Short Term Effects of Low Frequency Electromyostimulation on Parkinsonian Tremor

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Abstract

A series of 11 patients with mostly unilateral tremor-dominant Parkinson’s Disease (61-76 years) were investigated. Additionally to pharmacological therapy and physiotherapy, they underwent electrotherapy. The effect on tremor was observed.

The patients received a low frequency electrostimulation of flexors (morning) and extensors (afternoon) of the wrist, with a stimulation time of 20 minutes each. Three different frequencies within the low frequency range were used: 5 Hz, 50 Hz and 90 Hz, with a stimulation time of 10 seconds and a consecutive break of 20 seconds. Frequency and amplitude of the tremor of the index finger were investigated and calculated from video tapes for short time (<1 min) and long term (>60 min) effects.

The average tremor frequency was 3.9±0.3 cps (which did not change by either stimulation form). The average amplitude was 12±3 mm. Stimulation of the flexor muscles did not show significant effects with 5 Hz and 50 Hz, stimulation with 90 Hz reduced the tremor amplitude as a short term effect (9±2 mm, p≤0.02). Stimulation of the extensor muscles did not show significant effects with 5 Hz and 50 Hz, stimulation with 90 Hz reduced the tremor amplitude as a short term effect (6±2 mm, p≤0.02) and a long term effect was observed, too (9±3 mm, p≤0.02). The effects occurred repeatedly each day of therapy, and they were fully reversible. Now, a study has started to look for possible long lasting effects following three months of therapy.

1. Introduction

In the therapy of intractable tremor (Parkinsonian or essential), deep brain electrical stimulation is used with good results. Since the 1950s, stereotactic, localized destruction of the ventralis intermedius nucleus of the thalamus (v.i.m.) was used to diminish tremor. Nowadays, implantable systems allow to distinctively stimulate thalamic regions and nuclei (v.o.p., v.i.m.), the pallidum (rigidity) and subthalamic regions (akinesia, rigidity) in a non-destructive way.

Low frequency stimulation is used with an intensity of 2-3 V, a frequency of 130-185 Hz and a pulse width of 90-210 µs. This type of stimulation is said to be a "high-frequency" stimulation (see Discussion/Conclusion).

A stimulation frequency < 60 Hz often induces tremor, while a frequency > 100 Hz is able to suppress tremor activity.

1.1. Previous Work

The question was, if a non-invasive electrical myostimulation might have similar effects on the tremor.

A series of 11 patients (7 male, 4 female) with mostly unilateral tremor-dominant Parkinson’s Disease (61-76 years) were investigated. In part III (motor examination) of the UPDRS, they scored 16±4.

Additionally to pharmacological therapy (mean daily dosage of levodopa: 550mg) and physiotherapy, the patients underwent electrotherapy. They received a low frequency electrostimulation of flexor muscles (morning)
and extensor muscles (afternoon) of the wrist, with a stimulation time of 20 minutes each. Three different frequencies within the low frequency range were used: 5 Hz, 50 Hz and 90 Hz, with a stimulation time of 10 seconds and a consecutive break of 20 seconds.

Frequency and amplitude of the tremor of the index finger were investigated and calculated from video tapes for short time (<1 min) and long term (>60 min) effects. The average tremor frequency was 3.9±0.3 cps, it was not changed by either stimulation form. The average amplitude was 12±3 mm. Stimulation of the flexor muscles did not show significant effects with 5 Hz and 50 Hz, stimulation with 90 Hz reduced the tremor amplitude as a short term effect (9±2 mm, p≤0.02). Stimulation of the extensor muscles did not show significant effects with 5 Hz and 50 Hz, stimulation with 90 Hz reduced the tremor amplitude as a short term effect (6±2 mm, p≤0.002) and a long term effect was observed, too (9±3 mm, p≤0.02).

**Summary and Conclusions**

According to the present preliminary data, the electrical myostimulation (of a peripheral nerve) seems to have similar qualitative effects on central nervous pathways pathways as deep brain stimulation has, with a lower expression. The effects occurred repeatedly each day of therapy, and they were fully reversible. Now, a study has started to look for possible long lasting effects following three months of therapy.

Besides: The electrical stimulation in the frequency range as described mostly is described as a "high frequency” stimulation. This expression, however, does not meet any of the international classifications of frequencies. A frequency of up 200 Hz still is in the low frequency range! It is, however, within the higher range of the low frequency band.

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