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2. Paresthesia Coverage for Comparing the Inhibition of Somatosensory Evoked Potentials by Spinal Cord Stimulation and Transcutaneous Electrical Nerve Stimulation

To the Editor:

I read with great interest the article by Wolter et al (1) and appreciated the attempt to answer some important questions on the possible role played by the inhibition of somatosensory evoked potentials (SEPs) by spinal cord stimulation (SCS) used for chronic pain. Although I share with the authors most of their interpretations and opinions, it seems to me that the protocol used to answer the question about the comparison between SCS and transcutaneous electrical nerve stimulation (TENS), was not completely adequate because the 2 stimulations were not applied with the same characteristics. In fact, when applying SCS and TENS, they did not search the complete coverage of paresthesia in the tibial nerve territory, the nerve used for SEPs recordings. Since the coverage of the induced paresthesia is an important prerequisite for SCS efficacy (2), targeting the applied stimulations is indeed very important to adequately compare SCS and TENS. If SCS only covered the tibial nerve territory, the inhibition would be obviously stronger during SCS. In this regard, while it is probable that in the study of Wolter et al (1) SCS effectively covered the whole territory of the tibial nerve, it was unlikely that TENS had the same effect because its electrodes were placed in the medial side of the foot (innervated by the medial plantar nerve, only one of the 2 main terminal branches of the tibial nerve) and at the medial lower leg, 15 cm above the ankle (in the territory of the saphenous nerve).

The comparison of the inhibitory effects of SCS and TENS on SEPs remains an important point to reach for a better understanding of the differences between the 2 types of electroanalgesia and for a possible use of TENS as a screening tool for SCS (3). Interestingly, it is worth noting that the pathophysiological role played by the large diameter fibers (those investigated by SEPs and activated by both SCS and TENS) in neuropathic pain conditions has gained new importance as a consequence of the official redefinition of neuropathic pain as "pain arising as a direct consequence of a lesion or disease affecting the somatosensory system" (4). This system indeed comprises both the spino-thalamic tract (sensory small fibers) and lemniscal tract (sensory large fibers). It follows that, according to the new definition, a lesion or disease involving the large diameter fibers can be considered, logically speaking, a possible cause of neuropathic pain.

Further studies are then warranted to better compare the inhibitory effect of SCS on SEPs, possibly using

direct stimulation of the tibial nerve trunk, proximally to the site used for SEPs stimulation, as already used in the past to prove the inhibitory effect of TENS on SEPs (5).

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In response:

We thank Dr. Buonocore for his comments on our study. Indeed, to gain further insights about the mechanisms of action of SCS, also a better knowledge of the effects of SCS as compared to a peripheral stimulation such as TENS, is warranted. Not only from a theoretical point of view, but also from a clinical perspectiv, it would be interesting to know whether or not, on principle, SCS has advantages over a peripheral stimulation. In some conditions (such as postherpetic neuralgia) both SCS (1) and subcutaneous stimulation (or peripheral nerve field stimulation) (2) are possible. Thus closer information about the expectable magnitude of the effect would facilitate the decision for one or the other technique.

The inhibition of SEP amplitudes by SCS is a known phenomen (3-5), but a correlation to the clinical pain relieving effect of SCS has not yet been shown (5).

The examination of SEP amplitudes nonetheless offers the possibility of an objective technical measure of the effects of both TENS and SCS. However, there are a couple of difficulties, inherent to such a comparison, besides the position of the electrodes. The results therefore must be interpreted with caution. Available TENS and SCS devices have different control modes and it can be difficult, if not impossible, to adjust the systems in an equal manner regarding frequency and impulse duration. We noted that point when discussing our results.

Regarding the paresthesia coverage, in our study, the TENS electrodes were fixed at the medial (plantar) side of the foot and approximately 15 cm above the ankle, so that at least the distal electrode was situated within the tibial nerve territory. The electrode positions were chosen in order to have at least partial cutaneous stimulation of the tibial nerve territory, but at the same time exert a direct stimulation of the tibial nerve. In fact patients under TENS reported a tingling sensation within the tibial nerve territory, also beyond the distal electrode, which we can only explain by direct stimulation of the tibial nerve. We therefore believe, that both TENS and SCS were applied with comparable coverages of the tibial nerve territory.

The main point which supports the comparability of the two modalities in our study setting is, that both

were applied at the same intensity in relation to minimal and maximal stimulation thresholds.

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