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Does the effect of acupuncture depend on needling sensation and manipulation?

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KEYWORDS
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Summary
Background: Acupuncture sensation and manipulation have been considered to be an important component of acupuncture in traditional Asian medicine. However, there has been limited research as to whether acupuncture sensation is associated with therapeutic benefit. This study investigated the relationship between acupuncture sensation and analgesic effect according to acupuncture manipulation.
Method: Fifty-three healthy volunteers received three different forms of acupuncture in a single-blinded crossover design: superficial needling (0.3 cm), deep needling (2 cm) and needling with bi-directional rotation. The effects of acupuncture were evaluated by using the pressure pain threshold. Acupuncture sensation measurement was done in two ways.
Results: Both total acupuncture sensation and increase of the pressure pain threshold were maximum in needling with rotation, followed by deep needling and superficial needling. Repeated-measure analysis of variance (ANOVA) analysis was carried out to assess whether there was a significant difference; both showed significant difference ($p = 0.000$, 0.003). A paired sample *t*-test was carried out, which revealed that needling with rotation showed significant difference from both superficial needling and deep needling. Further, the correlation between the total acupuncture sensation and changes in pressure pain threshold were calculated using Pearson correlation; there was a significant correlation ($p = 0.002$, $p = 0.013$).
Conclusion: Acupuncture sensation and pressure pain threshold increase according to the depth and rotation of acupuncture. Especially, both display significant increase with needle rotation. Further, there is a significant correlation between acupuncture needling sensation and increase in pressure pain threshold. It seems that needle rotation and acupuncture sensation play an important role in verifying the effect of acupuncture.
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Introduction

Acupuncture sensation is one of the most important components in acupuncture treatment. Traditionally, while acupuncture needles were inserted, manipulated and retained, patients felt acupuncture sensations of numbness, heaviness, soreness and distension. Deqi is a key term related to this needle sensation, and it refers to excitation

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of qi through the acupuncture channels/meridians by means of needle stimulation. Deqi is assumed by many acupuncturists to be associated with a therapeutic effect and is often sought during needling.[2,8,11] More precisely, both the administering acupuncturists and the patient may be able to detect signs of deqi.[9,11,22] Early definition of deqi focussed on the acupuncturist's perception, but in recent years, researchers have put more weight on the patient's subjective needling sensation.[11,22]

Traditionally, acupuncture sensation has been described to have distinctive features that distinguish it from acute pain. There have been a number of studies to monitor the needling sensation and to create a credible rating scale for subjective sensation.[7,10,11,21,26,28] Further, recent attempts to clarify the needling sensation associated with deqi have concluded that a grouping of seven sensations is associated with the category of deqi ('aching', 'dull', 'heavy', 'numb', 'radiating', 'spreading' and 'tingling'), and a grouping of nine sensations ('burning', 'hot', 'hurting', 'pinching', 'pricking', 'sharp', 'shocking', 'stinging' and 'tender') with the category of acute pain.[19]

There have been some researches investigating the physiological basis for needling sensation. A 1985 study investigated the relationship between characteristics of needle sensation and groups of afferent fibres,[27] and some studies have found that acupuncture stimulation increases both skin and muscle blood flow[23] and blood flow velocity,[16] which may have resulted in acupuncture sensations of warm, radiating and energetic feeling. Recently, there have been some studies that used functional magnetic resonance imaging (fMRI); Limbic and paralimbic structures displayed the attenuation of signal intensity when experiencing deqi.[5] Further, deactivation of the limbic—paralimbic—neocortical network, as well as activation of somatosensory brain regions, was associated with deqi.[6] There were different activation and deactivation patterns of the brain between the predominant deqi group and the acute pain group.[1]

However, there are opposing results about whether specific acupuncture needling sensations, including deqi, are associated with therapeutic benefit.[11] In a small clinical trial of acupuncture for osteoarthritis of the knee, the participants' experience of deqi sensation was a predictor for improved outcome.[25] A pilot study also found a relationship between acupuncture analgesia, numbness and soreness, but not for other sensations commonly associated with deqi.[10] However, White et al. *conducted* a secondary analysis of data gathered in a randomised controlled clinical trial and found no relationship between the strength of *deqi* and pain reduction for osteoarthritis of the knee and hip.[29]

There has been limited research compared the analgesic efficacy and acupuncture needling sensation within individuals. Only one pilot study investigated the influence of manual, electro, and placebo acupuncture in a single subject cohort.[10] We thought that difference in depth and rotation of the acupuncture is the important factor to investigate the relationship between acupuncture needling sensation and analgesic effect according to acupuncture stimulation.

Bi-directional rotation of a needle inserted into deep soft tissue produces a greater acupuncture needling sensation intensity when compared to superficial needle insertion with mock deep penetration and bi-directional rotation.[3] A study reported that introduction of needle rotation significantly increased the deep, dull, heavy sensation.[22] Further, a preliminary study indicated a strong connection between acupuncture sensation and both tissue depth and needle rotation[22] In addition, there is a hypothesis that winding of tissue during needle rotation causes deqi, and needle manipulation transmits a mechanical signal to connective tissue cells *via* mechano-transduction.[13–15] Moreover, an Australian research group reported that needle manipulation increased the pressure pain threshold (PPT).[30]

We hypothesised that different intensities of stimulation, in the order of superficial needling, deep needling and needling with rotation, may cause different acupuncture sensations and as a result we can investigate the relationship between acupuncture needling sensation and analgesic effect within individuals.

Methods

Subjects

A total of 53 healthy volunteers (26 men and 27 women) were recruited by an advertisement posted at Kyung-Hee University, Seoul. The mean age of the participants was 22.1 ± 2.7 years. Inclusion criteria were ages between 18 and 40 years. All subjects participated voluntarily and were given written informed consents. They did not receive any form of compensation. Subjects were excluded if they were pregnant or diagnosed with a chronic medical disorder within 1 year. The study participants did not receive medications or any other medical treatment for at least 1 month before inclusion in the study. The Institutional Review Board at the Kyung-Hee University Hospital approved this study.

Design

Each subject's baseline PPTs were measured in session 1. Then, randomisation was done by throwing a dice. After that, in sessions 2, 3 and 4, acupuncture treatment was done using three modes in random order, and PPT change and acupuncture sensation were measured (Fig. 1). The three acupuncture treatments were superficial needling (0.3 cm), deep needling (2 cm) and needling with bi-directional rotation. The interval between each visit was more than 48 h. Measuring PPT and acupuncture sensation was performed during acupuncture treatment.

Acupuncture

Acupuncture points were selected on their frequent use in pain management: spleen 6 (SP6), spleen 9 (SP9), stomach 36 (ST36) and gallbladder 39 (GB39).[12] All subjects received acupuncture on the left leg. Acupuncture was applied by five trained and licensed acupuncturists with at least 1 year of experience. Acupuncture was performed using stainless steel single-use acupuncture needles (0.20 mm × 30 mm; DongBang Acupuncture). Each acupuncture treatment lasted for 5 min. The superficial needle was inserted to a depth of 0.3 cm and the deep needle was inserted to a depth of

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