

DEPENDENCE BETWEEN REACTION TIME AND AMPLITUDE CHANGES OF H-REFLEX EVOKED WITH IMPERATIVE SIGNAL PRESENTATION BY CONTRALATERAL LOWER LIMB MUSCLE

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The problem of organization of a forthcoming voluntary movement at spinal cord level causes warrantable interest. Most authors accept that prior to its execution changes of excitability of alpha-motoneuron pool set in characterized as tuning and pretuning (1–3,8). There is a debate in how far this pretuning and tuning has a specific character and in how far it is of unspecific nature (4). According to Ya. M. Kotz (1975), pretuning starts 55–60 msec prior to the beginning of voluntary movement and consists in an increase of excitability of motoneuron pool of agonist muscles before its execution. By this way, the possibility for other excitability changes of muscular motoneuron pools related or not to performing of voluntary motor response is ignored to a great extent.

In our previous investigations (9) we proved that 50 msec after presentation of a light signal requiring motor response there exists a characteristic correlation between reaction time and H-reflex amplitude changes in the case when this reflex is evoked by muscle – future agonist of forthcoming voluntary movement. However, such a correlation is not observed if H-reflex is evoked by muscle-antagonists or muscles which do not practically participate in this movement (10).

In order to exclude, on the one hand, the influence of motoneuron pool of muscles of the one leg, agonists to forthcoming voluntary movement, on the motoneuron pool of corresponding muscles of the other leg, contralateral to movement, and on the other hand, to verify if these changes established by us are unspecific and manifested in more muscles during organizing of a voluntary movement, we set us the task of investigating the dependence between reaction time and amplitude changes of H-reflex evoked by muscle which is analogous to an agonist of movement from the contralateral lower limb.

Material and Methods

Our experiments were carried out on three young individuals aged between 20 and 25 years. Subjects were sitting tranquilly on the chair and responding with maximal speed to light signal from blitz lamp through a red filter.

Motor response was plantar flexion of the right foot. H-reflex was evoked by the lateral head of M. gastrocnemius of the left leg only once for every light signal simultaneously with its presentation. One-day experimental programme consisted in 120 light signals divided into 3 blocks with 40 signals each. Prior to beginning and after every block, H-reflex was evoked by the same muscle without light signal presentations. The mean amplitude of these H-reflexes was considered an amplitude of control H-reflex at rest. Amplitudes of H-reflexes evoked only once for every light signal were compared with control H-reflex amplitude and their increase or decrease, respectively, was read.

Results and Discussion

Our data are presented on fig. 1. It is evident that there is no dependence between reaction time and H-reflex amplitude changes.

This fact allows us to accept that correlation between reaction time and amplitude changes of H-reflex evoked by a muscle agonist to forthcoming voluntary movement simultaneously with and 50 msec after signal presentation requiring a motor response has a specific character (9).

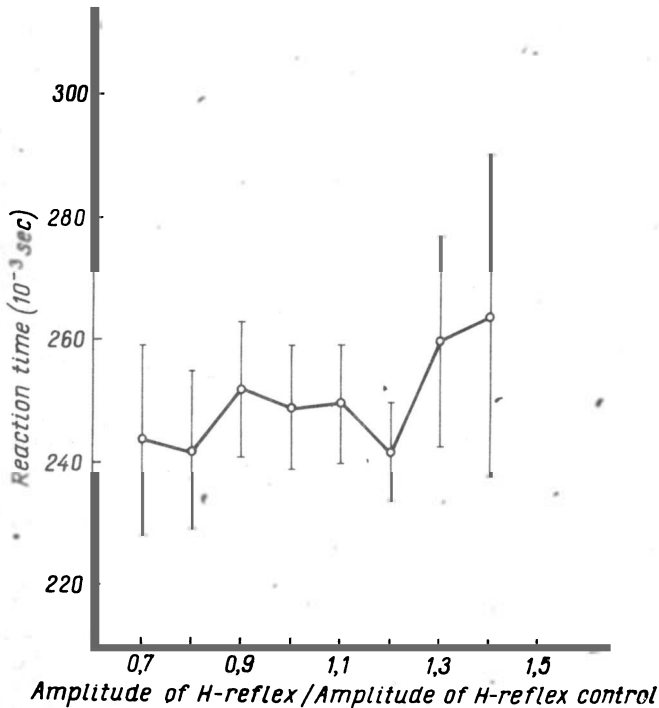


Fig. 1. Mean values of reaction time of three experimental subjects expressed as function of H-reflex amplitude changes evoked from the lateral belly of *m. gastrocnemius* of the left leg (H to H control). The movement is plantar flexion of the right foot. Confidence interval of arithmetic means designated by vertical line in every point is calculated at $p = 0.05$.

A. Eichenberger and D.C. Rugg (1984) report also a specific H-reflex amplitude increase. They read the difference between the increase of amplitude of the reflex evoked by one and the same muscle of the ipsilateral and contralateral side of movement. Experiments were carried out under conditions of a simple motor task and a choice motor task.

On the other hand, E. I. Paltzev and A. M. Elner (1983) establish dynamic changes of tuning to movement under conditions of induced increase of sensibility of human stretch-reflex mechanisms. They find out that 20–30 msec after signal for movement reflectory excitability decreases but then lightly increases.

These facts provide still another confirmation of the significance of the changes of mono-synaptic reflex excitability as an index for voluntary movement organization despite Person's

opinion (1982) that H-reflex can not be considered a reliable evaluation tool concerning motoneuron pool excitability as far as response intensity depends also on presynaptic inhibition level in the arch of reflex tested. In contrast to Ya. M. Kotz (1975), A. Eichenberger and D. G. Rüegg (1984) also suppose that specific H-reflex increase prior to movement results from elimination of presynaptic Ia terminal inhibition or from interneuronal activation in H-reflex polysynaptic components to a greater extent as compared with motoneuron sub-threshold activation but that these changes have specific character.

All that enables us to say that there is reason for continuing our research in this trend.

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ЗАВИСИМОСТЬ МЕЖДУ РЕАКЦИОННЫМ ВРЕМЕНЕМ И АМПЛИТУДНЫМИ ИЗМЕНЕНИЯМИ Н-РЕФЛЕКСА, ВЫЗВАННОГО ПОСЛЕ ПРЕДЪЯВЛЕНИЯ ИМПЕРАТИВНОГО СИГНАЛА МЫШЦЕЙ ПРОТИВОПОЛОЖНОЙ НОГИ

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РЕЗЮМЕ

Исследования проводились на трех молодых лицах в возрасте от 20 до 25 лет. Они сидели удобно на стуле и отвечали с максимальной скоростью на световой сигнал, поднимая пятку правой ноги с пола. Н-рефлексы вызван боковой головкой икроножной мышцы левой ноги, являющейся противоположной движению. Зависимости между реакционным временем и амплитудными изменениями Н-рефлекса не было установлено. В работе обсуждаются аргументы за и против специфического характера зависимости между реакционным временем и амплитудными изменениями Н-рефлекса.