

Influence of Stimulus Variation in TENS-Treatment of Patients With Vascular Headache

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Abstract

Transcutaneous electrical nerve stimulation (TENS) is accepted in the treatment of chronic pain, even if the mechanism of therapeutical dynamics is not known exactly up to now. The value of TENS in the treatment of headache, particularly vascular headache is discussed controversially. Several studies indicate that the efficacy of TENS can be measured by means of quantitative evaluation, and different stimulus patterns revealed to be effective in a different way. So the question was, whether different stimulation patterns lead to different results in the treatment of vascular headache.

19 patients with vascular headache were investigated. During a three week neurological rehabilitation program they received a TENS therapy following an A-B-A design with having therapy during week one, having no therapy during week two and again having therapy during week three. The therapy was performed each day (seven days), twice daily with a duration of 20 minutes each, with an intensity which was chosen slightly above the sensory threshold. Electrodes were placed over the temporal region and over the zygomatic bone when the pain was unilateral, and over FZ und PZ when the pain was localised bilaterally. There was no other variation in the therapy regime then with frequency: Six patients (group I) received a stimulation pattern with continuous impulses of 80 Hz, six patients (group II) a burst-stimulation and seven patients (group III) a variable impulse pattern. The therapeutical effect was estimated using a 100 mm visual analogue scale which had proved to be reliable before.

A significant improvement was seen with each of the three therapy forms: +32.1 mm (group I), +18.8 mm (group II) and +28.7 mm (group III). The difference between group I and II was significant with $p \leq 0.011$, the difference between group III and II with $p \leq 0.040$.

There is up to now no satisfying explanation for the efficacy of TENS. According to the present results, TENS-therapy is clinically effective in reducing vascular headache, potentially via a direct effect on the intracranial blood flow. When using TENS, the continuous stimulation pattern can be recommended just like the

stimulation regime with variable impulse patterns. Electrotherapy with bursts in the low frequency range is effective, too, but significantly less. The next step of the investigation will be a flow study using transcranial Doppler sonography.

1. Introduction

During the last decades, a large amount of diseases associated with various pain syndromes have been investigated concerning the effectivity and the clinical value of transcutaneous electrical nerve stimulation (TENS and related abbreviations like TNS, PENS etc.), and additionally a lot of papers have been published on experimental results. In the treatment of headache, particularly vascular headache the clinical value of TENS has been discussed controversially during the last decade. Part of this discussion might be the uncertainty of which kind of TENS has to be used, e.g. above all, which frequency or which stimulation pattern is thought to be best. Studies on pain threshold in healthy subjects indicate very clearly a dependency of TENS-efficacy and the stimulation pattern. Kröling et al. investigated a variety of patterns and found 80 Hz to be most effective, followed by frequency modulated stimulation and 2 Hz, being superior to the burst mode or the so-called "stochastic" mode of stimulation.

These dependencies of stimulation pattern and efficacy in healthy subjects lead to the question, if different stimulus patterns of TENS might also play a role in the clinical value of TENS when treating patients with vascular headache.

1.1. Previous Work

Patients

Nineteen patients with vascular headache were investigated (8 male, 11 female; age 41.4 ± 9.3 ys; time of

disease 10.1±7.8 ys). Diagnosis was made by one investigator (T.M.) according to the "Classification and Diagnostic Criteria for Headache Disorders, Cranial Neuralgias and Facial Pain". Six patients (group I) were treated with a continuous stimulation pattern of 80 Hz, six patients (group II) received a burst-stimulation and seven patients (group III) a variable impulse pattern.

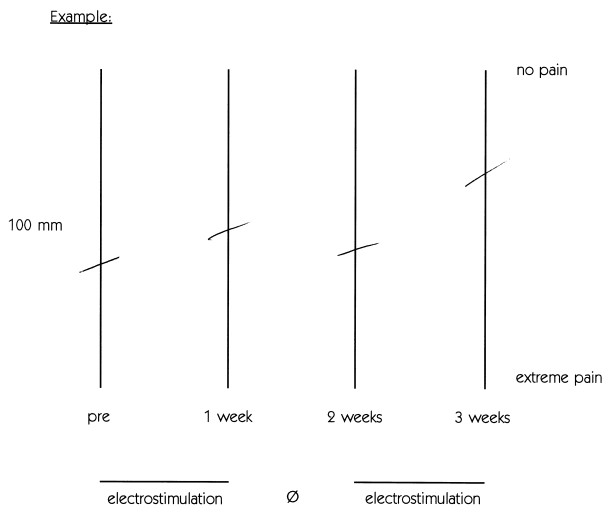
Stimulation

Electrotherapy was performed in randomized groups during an indoor rehabilitation in series of seven days following an A-B-A design, twice daily with a stimulation time of 20 minutes each and an I intensity just above sensory threshold. A = therapy, B = no therapy. Devices of the following companies were used: Bentronic, Enraf Nonius, Innocept. For patients with unilateral headache, electrode position was chosen frontal and lateral. In cases of bilateral headache, the electrode position was chosen on nasion andinion.

Outcome measurement

Parameter of the therapeutical outcome was a vertical visual analogue scale (VAS) with a length of exact 100 mm. The exact length and the meaning for evaluation was not noticed by the patient. The indications of the VAS reached from "no pain" to "extreme pain". The patients made estimations on their actual pain once weekly, before and just after one series of therapy (Fig. 1)

Fig. 1: Visual Analogue Scale (example)

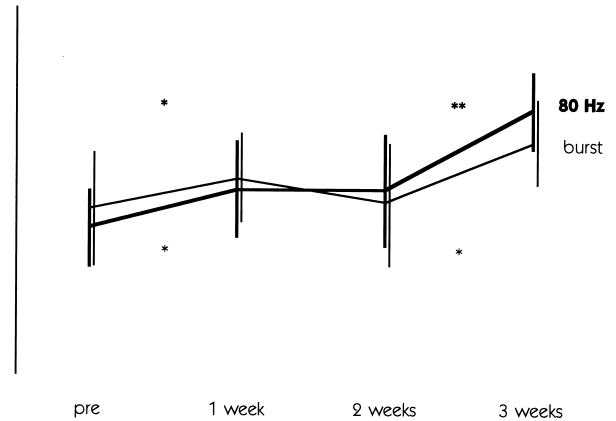


Results

Significant improvement ($p \leq .02$) was seen in each of the three groups, while the therapy form 80 Hz showed most effective, followed by the variable frequency pattern: +32.1 mm (group I), +18.8 mm (group II), and 28.7 mm (group III). The difference between group I and group II was significant with $p \leq .011$, the difference between group

III and group II was significant with $p \leq .040$ for the second therapy series A (Fig. 2). Improvement of pain intensity did not only occur in each of the three groups, they also were significant during the therapy series, while no significant changes were seen during the time without therapy (B).

Fig. 2: VAS-Results 80 Hz vs. Bursts. * and ** indicate statistical significance of $p \leq .02$ and $.01$, resp. for the improvement of each therapy form during phase "A"



2. Summary and Conclusions

In the treatment of vascular headache with TENS, the continuous stimulation with 80 Hz can be recommended just like the stimulation with a variable impulse pattern in the low frequency range. Further investigations are going to be done concerning the long term outcome.

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