuncture at non-acupoints, blood flow decreases with statistical significance. Shallow acupuncture is inferior to needling sensation acupuncture in the extent of change in blood flow. Sham acupuncture can also cause needling sensation but with no significant influence on blood flow.

REFERENCES