

Microcirculation And Temperature Monitoring During Acupuncture On Jiexi (St.41)

G Litscher, L Wang, I Gaischek

Citation

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Abstract

Laser Doppler flowmetry as well as laser Doppler imaging and thermal imaging play an important role in the scientific of peripheral effects of acupuncture.

Microcirculation and temperature monitoring was performed in four healthy volunteers (mean age \pm SD: 33.5 \pm 11.4 years; 3 female, 1 male) prior to, during and after insertion and stimulation of an acupuncture needle at the acupoint Jiexi (St.41).

The average skin perfusion (Flux) increased significantly at the recording position Zhiyin (UB.67). This was not the case in a control point.

It is supposed that similar effects are present as during stimulation of the acupoint Neiguan (Pe.6) at the wrist of the hand which showed a marked increase after 1 minute in microcirculation at the fingertip.

INTRODUCTION

Acupuncture is a component of Traditional Chinese Medicine (TCM), and has evolved empirically over thousands of years. However, bioengineering assessment of acupuncture has only begun recently [1,2,3,4,5,6,7].

The registration of microcirculatory changes plays an important role in the scientific investigation of the peripheral effects of acupuncture [2].

The aim of this article was to investigate possible peripheral effects (microcirculation and temperature) at the acupoint urinary bladder 67 (UB.67; Zhiyin) following needling and manual needle stimulation of the acupoint Jiexi (St.41) in four healthy volunteers.

METHODS

PARTICIPANTS

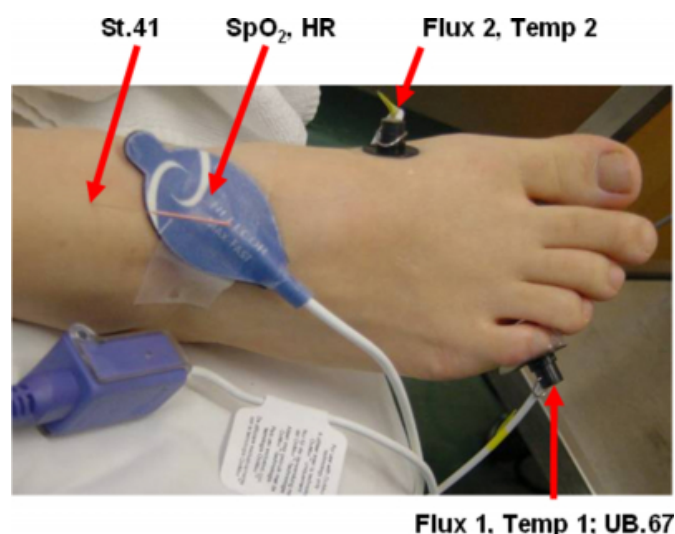
The four healthy volunteers (mean age SD: 33.5 \pm 11.4 years; range 20 – 48 years; 3 female, 1 male) agreed to participate in the study and gave written informed consent. The experiments were approved by the Ethic committee of the Medical University of Graz. The participants did not receive any treatment for 24 hours before measuring microcirculation and body temperature.

TECHNICAL EQUIPMENT

The microcirculatory parameter Flux (equal to the product of the average speed and concentration of moving red blood cells in the tissue sample volume) and temperature at the acupoint UB.67 were registered using a laser Doppler flowmetry device (DRT4) from Moor Instruments Ltd. (Millwey, Axminster, U.K.). Laser wavelength was 780 nm, whereby the raw signal was filtered with a digital filter from 20 Hz to 22.5 kHz. Probe (diameter 8 mm, length 7 mm) output was defined with 1 mW. The temperature unit (5 – 50 °C) had a resolution of 0.2 °C. Oxygen saturation (SpO₂) and heart rate (HR) were measured with a Nellcor OxiMax N-595 (Tyco Healthcare Group LP, Pleasanton, CA, USA). The sensors of the experimental devices are shown in Figure 1.

Figure 1

Figure 1: Acupuncture needle at the acupoint St.41 and sensors for recording microcirculation and temperature. In addition, a reflectance sensor for oxygen saturation (SpO₂) and heart rate (HR) measurement is applied.



In addition an infrared thermal imaging device was used in this study. The ThermoCAM P640 (Flir Systems Inc., Portland, Oregon, USA) with optics of 24° x 18° /0.3 m operates at wavelengths ranging from 7.5 – 13 µm and temperature ranging from -40 °C to +500 °C with a sensitivity of 0.06 °C at 30 °C and 30 Hz image frequency.

PROCEDURE AND ACUPUNCTURE POINTS

For the measurements the healthy volunteers lay down in the laboratory (temperature 22 – 23 °C), shielded from outdoor heat for approximately 10 minutes to allow the skin temperature to adjust to room temperature.

The following acupoint mentioned in the introduction was stimulated on the right foot:

St.41 Jiexi [8,9]

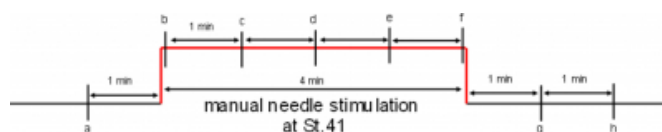
Location: On the dorsum of the foot, at the midpoint of the transverse crease of the ankle joint, in the depression between the tendons of m. extensor hallucis longus and digitorum longus.

Indications: Headache, dizziness, abdominal distension, pain of the ankle joint, muscular atrophy, motor impairment, pain and paralysis of the lower extremities.

The stimulation procedure (manual needle acupuncture) and the measuring profile are shown in Figure 2.

Figure 2

Figure 2: Measurement profile and measurement times (a – h).



To assess the reliability and validity of manual needle acupuncture, acupuncture was carried out by the same Chinese medical doctor experienced in TCM (L.W., MD). Total duration of stimulation was 4 min.

Needle acupuncture was performed using sterile single use needles 0.30 x 30 mm (Huan Qiu; Suzhou, China). After local disinfection of the skin the needling method was perpendicular (0.4 – 0.8 cun) [8]. Stimulation for a duration of 20 sec in intervals of 1 minute consisted of a combination of rotating and thrusting movements using a special manual acupuncture stimulation technique (sedation method). The needle was removed after 4 minutes (comp. Figure 2).

Data recording, thermal imaging (separate session) and microcirculation monitoring were performed at the acupoint urinary bladder 67 (UB.67):

UB.67 Zhiyin [8,9]

Location: On the lateral side of the little toe, about 2 mm proximal to the nail corner.

Indications: As Jing well point, for acute emergencies. Specifically indicated for breech position of the fetus during pregnancy, promotion of labor and analgesia in childbirth.

STATISTICAL ANALYSIS

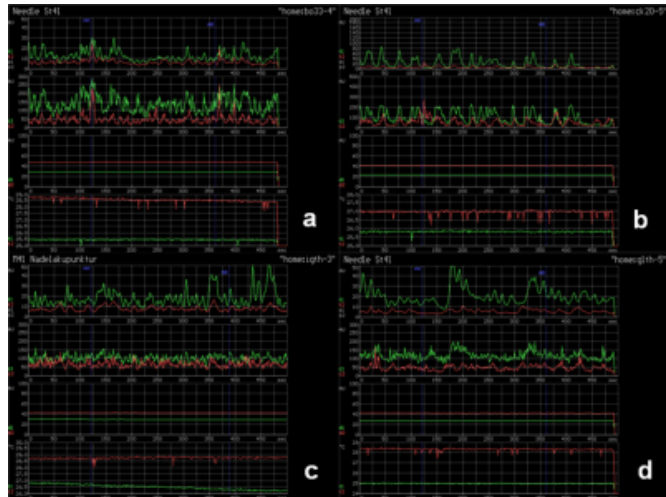
Data were analyzed using SigmaStat (Jandel Scientific Corp., Erkrath, Germany) software. The results were graphically presented as trend curves (contact measurement parameters) and thermal images (non-contact measurement parameters). Changes were considered significant at a p-value < 0.05.

RESULTS

Figure 3 shows typical examples of laser Doppler flowmetry monitoring of the 4 healthy volunteers during needle acupuncture.

Figure 3

Figure 3: Microcirculation monitoring in four healthy volunteers during needle acupuncture at St.41. From top to bottom: Flux, concentration, backscattered light and temperature. Green: UB.67; red: control point (localisation compare Figure 1, Flux2, Temp2).

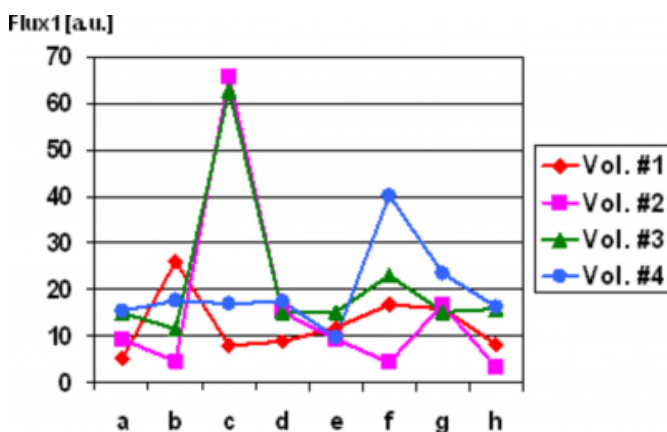


In all test persons the parameter Flux 1 increases significantly during needle acupuncture.

Figure 4 shows the microcirculatory parameter Flux 1 of the four volunteers, measured at the acupoint UB.67 before, during and after manual needling and stimulation of the acupoint St.41.

Figure 4

Figure 4: X-axis: measuring times (a – h; comp. Figure 2); y-axis: Flux 1 in arbitrary units (a.u.) of UB.67 in four volunteers.



The total results of the temperature, flux, oxygen saturation and heart rate measurements are shown in Figure 5.

Figure 5

Figure 5: All registered parameters of four healthy volunteers (mean values at measuring times a – h; comp. Figure 2).

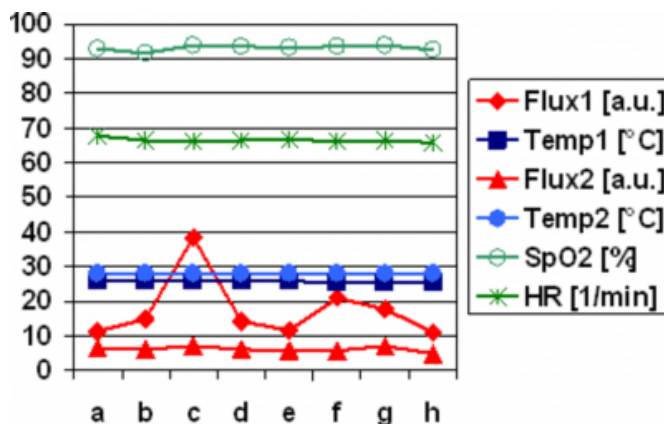
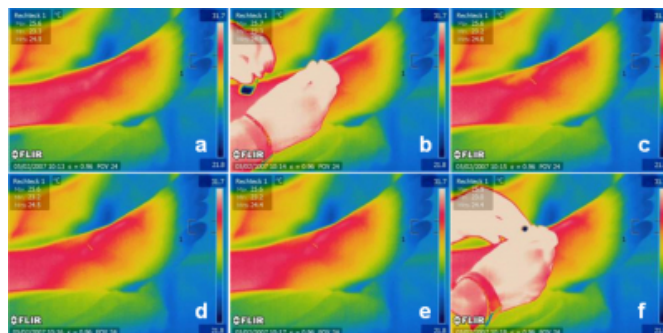


Figure 6 demonstrates graphically thermal images of the right foot (in the front) of a healthy person. No significant changes in temperature were found. Figure 6b shows the insertion of the needle at the acupoint St.41, and Figure 6f the removal of the needle.

Figure 6

Figure 6: Thermographic images of a 48-year-old healthy volunteer during manual needle stimulation at acupoint St.41 (measuring times a – f, comp. Figure 2).



DISCUSSION

Laser Doppler flowmetry is a suitable method for measuring microcirculation on the skin. Possible advantages of this technique, particularly in the field of acupuncture, are currently being evaluated [2].

The present publication describes the data of four healthy volunteers in this field of research and shows that manual needle acupuncture at St.41 has influence on a microcirculation parameter (Flux) at the peripheral acupoint UB.67. It is particularly interesting that Flux significantly increased only 1 minute after beginning acupuncture stimulation. An improvement in local, peripheral microcirculation takes place in three of four volunteers.

At this moment, a number of studies to objectify microcirculation in connection with acupuncture exist in the literature. A review article on this topic was published recently by our research group [2]. There are only few publications available concerning stimulation of the acupuncture point Jiexi (St.41) and microcirculation / temperature monitoring. For example, continuous microcirculation monitoring of the right foot was carried out for the first time in a 62-year-old patient with cryoglobulinaemia before, during and after manual needle insertion at Jiexi using the method of laser Doppler perfusion imaging by our group [10]. In addition to visual inspection, changes in mean perfusion were also used as evaluation parameters in that study. In that case report we also found an average increase in mean perfusion values during acupuncture. At the same time, a decrease at two “spots” in the region of the first and second toe occurred. However, the mean perfusion was markedly increased (+ 76 %) two minutes after removing the needle, compared to the initial value before acupuncture. Our results of that case report suggest that the biomedical technique of laser Doppler imaging is also a useful method for monitoring the effects of acupuncture on the peripheral microcirculation.

CONCLUSION

The present report demonstrates preliminary results on only four volunteers. Therefore it is not possible to draw rash conclusions. However, it seems to be possible that similar effects are present as during stimulation of Neiguan acupoint (Pe.6) at the wrist of the hand, which first significantly reduced skin blood perfusion at the tip of the index finger and then showed a marked increase after 1 minute in microcirculation. This has been proved by our research group in 51 healthy volunteers recently [11].

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CORRESPONDENCE TO

Gerhard Litscher, Prof MSc PhD MDsc Research Unit of Biomedical Engineering in Anesthesia and Intensive Care Medicine and TCM Research Center Graz Medical University of Graz Auenbruggerplatz 29 A-8036 Graz Austria Tel. ++43 316 385 3907, -83907 Fax ++43 316 385 3908 Email: gerhard.litscher@meduni-graz.at <http://litscher.info> <http://litscher.at>

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Author Information

Gerhard Litscher, MSc PhD MDsc

Research Unit of Biomedical Engineering in Anesthesia and Intensive Care Medicine and TCM Research Center Graz,
Medical University of Graz

Lu Wang, MD

Research Unit of Biomedical Engineering in Anesthesia and Intensive Care Medicine and TCM Research Center Graz,
Medical University of Graz

Ingrid Gaischek, MSc

Research Unit of Biomedical Engineering in Anesthesia and Intensive Care Medicine and TCM Research Center Graz,
Medical University of Graz