An Investigation Into the Magnitude of the Current Window and Perception of Transcutaneous Electrical Nerve Stimulation (TENS) Sensation at Various Frequencies and Body Sites in Healthy Human Participants

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Abstract

Introduction: Strong nonpainful transcutaneous electrical nerve stimulation (TENS) is prerequisite to a successful analgesic outcome although the ease with which this sensation is achieved is likely to depend on the magnitude of current amplitude (mA) between sensory detection threshold (SDT) and pain threshold, that is, the current window.

Objectives: To measure the current window and participant’s perception of the comfort of the TENS sensation at different body sites.

Methods: A repeated measure cross-over study was conducted using 30 healthy adult volunteers. Current amplitudes (mA) of TENS [2 pulses per second (pps); 30 pps; 80 pps] at SDT, pain threshold, and strong nonpainful intensities were measured at the tibia (bone), knee joint (connective tissue), lower back [paraspinal (skeletal) muscle], volar surface of forearm (nerve) and waist (fat). The amplitude to achieve a strong nonpainful intensity was represented as a percentage of the current window. Data were analyzed using repeated measures analysis of variance.

Results: Effects were detected for body site and frequency for SDT (P<0.001, P=0.018, respectively), current window (P<0.001, P<0.001, respectively), and strong nonpainful TENS as a percentage of the current window (P=0.002, P<0.001, respectively). The current window was larger for the knee joint compared with tibia (difference [95% confidence interval]=12.76 mA [4.25, 21.28]; P=0.001) and forearm (10.33 mA [2.62, 18.40]; P=0.006), and for the lower back compared with tibia (12.10 mA [1.65, 22.52]; P=0.015) and forearm (9.65 mA [1.06, 18.24]; P=0.019). The current window was larger for 2 pps compared with 30 pps (P<0.001) and 80 pps (P<0.001). Participants rated strong nonpainful TENS as most comfortable at the lower back (P<0.001) and least comfortable at the tibia and forearm (P<0.001).

Conclusions: TENS is most comfortable and easiest to titrate to a strong nonpainful intensity when applied over areas of muscle and soft tissue.