

Acupuncture Points have Subjective (Needling Sensation) and Objective (Serum Cortisol Increase) Specificity

LU Roth, A Maret-Maric, RH Adler, BE Neuenschwander

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Summary

This randomised, controlled trial was to determine if blinded subjects are able to discriminate between needle stimulation at traditional acupuncture points and sham points, based on the appreciation of needling sensation (de qi); and if needling at traditional points is related to the objective parameter of serum cortisol increase. Manual acupuncture at traditional and sham points was applied to 20 healthy male students in a single-blind crossover design. Needle sensation (de qi) was reported as significantly stronger with traditional needling than with sham acupuncture. Needling at traditional acupuncture points moderately, but significantly, increased serum cortisol values at 5, 25 and 45 minutes after cessation of stimulation. Needle sensation did not correlate with serum cortisol levels. Experience of pain did not show a difference between traditional and sham needling, nor did it correlate with serum cortisol levels. We conclude that acupuncture points show subjective (needling sensation) and objective (serum cortisol increase) specificity.

Key words

Acupuncture, Needling sensation, Randomised controlled trial, Serum cortisol, Single-blind crossover design, Specificity of acupuncture points.

Introduction

The specificity of acupuncture points is a much debated issue. Specific anatomical structures have been mentioned (Heine, 1988). Accurate stimulation is said to induce a peculiar needling sensation (*de qi*) (Wang *et al.*, 1985). Electrical skin resistance at acupuncture points is said to be different from other skin areas, but there is some doubt about this (McCarroll and Rowley, 1979). Acupuncture has been shown to increase β -endorphin. The prohormone for the synthesis of β -endorphin, MSH, Lipotropin and ACTH is α -melanocyte stimulating hormone. It was therefore assumed that acupuncture might increase serum cortisol. Under electroacupuncture at traditional acupuncture points compared to non-specific points, Bossut *et al.* (1983) observed an increase of β -endorphin and Cheng *et al.* (1980) of serum cortisol in horses. Liao *et al.* (1979, 1980) found the same effects in rabbits. In an uncontrolled

study Malizia *et al.* (1979) observed significant increases of serum ACTH and β -endorphin in healthy human males. Lee *et al.* (1982) in a controlled study found increases of serum cortisol, but their statistical procedure did not take the heavily skewed distribution of data in their study into account. Potential intervening influences like painful or unequal stimulation of the needles in the two conditions, mood, involvement, anxiety, belief in the effect of acupuncture and behaviour of the acupuncturist were not controlled.

The aims of our study were to determine

- If blinded subjects are able to discriminate between needle stimulation at traditional acupuncture points and sham points, based on the appreciation of needling sensation (*de qi*).
- If needling at traditional points is related to the objective parameter of serum cortisol increase.

The project was approved by the Ethical Board of the University of Berne Medical School.

Method

Experimental procedure

A single-blind crossover design was used. The subjects were 20 healthy male students aged 18 to 35 years. On introduction into the study, 10 were randomly assigned to a group which received acupuncture at traditional points in the first trial and non-traditional, sham points in the second. The other 10 students formed a group which received acupuncture in the reverse order, at sham points first and traditional second. They had been interviewed, along with other students, to determine their suitability to take part. Any disease, intake of medication within the two weeks before the experiments, or experience with or knowledge of acupuncture resulted in exclusion from the trial. If medication was taken between the trials, the interval was extended to 3 weeks instead of 1. If the requirements regarding smoking (not for 12 hours before the trial), fasting and no physical effort (on the morning of the trial) were not followed, the test was delayed by one day.

The interval between the two trials was eight days. At 8.30am two subjects arrived in the laboratory. They were then kept separate from each other. After arrival they filled out questionnaires A and B (Table 1), or in the second trial only questionnaire B.

Table 1

INITIAL QUESTIONNAIRE

Subject	Question	Answers (10cm line)
A 1. Belief in the effect of acupuncture	Do you believe in acupuncture?	It has certainly no effect It is certainly effective
2. Readiness to accept acupuncture	Would you submit yourself to acupuncture as a form of therapy?	Anytime Never
B 1. Relaxation	How do you feel at present?	Completely relaxed Completely nervous, tense
2. Mood	How do you feel at present?	I feel completely uneasy and depressed I am feeling very optimistic and fine
3. Expectation of pain	Are you anxious about feeling pain from acupuncture today	Yes, I am very anxious No, I feel completely free of anxiety

Table 2

QUESTIONNAIRE AFTER ACUPUNCTURE

Subject	Question	Answers (10cm line)
C 1. Experience of pain	How did you experience the needling?	Absolutely painless Extremely painful
2. Needle sensation	Did you have a special feeling during the needling?	Intense prickle, feeling of warmth, heaviness, electricity, etc. Nothing at all
3. Degree of relaxation	How did you feel during treatment?	Completely calm and relaxed Completely tense and rigid
4. Degree of control	How did you feel during treatment?	I felt always in control I felt completely helpless and at the mercy of the experimenter
5. Involvement	How did you feel during treatment?	I was absolutely indifferent I was completely involved
D 1. Behaviour of the physician	Did the doctor behave differently today compared to the first trial?	No difference Significantly different

At 8.40am a venflon intravenous canula (1mm diameter) was inserted on the dorsal side of the hand. Venous blood was collected in heparinised 5ml plastic tubes and centrifuged immediately after collection (10min at 3000rpm). The serum was subjected to fluorescence immuno assay (*Stratus, Baxter Diagnostic Inc.*) for Cortisol, measured in nmol/l. At 9.10 the first blood sample was drawn. At 9.15 acupuncture was started. At 9.30 the second blood sample (during acupuncture) was drawn. At 9.45 the acupuncture needles were removed. At 9.50 (5min. after the end of acupuncture) the third blood sample was drawn; at 10.10 the fourth (25min after termination of acupuncture); and at 10.30 the fifth sample (45min. after termination). At 10.35 the venflon canula was removed. Questionnaire C was filled out after the first trial, and questionnaire D after the second (Table 2).

Each subject received a booklet at least 14 days before the first trial. It gave an account of the experimental procedure, a short description of possible side effects and risks of acupuncture, training questionnaires, a form for declaration of informed consent, the exact dates of the trials and an agreement to pay the subject 40 Swiss francs for participation. The booklet contained the following instructions: to present themselves in a fasting state (last meal on the evening before the trials), to stop smoking at least 12 hours before the trials, and to take no medication during the last 14 days.

Needling

The depth of acupuncture needle insertion was 8mm (± 2 mm), with the needles perpendicular to the body surface. Six *Seirin* needles, diameter 0.3mm, and length 30mm were manually stimulated: every five minutes three rotations were applied within 2 seconds without using pressure or pulling. Each subject was treated at both trials by the same acupuncturist.

AM and LR are physicians who have successfully completed the Swiss national board exam for the degree of physician, and who conducted the present study as part of the requirements for their MD degree. They were trained in acupuncture at the Ludwig Boltzman Institute for Acupuncture, Kaiserin Elizabeth Hospital, Vienna, and by the Swiss Society for Acupuncture.

Subjects were asked to lie on the abdomen, so they could not see the needles. In both the traditional and sham groups, three points were bilaterally stimulated. In the traditional group these were:

- Tsusanli*, one finger breadth lateral to the lateral border of the tibia at the level of the tibial tuberosity.
- Shenshu*, between the lateral processes of L2 and 3, two finger breadths paramedially.
- Chishi*, between the lateral processes of L2 and 3, four finger breadths paramedially.

The three bilateral sham points were at least 5cm away from a correct acupuncture point, at least 3cm

from a "meridian", and not in the same dermatome as the selected specific point. They were at:

- i. The lateral head of the gastrocnemius muscle, halfway between the head of the fibula and the angle of both gastrocnemius muscles.
- ii. Halfway along the lateral margin of the scapular bone with the arm adducted.
- iii. At the inferior angle of the scapular bone with the arm adducted.

Questionnaires on understanding, expectation and experience were completed by the subjects using visual analogue scales of 100mm length, the ends of which were marked by the statements shown in *Tables 1* and *2*. All subjects completed the trials satisfactorily.

Statistical Analysis

The relative serum cortisol values after traditional and sham acupuncture were compared using Wilcoxon-Ranksum Tests. Medians and confidence intervals for relative cortisol values at the five sampling times were computed using a Bootstrap analysis (10). Wilcoxon-Ranksum tests were used for the comparison of factors thought to be able to confound the cortisol values. The correlations between the co-factors and serum cortisol values were assessed by the Spearman coefficient of correlation. A Bootstrap analysis was used to assess the confidence intervals of the correlation between the co-factors and the relative serum cortisol values.

For the comparison of traditional with sham acupuncture, relative cortisol values were used. The relative value is expressed by subtracting the sham value (S) from the traditional (T), divided by the sham value times 100; $(T-S)/S \times 100$.

These values take into account the individual levels of serum cortisol: e.g. see *Table 3* to find the relative cortisol value of subject No.1 at the fourth time point (25 min after the trial), $T = 374$, $S = 309$, thus $374-309/309 \times 100 = 21\%$.

Results

Cortisol values at the five sampling times for each of the 20 subjects with traditional and sham acupuncture are shown in *Table 3*.

The difference between traditional and sham acupuncture steadily increases over time and yields significantly higher cortisol values towards the end of the time period (*Table 4*).

Table 5 presents the Bootstrap analysis for the median and its confidence interval for relative cortisol levels at the five sampling times. The median increases over time and is about 20% higher towards the end. Since the distribution of the cortisol levels was heavily skewed, the median and not the mean was used.

In regard to the questionnaire items, only the needling sensation ($p=0.0002$) was experienced as differing between traditional and sham acupuncture. With traditional acupuncture the subjects felt the typical needling sensation (*de qi*) of intense prickling, warmth, heaviness and electricity.

Table 6 illustrates the Bootstrap analysis for the Spearman correlations between the questionnaire

Table 3

ABSOLUTE SERUM CORTISOL VALUES (nmol/l)

Subject		5min before	During trial	5min after	25min after	45min after
1	S	494	410	431	309	304
	T	351	320	368	374	368
2	S	648	555	518	356	382
	T	320	377	475	442	437
3	S	457	441	403	331	322
	T	563	535	492	372	345
4	S	335	256	264	248	235
	T	195	276	356	303	246
5	S	469	417	316	267	251
	T	376	397	421	316	279
6	S	372	272	258	212	188
	T	616	506	559	491	416
7	S	454	400	341	344	340
	T	458	563	509	456	397
8	S	361	306	337	283	254
	T	587	501	385	304	288
9	S	343	379	328	288	261
	T	282	262	294	309	298
10	S	320	374	311	298	247
	T	455	396	420	352	310
11	S	129	126	110	154	117
	T	205	235	267	278	280
12	S	374	381	358	323	289
	T	490	447	415	372	330
13	S	245	236	219	217	164
	T	342	319	361	261	249
14	S	247	240	200	193	194
	T	287	269	232	326	267
15	S	394	358	315	258	246
	T	301	268	244	251	252
16	S	384	310	324	259	267
	T	303	239	212	246	388
17	S	260	227	195	176	166
	T	450	648	788	811	644
18	S	417	398	330	271	216
	T	353	315	360	259	239
19	S	437	415	387	355	314
	T	350	447	454	351	522
20	S	436	351	334	279	294
	T	335	306	328	363	344

S = Sham T = Traditional

items (difference between traditional and sham) and the serum cortisol values 45min after acupuncture. Due to the small sample size the confidence intervals are large and the analysis suggests only a possible correlation between relaxation and cortisol values.

Discussion

The results indicate that acupuncture points show subjective (needling sensation) and objective, physiological (increase of serum cortisol) specificity. The needling sensation was different at traditional as opposed to sham points of stimulation. It could be argued that it is the needling sensation and not acupuncture *per se*, which induces the rise in cortisol levels. The observation that the intensity of the needling sensation and serum cortisol levels showed no correlation opposes this interpretation.

Table 4

RELATIVE SERUM CORTISOL LEVELS

	5min before	During trial	5min after	25min after	45min after
Positive ranks (n=increase of cortisol)	10	12	14	16	20
Negative ranks (n=decrease of cortisol)	10	8	6	4	0
p	0.823	0.351	0.021	<0.001	<0.001

Table 5

MEDIAN AND CONFIDENCE INTERVALS FOR RELATIVE CORTISOL VALUES

	5min before	During trial	5min after	25min after	45min after
Median values	-7	7	17	19	17
Confidence intervals	-20 +35	-17 +28	4 35	10 27	14 41

Table 6

CORRELATIONS BETWEEN QUESTIONNAIRE ITEMS AND SERUM CORTISOL VALUES 45min AFTER ACUPUNCTURE

Factor	Correlation	Confidence Interval
Needling sensation	0.306	-0.213/0.657
Relaxation	-0.481	-0.729/-0.079
Belief in the effect of acupuncture	-0.255	-0.653/0.299
Acceptance of acupuncture	-0.271	-0.636/0.142
Expectation of pain	-0.105	-0.544/0.320
Even mindedness	0.093	-0.407/0.537
Mood	0.068	-0.440/0.506
Experience of pain	0.078	-0.366/0.490
Degree of control	0.015	-0.457/0.433
Involvement	0.288	-0.191/0.716
Physician behaviour	0.105	-0.420/0.616

That pain intensity does not differ between traditional and sham acupuncture, and is not related to the serum cortisol levels, argues in favour of the specificity of acupuncture points.

Answers to the questionnaire items "Belief in the effect of acupuncture", "Readiness to accept acupuncture", and "Behaviour of the physician" were unrelated to the serum cortisol levels. Answers to the items: "Relaxation", "Mood", "Expectation of pain", "Degree of control", and "Involvement" were no different with either form of acupuncture, nor did these factors correlate with serum cortisol levels. However, the "Degree of relaxation" did eventually correlate negatively with serum cortisol levels, which is in keeping with the known relationship between cortisol and stress.

This study is to our knowledge the first showing an increase of serum cortisol under manual acupuncture. In comparison to Malizia *et al.* (1979) ours was a controlled study, confirming the observations of Lee *et al.* (1982), but with the additional control of potential intervening psychological factors.

The specificity of acupuncture points receives some support through our data, despite the fact that

the anatomical and electrophysiological properties of these points are far from defined.

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Lothar U Roth MD

Chirurgische Abt., Bezirksspital, Herzogenbuchsee

Alexander Maret-Maric MD

Orthopädie, Inselspital, Bern

Rolf H Adler MD

Med Abt CL Lory-Haus, Inselspital, Bern

Beat E Neuenschwander PhD

Bundesamt für Gesundheit, Abt Medizin, Liebefeld

Address for correspondence

Prof Rolf H Adler

Med Abt CL Lory-Haus, Inselspital

3010 Berne, Switzerland

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