

INTRODUCTION *deqi* is a composite of unique acupuncture sensations. It implicates the mobilization of *qi* (vital energy) that is related to clinical efficacy according to traditional Chinese medicine (TCM). How *deqi* differs from sensations elicited by conventional modes of sensory stimulation needs to be clarified in investigations of acupuncture mechanisms. In our acupuncture fMRI studies, we interviewed the subject for the sensations experienced during the procedures. The sensations asked were based on acupuncture clinical practice and TCM literature¹ rather than pain questionnaires in current literature^{2,3}. The purpose of the study was to identify the sensations salient to acupuncture and to detect if there are differences between frequently used classical acupoints.

METHODS

Subjects: 56 right handed, acupuncture-naïve volunteers, 36 F/20 M, age 20-47 y.o. (mean 29, SE 0.41). They were blinded to the order of acupuncture and sensory control and could not see the procedure being performed.

Acupuncture: right LI4, ST36 and LV3 in the same subject, duplicate runs for each point

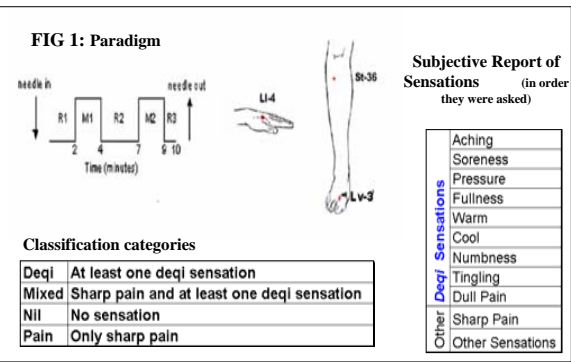
Paradigm: Fig 1. Needle rotation, even motion, 60/min x 2min (M1, M2) Rest periods with needle in place (R1, R2, R3)

Interview after each run about sensations for response classifications (Tables 1a,b) Sharp pain = noxious stimulus

Intensity of sensations rated on a scale of 0-10 (1-3= mild, 4-6=moderate, 7-9= strong, 10=unbearable).

Control: Tactile stimulation over acupoint with 5.88 von Frey monofilament and a matched paradigm.

Data Analysis X2, ANOVA, Spearman's correlation analysis and discriminant analysis were performed to compare the psychophysical response between acupuncture and tactile stimulation.



Classification categories

Deqi	At least one deqi sensation
Mixed	Sharp pain and at least one deqi sensation
Nil	No sensation
Pain	Only sharp pain

FIG 5 A,B,C: Sensations salient to acupuncture *deqi*

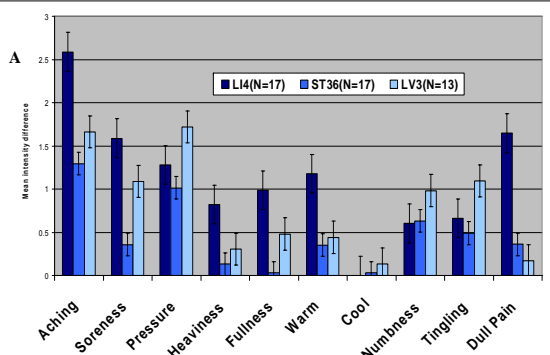


FIG 5A. Mean intensity difference per subject between acupuncture and sensory. For each sensation, the mean intensity difference is found through the summation of the differences between acupuncture and sensory in each of the subjects divided by the total number of subjects.

FIG 5B. Sensations ranked by magnitude of mean intensity difference between acupuncture and sensory control

	Aching	Soreness	Pressure	Heaviness	Fullness	Warm	Cool	Numbness	Tingling	Dull Pain
LI4	10	8	7	4	5	6	1	2	3	9
ST36	10	5	9	3	1.5	4	1.5	8	7	6
LV3	9	7	10	3	5	4	1	6	8	2

10=largest difference, 1=smallest difference).

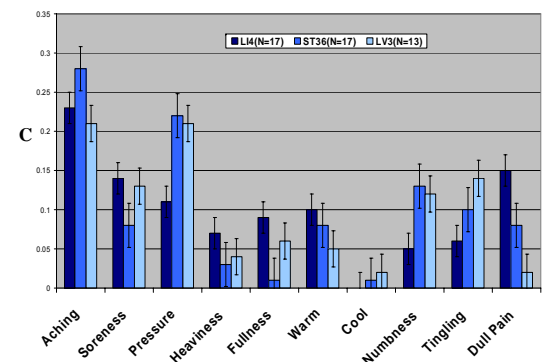


FIG 5C. Intensity of *deqi* weights normalized to a sum of 1 per acupoint. The sensations with largest *deqi* weights between the acupuncture and sensory indicate that they are more characteristic of acupuncture than of sensory control. Aching had the largest *deqi* weight for LI4 and ST36 and the next to largest for LV3 (See FIG 5B). Pressure also had a large *deqi* weight for all three acupoints. Dull pain had a large *deqi* weight for LI4, but only a small weight for LV3. Differences were observed between acupoints.

FIG 7 Tables 1-3 Patterns characteristic of acupuncture

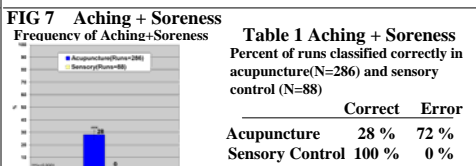


Table 1 Aching + Soreness
Percent of runs classified correctly in acupuncture (N=286) and sensory control (N=88)

	Correct	Error
Acupuncture	28 %	72 %
Sensory Control	100 %	0 %

The concomitant presence of aching and soreness can be used to classify a procedure as acupuncture with a very low false positive rate. In fact, aching and soreness never occurred together in sensory control, but they occurred together in 28% of acupuncture runs. (presence=acupuncture, absence=sensory control)

Table 2 Aching and/or soreness
Percent of runs classified correctly in acupuncture (N=286) and sensory control (N=88)

	Correct	Error
Acupuncture	55%	45%
Sensory Control	97%	3%

Aching and soreness are significantly more frequent in acupuncture than in sensory control (See FIG 2). Using the composite of the presence or absence of these sensations, one can correctly classify more than 55% of acupuncture and 97% of sensory control runs. (presence=acupuncture, absence=sensory control).

Table 3 Aching, Soreness, Pressure or Numbness
Percent of runs classified correctly in acupuncture and sensory control

	Correct	Error
Acupuncture	69%	31%
Sensory Control	88%	12%

These sensations are significantly more frequent in acupuncture than in sensory control (FIG 2). If any of these four sensations occurred, it was usually an acupuncture run whereas if none occurred it was usually sensory. Using the composite of the presence or absence of these sensations, one can correctly classify more than 69% of acupuncture and 88% of sensory control runs (presence=acupuncture, absence=sensory control).

DISCUSSION and CONCLUSION

The study shows that acupuncture and sensory control produce different patterns of psychophysical sensory response, and a subset of sensations are more characteristic of acupuncture. These findings contribute to the understanding of the characteristics of *deqi*. Aching had largest *deqi* weight for 2 of the acupoints and the next largest for the third (FIG 5C). The occurrence of aching together with soreness can be used to discriminate acupuncture from sensory control with a very low false positive rate (Table 1, FIG 7). The occurrence of aching and/or soreness can correctly classify a larger percentage of runs (Table 2, FIG 2). When the occurrences of four sensations are considered even more acupuncture runs can be classified correctly (Table 3, FIG 2). The finding that LI4 elicited the strongest response as indicated by the number and intensity of *deqi* sensations is consistent with the well-known potency of this acupoint in clinical practice (FIG 3, FIG 5C). Many of the sensations reported are conducted by A γ and A δ fibers⁴. The data will be further analyzed to search for correlations of the reported sensations with the types of receptors and nerve fibers at the acupuncture sites as well as the relationship between the sensations and the central effects measured by fMRI.

References:

- Cheng X N (1987), Chin Acupuncture and Moxibustion, Beijing, Foreign Languages Press
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RESULTS

FIG 2: Comparison of frequency of sensations between acupuncture and sensory (all response groups)

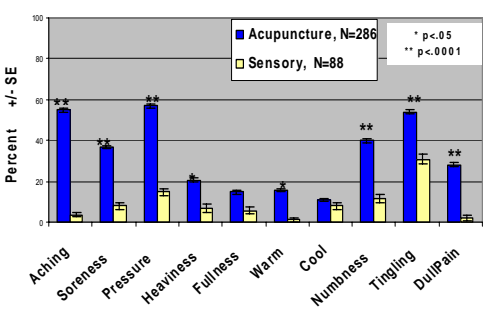
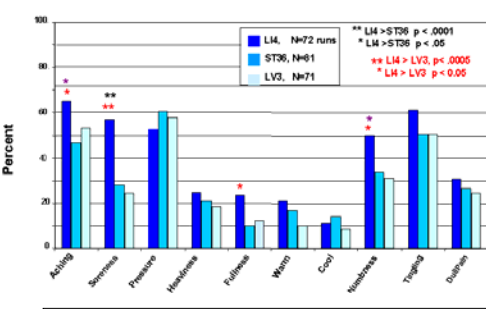


FIG 3: Comparison of frequency of sensations between acupoints (all groups)



LI4 elicited the strongest response. LI4 elicited significantly more sensations than ST36 and LV3. Soreness and numbness occurred twice as often as at ST36 and LV3, aching 1.4 times and fullness 2.4 times as frequent as at LV3. No significance difference between ST36 and LV3.

Aching, soreness, pressure, numbness, tingling and dull pain, were significantly more frequent in acupuncture than in sensory control (30-58% vs. 3-30%) In sensory control, tingling was fairly common, other sensations occurring in 15% or less.

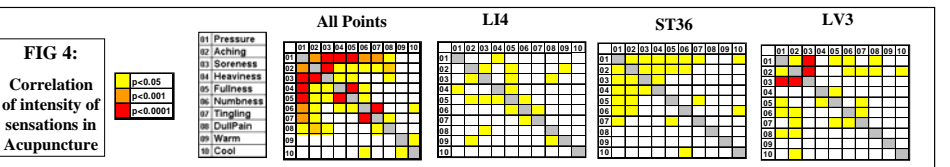


FIG 4: Correlation of intensity of sensations in Acupuncture