# Transcutaneous Electrical Nerve Stimulation for Relief of Pain of Venopuncture

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TENS (transcutaneous electrical nerve stimulation) has been adopted in the treatment of some types of pain, such as neurogenic pain, low back pain, post herpetic pain[1-3]. In this study we assessed the effect of TENS on the pain of venopuncture.

## Method

TENS was performed 25 times in 19 healthy males and females 18–36 years old. Ten milliliter of 5% glucose solution was injected via a cutaneous vein in one side of the antecubitus or forearm by 24G. injection needle. Five minutes later, the same solution was injected via the corresponding vein on the contralateral side. TENS was given by positive and negative twin electrodes which were positioned so as to sandwich the point of injection of the selected arm. (fig. 1) In 13 trials, TENS was used on the side which was injected first, and in the other 12 trials, to the secondary injected side. Electrodes were made of an alloy of lead and tin (a half piece: about 10g, 5 mm × 20 mm).

The spike current pulse was delivered by the stimulator (®Neuropulse, Hirose electric corp.). Pulse repetition frequency was kept at 50 Hz, pulse duration was 0.1 msec and voltage was estimated to 30–40 V. Its operative amperage was not measured. The intensity of the stimulation was adapted to each individual. The intensity was increased until producing slight pain. This slight pain almost always ceased within a few seconds if kept level, or by temporarily attenuating the intensity. The needle was then inserted. After two injection procedures, every volunteer answered a questionaire about the degree of pain of the puncture. Pain intensity without TENS scored 5, while the pain intensity with TENS was rated individually along a 7 graded scale as follows. 7; Pain was more intense compared to without TENS. 6; Pain was slightly more intense. 5; same degree of pain perceived. 4; pain was slightly milder. 3; pain degree was between 2 and 4. 2; little pain perceived. 1; there was no pain or sensation of puncture.

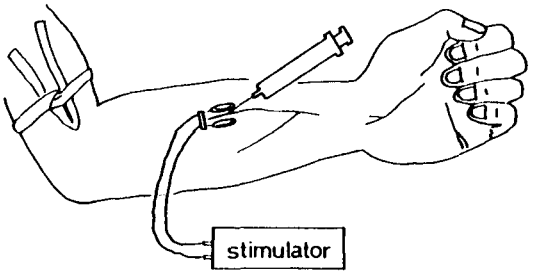


**Fig. 1.** Schematic representation of TENS.

Differences between with TENS and without TENS were analyzed using Wilcoxon's sign test.

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**Table 1.** Representation of pain score results

| pain score | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
|---|---|---|---|---|---|---|---|
| without TENS | | | 25 | | | | |
| with TENS | 0 | 1 | 3 | 6 | 8 | 6 | 1 |

7; Pain was more intense compared to without TENS. 6; Pain was slightly more intense. 5; Same degree of pain perceived. 4; Pain was slightly milder. 3; Pain degree was between 2 and 4. 2; Little pain perceived. 1; There was no pain or sensation of puncture. $P < 0.005$ without v.s. with TENS

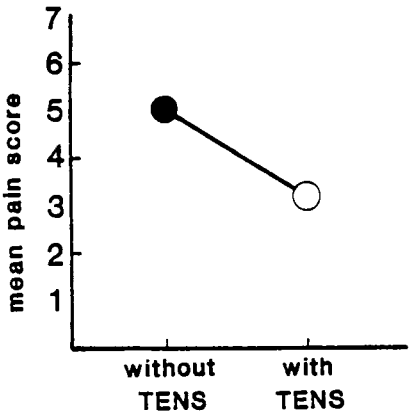


**Fig. 2.** Mean pain score.

## Results

The pain score with TENS decreased in 21 trials in comparison to without TENS, was the same in 3 trials and increased in 1 trial. (table 1) One volunteer perceived no sensation but paresthesia when the needle was even inserted. The pain of venopuncture was decreased significantly with the use of TENS ($P < 0.005$). Mean pain score with TENS was decreased to 3.3 from 5.

## Discussion

The electrodes were made of an alloy of lead and tin, because it's easy to form and to stimulate electrically. Conductive electrode jell was not necessary because electrical resistance of the skin could be kept low, since the electrode firmly touched the skin aided by gravity, and a sterilized solution (chlorhexidine (5%) ethannol 83%) was present between the skin and the electrode which did not readily escape in to vapor. As it was necessary to produce paresthesia over the point of venopuncture, the point of injection was sandwich between the electrodes.

The results from this study suggest that the pain of needle insertion can be decreased markedly, instantly and cleanly without medication to the skin such as local anesthetics. This pain inhibition is probably mainly due to the inhibition of the secondary nociceptive neuron in the spinal cord by large afferent fibers. Presynaptic inhibition may play a role in this type of inhibition of the secondary neuron[4–5]. Descending inhibition also might play some role in this inhibition[6]. This analgesic effect was unlike the effect of acupuncture, because in this study venopuncture was carried out within, at most 30 sec after the start of electrical stimulation whereas pain threshold augumentation by acupuncture is evoked only after about 20 min or longer stimulation (unpublished our data). Low frequency TENS, which would produce an acupuncture-like effect, did not augument pain threshold immediately. Since a low frequency (2–5 Hz) of stimuli did not produce an immediate analgesic effect, for practical reasons a high frequency (50 Hz) stimulation was chosen in this study.

In conclusion, the pain of venopuncture with TENS, which provoked paresthesia over the point of puncture, significantly decreased when compared to without TENS. This suggests that TENS would be useful to carring out painless injections.

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