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Correct Electrode Placement During Sham Stimulation in Transcutaneous Auricular Vagus Nerve Stimulation

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To the Editor,

In recent years, transcutaneous auricular vagus nerve simulation (taVNS) has been used for pain management in chronic musculoskeletal disorders, stimulation of increased parasympathetic activity in autonomic nervous system disorders, reduction of the level of inflammatory cytokines in inflammatory rheumatological diseases, and improvement of motor function in neurological patients. When using this method, different electrode placement methods have been proposed, but there are some situations that need to be considered.

Wu et al. (1) included 92 patients with Meniere's disease in their study. 46 patients received taVNS combined with Betashistine treatment, while 46 patients received sham taVNS combined with Betashistine treatment. The participants were received 12 weeks of taVNS (30 minutes each time, twice a day, five times a week) in this study. In the intervention group, the electrodes were placed on the simba concha and the concha in the outer ear, whereas in the control group, the electrodes were placed in the antihelix. As can be seen in the study by Wu et al (1), in the control group the electrodes (anode and cathode) were placed in such a way that the vagus nerve branches remained between anode and cathode. In this case, it is likely that the vagus nerve was stimulated and it would be wrong to call it placebo or sham stimulation.

Bajd and Munih (2) investigated the effects of basic functional electrical stimulation on surrounding tissues and found that when a stimulating current is applied to electrodes placed on the skin over sensorimotor structures, an electric field is generated between the two electrodes. In this study, the effect of the electrical current between the anode and cathode on the nerve tissue was attempted to be more clearly explained in Figure 1. The flow of ions along the nerve affects the transmembrane potential and can generate an action potential. The action potential spreads along the nerve and causes excitation.

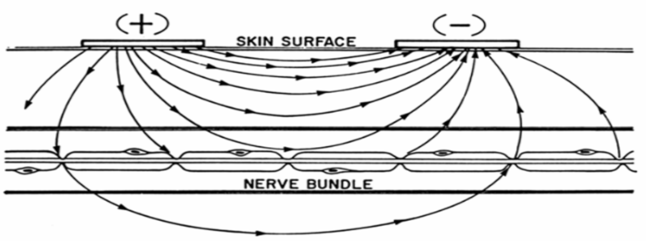

Figure 1. Effect of the electrical field generated by anodal and cathodal electrodes on nerve tissue (2).

Transcutaneous electrical nerve stimulation (TENS), which has been used for peripheral nerve stimulation for many years, delivers electrical currents through electrodes across the intact surface of the skin (3). TENS selectively activates peripheral nerve fibres to produce physiological neuromodulation. In order to achieve neuromodulation, electrodes are placed on each side with the peripheral nerve in the centre and the nerve cells are depolarised by the electrical field created. (4). In order to activate of the nerve fibers with the TENS, the cathode in the form of the current released from the electrodes placed on the skin stimulates the axon, causing deporalization and initiating impulse transmission. Although it is difficult to predict the exact results of electric current related to the non-homogeneous thickness and impedance of the skin, the electrical current is likely to stimulate superficial cutaneous nerve fibers (5).

As a result, if anode and cathode electrodes are placed around a region with vagus nerve branches, vagus nerve stimulation will be a real stimulation and this cannot be called a sham simulation. It is inevitable that the resulting electric field will cause stimulation in the vagus nerve branches.

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Conflicts of interest

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