The effect of acupuncture on oral microcirculation in healthy volunteers: an exploratory study

Giuseppe Alessandro Scardina, A Ruggieri, F Provenzano, P Messina

ABSTRACT
Background: Acupuncture is a therapeutic technique currently used in the treatment of many pathologies. The aim of this study is to evaluate the potential effect of acupuncture on “in vivo” variations in oral microcirculation in healthy subjects.

Methods: An exploratory study was conducted on 40 healthy subjects: 20 cases (mean 55.90, SD 16.04) and 20 controls (mean 51, SD 11.91). Videocapillaroscopy was used to detect variations in oral microcirculation. This method permits an accurate and non-invasive in vivo study of the capillaries of the oral mucous. The site selected for this pilot study is the lower lip since it is the simplest to investigate and is more readily accessible. Assessments were carried out in three phases: t0 before the application of the needles; t1 one minute after the application; t2 five minutes after the application; similar time points were used for the control group. Data were compared using the Mann-Whitney test.

Results: The study showed characteristic changes in oral microcirculation induced by acupuncture. The tortuosity of capillary loops and in the diameter of the afferent microvascular loop changed significantly (p<0.05) over time in the acupuncture group but not in the controls.

Conclusions: The findings lend support to our expectation that acupuncture may generate significant variations in oral microcirculation in healthy adults. Further research is needed to confirm these findings and evaluate the therapeutic role of acupuncture in oral pathologies.

Acupuncture can be considered the principal therapeutic system in Oriental Medicine. Since its introduction in the West in the 19th century, this ancient practice has been the subject of heated debate originating in the distrust with which Western physicians viewed acupuncture in the light of the difference in underlying concepts of the two medical systems. Western physicians base their approach to medicine on the objectivity of anatomical-physiological laws and the centre of their study is the understanding of the aetiology and pathology of conditions as the basis of curative treatment. While this debate continues, acupuncture is proving clinically effective and becoming integrated in Western medicine, so the discussion in the scientific world has moved on to consider the uses and the therapeutic prospects of acupuncture.1–3

Scientific literature contains many reports of the use of methods such as laser Doppler and immunohistochemical examinations to investigate acupuncture.4–7 The idea for this study comes from the absence of basic research into acupuncture’s effect on conditions in oral medicine and surgery pathologies, considering the relatively wide use of acupuncture in dentistry. Its aim is to explore the possible variations in microcirculation in the labial mucosa in healthy subjects given acupuncture.

MATERIALS AND METHODS
The study was conducted on 40 subjects who had no history of any systemic pathology, did not take medicines and were non-smokers, thus meeting our definition of healthy volunteers. Twenty volunteers were recruited for the intervention phase with acupuncture, following which 20 further volunteers were recruited as controls without intervention. The intervention group was composed of 20 subjects, nine males and 11 females. The age range varied between 25 and 67 years (mean 55.9, standard deviation (SD) 16.04). The control group was composed of 20 subjects, nine males and 11 females. The age range varied between 27 and 65 years (mean 51, SD 11.91) (table 1) After having signed the informed consent to proceed with acupuncture, videocapillaroscopic examination and the processing of personal data, the volunteers were submitted to the complete study of labial microcirculation under acupuncture. The observations were conducted at three time points. For the intervention group:

- t0 Capillaroscopic study of oral microcirculation before acupuncture (this represents the baseline for comparing subsequent measurements of the microcirculatory system);
- t1 Capillaroscopic study following the introduction of needles in the pre-arranged points after around 1 minute from the insertion and stimulation of the needles;
- t2 Capillaroscopic study after a second stimulation at 5 minutes after the insertion of the needles.

The observations were made in the control group in equivalent three time intervals and in the same conditions, except without the introduction of needles, to control for the effects of time, position and breeze in the room.

Acupuncture

The acupuncture technique employed in the study is based on Traditional Chinese Medicine. Ten sterile, disposable, slender needles with a steel body and a copper head were applied through a guide tube. The dimensions of the chosen needles were 0.26 mm in diameter and 25 mm in length, and needles were retained for 15 to 20 minutes. The acupuncture points stimulated were: SI1, TE1 and LI4 unilaterally; TE21, ST5 and ST6 bilaterally; and CV24 in the midline.

The angle and depths of insertion were: SI1, perpendicular, to 2 mm; TE1, perpendicular, to 2 mm; LI4, perpendicular, to 1–2 cm; TE21, perpendicular, to 1–2 cm; ST5, perpendicular, to 0.5–1 cm;
ST0, perpendicular, to 0.5–1 cm; CV24, oblique, to 0.5–1 cm. The response of de qi was elicited, accompanied by redness and a feeling of numbness around the needles. The operator (FP) had a specific experience in the clinical application of acupuncture in the field of dentistry and particularly in the integrated therapy of temporomandibular dysfunctions and in atypical facial pain.8

**Table 1** Age and gender of the intervention and control group enrolled in the study

<table>
<thead>
<tr>
<th></th>
<th>Intervention group</th>
<th>Control group</th>
</tr>
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<tbody>
<tr>
<td>M/F</td>
<td>9/11</td>
<td>9/11</td>
</tr>
<tr>
<td>Age range in years</td>
<td>25–67</td>
<td>27–65</td>
</tr>
<tr>
<td>Age, mean (SD)</td>
<td>55.90 (16.04)</td>
<td>51 (11.91)</td>
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</tbody>
</table>

**Table 2** Capillaroscopic measurements (mean, (standard deviation)) at baseline and at two observation time points in healthy volunteers with either no intervention (control) or acupuncture (intervention)

<table>
<thead>
<tr>
<th>Capillaroscopic parameter</th>
<th>Control group</th>
<th>Significance</th>
<th>Intervention group</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tortuosity</td>
<td>t0: 1.58 (0.40) NS</td>
<td>t0: 1.78 (1.20) p = 0.021</td>
<td></td>
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<tr>
<td>t0 – t1</td>
<td>t1: 1.91 (0.38) NS</td>
<td>t1: 4.78 (1.80) p = 0.032</td>
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<tr>
<td>Density of capillaries</td>
<td>t0: 29.10 (6.56) NS</td>
<td>t0: 32 (10.6) NS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>t0 – t2</td>
<td>t2: 29.75 (4.78) NS</td>
<td>t2: 29.20 (8.23) NS</td>
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</table>

**Video capillaroscopy**

Oral videocapillaroscopy (Videocap 200 DS Medigroup, Milan, Italy) is a simple, repeatable, non invasive, panoramic technique that is performed in vivo and is well tolerated by the patient. The technique does not require any limitation on oral consumption of drink or food in a period before the study. This computerised technique is used with specific software that allows the acquisition and elaboration of the data. Our unit has gained considerable experience with the technique over many years and have standardised the methods.

The videocapillaroscope is made up of a central unit, a fibre optic probe with video-optic terminal and a high resolution colour monitor. The central body includes a light source consisting of a cold halogen light emitted by a 100 W lamp fitted with an automatic or manual control device to regulate the luminosity. The probe is made up of a flexible cable containing a bundle of optic fibres, and a cable which connects the unit that elaborates the video signal contained in the central unit to the video-optic terminal. The terminal itself is made up of a colour micro television camera and a support for holding different lenses. The lens has a focal spot (the area of the optic field visible when the apparatus is in focus) of 1.811 mm² and enlargements which vary from 10 to 1000×. For the study in question, a 200× enlargement was used.

The morphofunctional evaluation of microcirculation is based on specific parameters—length of the capillary loop, diameter of the loop, diameter of afferent and efferent loops, capillary tortuosity and density. The videocapillaroscopic investigation was always performed with the subjects seated, with the same light source, at the same room temperature (23°C), in the morning, by the same operators (GAS, AR) and repeated twice for every area under investigation.9 10 The data acquisition was completely automated after each operator (GAS, AR) had selected a suitable field for measurement and the parameters to be measured. The site selected for the study was the mucosa of the lower lip.

**Statistic analysis**

An exploratory statistic analysis was conducted using the Mann-Whitney U test. The level of significance was p<0.05. The collected data was analysed with StatView 5.0.1 (SAS Institute Inc., Cary, NC). The acquired data refer to the mean value among those acquired in the measurements for every prearranged parameter. The changes from baseline to the two subsequent time points, t0–t1, t0–t2, were compared.

**RESULTS**

In all cases, and at each time point in the study, the visibility of microcirculation during the capillaroscopic examination was clear, and focusing simple and immediate. The direction of the capillaries of the labial mucous in the healthy subjects was parallel to the surface where the probe was set during the examination, and no variations in direction were recorded during the phases in which acupuncture was practiced.

The two groups were similar in age and gender (table 1). The group mean values for the measurements taken are presented in table 2. No significant changes were seen in the control group. In the acupuncture group, statistically significant changes (p<0.05) were observed between baseline and time points t1 and t2 for the diameter of afferent loops, and for the tortuosity of capillaries (as assessed as the number of intersections seen in the field). Changes in length of the capillary loop, diameter of the loop, diameter of efferent loop and density of capillaries were not significant in the acupuncture group.

**DISCUSSION**

Acupuncture needling is associated with increases in capillary tortuosity and diameter of afferent loop in the oral mucosa of health volunteers.

Many branches of medicine employ acupuncture by exploiting its proven effects such as the reduction of pain sensation, or reduction of nausea of chemotherapy or pregnancy. Research is
conducted into new effects not yet proven, for example, variations in hormones such as angiotensin and its use in the complications of dysmetabolic pathologies such as diabetes. In the last two years, many studies have been made on the cardiocirculatory system and in particular on the modulation of the pressure values, on the use of acupuncture as an adjuvant to pharmacological therapies, on the reduction of cancer pain, on treatment of neuropathies and on the investigation of the effects of acupuncture on macro and microcirculation, especially at nail, skin and muscle layer level.

A recent study conducted by Komori et al confirmed that acupuncture stimulation increases the diameter and blood flow velocity of the peripheral arterioles. According to this study, acupuncture stimulation can enhance the microcirculation and may be a useful supportive treatment for diseases caused by poor peripheral blood flow. Besides, the vasomodulatory effect has been previously proven through elegant thermographic methods that showed how acupuncture is able to produce cutaneous and muscular vasodilatation. In addition, it has been shown how the action of acupuncture on microcirculation occurs not only at the cutaneous level, but also in deeper areas such as within the brain circulation. Examinations conducted by means of spectroscopy and fluxometry with laser Doppler have provided proof of how acupuncture can increase the speed of blood flow and modulate perfusion in microcirculation.

In the odontostomatologic field, the most recent studies on the use of acupuncture in oral pathologies concern the treatment of periodontal pathology, orofacial pain and the variation in salivary flow, both on sialorrhoea and, above all, on xerostomia, especially in post-radiation therapy. Currently, there do not exist specific studies on the possible influences of acupuncture on oral microcirculation, especially at a mucosal level and on odontostomatologic patients. Our study demonstrates that acupuncture influences oral microcirculation, causing an increase of the diameter of afferent capillary loop and of tortuosity. This study represents the first and basic analysis of the behaviour of modulated microcirculation by means of acupuncture and it seemed fundamental to have as starting point healthy volunteers, devoid of any local or systemic disorder or pharmacological factor that could previously distort oral microcirculation. The results demonstrated the modulation of microcirculation and this could be of value in conditions in which blood perfusion and microcirculation play an important role in the onset and in the perpetuation of the pathological state, such as in inflammatory pathologies or those accompanied by angiogenesis. Our results showed an effect in healthy subjects, and it is reasonable to suggest that it will be possible to apply this acupuncture technique to patients affected by odontostomatological illnesses, especially where they are also accompanied by an alteration in microcirculation, such as in burning mouth syndrome.

CONCLUSIONS
This original study has shown that acupuncture exerts a modulatory effect on oral microcirculation. Further research will be required to determine which the effective components of the acupuncture intervention are, and their mechanisms. This exploratory study in healthy subjects paves the way for the application of acupuncture in conditions seen in oral medicine and surgery, and further enriches the scientific literature on the effects, mechanisms and effectiveness of acupuncture.
Summary points

- Acupuncture is known to alter blood flow.
- Video-capillaroscopy permits in vivo observations.
- We used it to observe the capillaries of the oral mucosa.
- Acupuncture increased capillary diameter and induced tortuosity.

Competing interests: None.

Ethics approval: The study was approved by the Ethical Committee Department of the University of Palermo.

Provenance and peer review: Not commissioned; externally peer reviewed.

REFERENCES

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