Biomed. Technik
38 (1993), 179-185

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Basic Aspects of Action Tremors in the Human M. Brachioradialis

Grundlegende Aspekte von Muskelschwingungen im M. Brachioradialis des Menschen

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Key words: Action tremor – acceleromyogram (AccMG) – EMG – isometric contraction – isometric maximal voluntary contraction (MVC)

Since the first measurements of tremors it was obvious that the tremor signal originates from very complicated and continuously changing nervous and mechanical factors. However, the tremors originate in the beginning from the action tremors of the skeletal muscles. In this study the basic structure of the action tremors, regular 13-Hz oscillations, was revealed (measured by an accelerometer fixed on the distal end of the muscle belly of the m. brachioradialis). The mechanical oscillations measured with this technique had a linear relationship to the electrical oscillations of the EMG. Further, harmonic interference of isometric contraction with faradic contraction was observed. During simultaneous contraction of neighbouring muscles, completely synchronous but exactly out-of-phase oscillations were observed.

Schlüsselwörter: Muskelschwingungen, Acceleromyogram (AccMG), EMG, isometrische maximale freiwillige Kontraktion (MVC)

Seit der ersten graphischen Darstellung des Zitterns war es deutlich, daß das Tremorsignal durch einige komplizierte mechanische und nervöse Faktoren bestimmt wird. Im Anfang aber wird das Zittern durch die Muskelschwingungen des Skelettmuskels verursacht. In unseren Untersuchungen wurde die Grundform der Muskelschwingungen des M. Brachioradialis, die regelmäßigen 13-HzOszillationen, deutlich gemacht (durch Aufkleben eines Beschleunigungsaufnehmers auf das Ende des Muskels). Die mit dieser Technik gemessenen mechanischen Oszillationen hatten ein lineares Verhältnis zu dem gleichzeitig gemessenen EMG. Auch wurde eine harmonische Interferenz der Oszillationen beobachtet, die durch faradischen Strom und eine maximale isometrische Muskelkontraktion verursacht wird. Während einer simultanen Kontraktion der angrenzenden Muskeln wurden Oszillationen mit exakt demselben Rhythmus, aber mit gegenläufiger Phase, erzeugt.

Introduction

The phenomenon of trembling or tremor of the fingers and hands has long been known. It occurs out of nervousness, during or after a period of strain, cold, hyperthyroidy, etc. In the past, this phenomenon was observed by means of a sooted box [6,10].

In 1978 Desmedt [2] published *Physiological tremor*, Findley and Capildeo [4] the book *Movement disorders: tremor*, in 1984. These books summarize the current state of knowledge in this field.

The majority of tremor measurements are done on the fingers, hands or wrists. However, the contraction of the skeletal muscles is the primary source of the tremors. These action tremors of the muscles are influenced by damping, conduction and resonance. The ultimate result of these factors is tremor of the fingers, etc. The genesis of tremors is very complicated.

It is essential to reduce the number of these disturbing factors during experiments. This may be accomplished by placing the sensor on the muscle, the source of the oscillations. This technique was practiced, among others, by Keidel and Keidel [7]. There are difficulties with their methods:

1. The limb was not fixed, so resonance was possible.
2. The chosen muscles are mechanically very complicated.

This study sought to reduce the number of disturbing factors by the following means:

1. choosing structurally simple monopolar and monoarticular muscle
2. diminishing resonance by fixation of the extremity
3. seeking a suitable place for the sensor
4. using a quantifiable stimulation: faradic current, isometric contraction, etc.

All experiments were performed with an accelerometer, and the last experiment also included EMG.

This study was limited to the investigation of oscillations within the action tremor spectrum, frequency of about 8 – 14 Hz.