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CLINICAL STUDY

Frequency steps and compositions determine properties of needling sensation during electroacupuncture

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Abstract

OBJECTIVE: To investigate the relationship of electro-parameters and the electroacupuncture sensation (EAS), which is thought to be an important factor for optimal treatment.

METHODS: The frequency steps and compositions of three frequently used electrical stimulations were set when the switch of the electroacupuncture apparatus was turned to the second or third grade of the dense-disperse frequency wave (DD2 and DD3, respectively) or the second grade of the continuous wave (C2). Three groups of patients according to the three electroacupuncture stimulations were divided again into three sub-groups according to the stimulated acupoints: the face acupoint Quanliao (SI 18), the upper-limb acupoint Quchi (LI 11) and the back acupoint Dachangshu (BL 25). The EAS values were measured every 5 min during 30 min electroacupuncture treatments using a visual analogue scale.

RESULTS: The frequency compositions of the three electroacupuncture stimulations were 3.3 and 33 Hz, 12.5 and 66.7 Hz, and 3.3 and 3.3 Hz; each frequency step was 30, 54 and 0 Hz, respectively. In each sub-group of the C2 group, the EAS values from 10 to 30 min were significantly weaker than at 0 min. The sensation fluctuations in the DD2 and DD3 groups were different during the 30 min.

CONCLUSION: The greater the frequency step of the electroacupuncture stimulation, the longer the needling sensation lasted. The electroacupuncture stimulations of the DD3 group were unsuitable for the facial acupoint because of its painful and uncomfortable EAS, but more suitable for the back acupoint.

Key words: Electroacupuncture; Electroacupuncture apparatus; Electroacupuncture sensation; Radio waves

INTRODUCTION

Needling sensation is of great importance during acupuncture treatment in Traditional Chinese Medicine (TCM).[1] TCM doctors must pay close attention to their patients' reactions to lifting-thrusting and twirling the needle, and they believe that the needling sensation is closely related to the curative effect of acupunc-

ture. Several pilot studies show that the needling sensation is beneficial to treatment.[2,3]

Electroacupuncture apparatuses have been used for acupuncture treatment since 1960 and have lightened the workload of the acupuncturist. Electroacupuncture sensation (EAS) is a needling sensation aroused by an electroacupuncture apparatus, and has been discussed since the apparatus came into popular use. The earlier apparatuses only emitted a single-frequency signal, called a continuous wave. It is soon found that the EAS becomes weak and even disappears quickly (in approximately 5-10 min) while the patient is being treated by the continuous wave.[4] The rapid decline of the EAS was much faster than the sensation produced by twirling and lifting-thrusting the needle during manual acupuncture. This phenomenon is called the time-dependent electroacupuncture sensation decrease (TESD).

Sensory physiology has shown that constant stimulation causes sensory adaptation.[5,6] The TESD phenomenon is just one example of sensory adaptability. Subsequently, the dense-disperse frequency (D.D.) wave is introduced into the electroacupuncture apparatus to overcome TESD. The D.D. wave consists of two frequency-alternating electrical pulses. The relatively low-frequency pulses are called disperse-frequency pulses, and the high-frequency ones are called dense-frequency pulses. Usually, there are more than three separate grades of continuous waves and D.D. waves on the faceplate of the electroacupuncture apparatus. The frequency composition of each grade is different. [4] The second grade of the continuous wave (C2), the second grade of the D.D. wave (DD2) and the third grade of the D.D. wave (DD3) are used most widely by acupuncturists in China. However, many acupuncturists still complain that DD2 does not fully avoid the TESD, and they have to increase the magnitude of the stimulus to avoid the TESD. Additionally, DD2 and DD3 sometimes make patients too uncomfortable in the treatment.

Although the D.D. wave has been used for more than 50 years, how EAS is evoked by the D.D. wave evoked is still unclear. The present study aimed to elucidate its regularity.

MATERIALS AND METHODS

The frequency compositions of the D.D. wave and the continuous wave of the electroacupuncture apparatus (CMNS6-1, Jiajian Medical Instrument Company, Suzhou, China) were tested by a digital signal oscilloscope (Tektronix TDS2022B, Beaverton, OR, USA).

Subjects and groupings

Totally 270 subjects, ranging in age from 18 to 68 years, were selected from the outpatient department of the People's Hospital of Fujian Province, Fuzhou, China. All subjects were conscious and could walk into the consulting room. Subjects were assigned to groups blindly. This study was approved by the Clinical Research Ethics Committee of the Fujian Academy of Traditional Chinese Medicine. Documented consents from all patients were obtained. 217 subjects, 111 women and 106 men, completed the measurement and the data was analyzed in the end.

Subjects with primary symptoms of facioplegia, neck pain or backache were selected and divided into three groups (DD2, DD3 and C2) randomly according to a random number table. The three frequently used electroacupuncture stimulations, the second and third grade of the dense-disperse frequency wave (DD2 and DD3), and the second grade of the continuous wave (C2) were adopted respectively in the groups.

The acupoints Quanliao (SI 18), Quchi (LI 11) and Dachangshu (BL 25) were selected. Each group was then divided again into three sub-groups. Subjects with a chief complaint and symptoms of facioplegia were divided into sub-groups DD2-ql, DD3-qc and C2-ql, subjects with neck pain into sub-groups DD2-qc, DD3-qc and C2-qc and subjects with backache into sub-groups DD2-dcs, DD3-dcs and C2-dcs in the order of their visits (Figure 1).

Subjects were divided into three groups and each group was then divided again into three sub-groups. C2, subjects were treated with the second grade of the continuous wave; DD2, subjects were treated with the second grade of the dense-disperse frequency wave; DD3, subjects were treated with the third grade of the dense-disperse frequency wave. ql: The subjects with the primary symptoms of facioplegia were treated with acupuncture at Quanliao (SI 18). qc: The subjects with the primary symptoms of neck pain were treated with acupuncture at Quchi (LI 11). dcs: The subjects with the primary symptoms of backache were treated with acupuncture at Dachangshu (BL 25). Ages were compared by one-way analysis of variance (ANOVA) in each sub-group among all three groups, with no significant differences ($P > 0.05$, data not shown).

Visual analogue scale (VAS)

A cardboard ruler was made according to the method of international VAS[7,8] for detecting EAS. The ruler consisted of side A and side B. There was one mark in the middle of side B labelled as the standard feeling point. There were 20 marks with 1-cm intervals from the right to the left on side A. The standard feeling point on side B was at the same place as mark 10 on side A (Figure 2).

Electroacupuncture method

The subjects took a recumbent position in a quiet room at 20-27 ℃. Stainless-steel acupuncture needles with 0.3 mm × 25 mm and 0.3 mm × 40 mm were used (Jiajian Medical Instrument Company, Suzhou, China).

For the sub-groups DD2-ql, DD3-ql and C2-ql, a 25-mm needle was inserted vertically into left Quanliao (SI 18), and a 40-mm needle was inserted agley (at