

RELATION BETWEEN THE REACTION TIME AND AMPLITUDE CHANGES OF H-REFLEX EVOKED BY MUSCLE OF CONTRALATERAL LOWER EXTREMITY IN CONDITIONS OF SIMPLE MOTOR TASK

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Key-words: H-reflex — reaction time — forthcoming voluntary movement

Continuing our previous studies we presume it would be interesting to investigate the relation between the reaction time (RT) and amplitude changes (AC) of H-reflex evoked by muscles, identical to the agonists of a forthcoming voluntary movement (FVM), but from the contralateral extremity. The results of the investigation give certain information about the problem of specificity of the changes of the segmentary apparatus of the spinal cord before movement. Paltzev (1971) suggests that these changes are so local that according to the movement with such complex-built muscle as *m. quadriceps femoris*, the extending of the knee comes after the increase of amplitude of T-reflex in three its heads, whereas the flexion of coxal articulation comes after the increase of amplitude of T-reflex only of *m. rectus femoris*.

In our study we considered the well known facts that the corresponding segmentary apparatuses of spinal cord for the muscles of both lower extremities are interrelated concerning walking most of all. That is why Gurfinkle and Paltzev (1965) and Paltzev (1971) study the relations between the changes of monosynaptic reflectory irritation at spinal cord level and the relations resulting from the sequential or simultaneous movement of both lower extremities.

Material and methods

The experiments were carried by three subjects who were sitting on a chair in a dark room and flexed in the knees at angle 100° extremities. Following a preliminary instruction they reply with maximum velocity to a light signal from a blitz-lamp through a red filter. Light signals were set each 10—12 seconds with absolute probability=1. The motor response was lifting of the right lower extremity from a key connected to electronic watch. The latter was switched on by the light signal and off by lifting of the extremity. Fifty msec after setting the imperative signal was evoked a H-reflex by *m. gastrocnemius lateralis* of the left leg which actually was not participating in the motor response.

The amplitudes of H-reflexes and their values were equal to the average amplitude of control H-reflexes evoked during relaxation before and after each of the three blocks of the one-day experimental programme. The increase or decrease of the amplitudes of H-reflexes was read, thus forming groups of the corresponding RT according to these changes. More details and information — Tzekov Tc. (1982).

Results and discussion

The results of the study are presented on figure 1. H-reflexes were evoked by *m. gastrocnemius lateralis sinister* 50 msec after setting of the signal requiring a motor response: plantar flexion of the right foot. The true interval of average values presented by vertical lines at any point was calculated with $p=0.05$.

From the results (fig. 1) it is obvious that the characteristic hyperbolic relation between the RT and AC of H-reflex with minimum level during the evocation of H-reflexes by muscles-agonists of FVM (Tzekov, Gerilovski, 1974) was not registered in our present experiments. This is an additional reason to accept the specific character of the changes of the segmentary apparatus of the spinal cord which spreads over the motoneuron pool of the future agonists of FVM.

Therefore, the question of the possible reason (or reasons) for the established data in our study is open to discussion. It can be suggested that the characteristic relation between the RT and AC to H-reflexes evoked by muscles-agonists of FVM is a result of the influence of reflex evocation upon motoneuron pool.

Thus, lower H-reflex tends to less number of alpha-motor neurons in suppression; therefore, bigger part of the latter will be in relaxation and the RT is supposed to be shorter. The contrary result would be only with higher amplitude of H-reflex — bigger number of alpha-moto neurons in suppression and longer RT respectively. However, our suggestion can explain only one part of the hyperbolic curve of the relation between RT and AC of H-reflex evoked by muscles-agonists of FVM.

From the other hand the duration of RT is dependent to the moment of evocation of H-reflex. According to irritation before, simultaneously or after the imperative signal Gurfinkel and Paltzev (1965) register various values of RT; the authors presume that this is due to the interrelations of trace processes which spread over certain segments of the spinal cord or if more precisely determined — the motoneuron pool of the muscles after reflectory response and supraspinal "adjustment" influences in movement realization. Although the authors in their experiments investigated the monosynaptic reflectory irritation of the spinal cord by T-reflexes, the established results could be related to evoked H-reflexes too. In our experiments the H-reflex was evoked at the same time and therefore we could not expect that the characteristic changes were due to the time and period of evocation of H-reflexes.

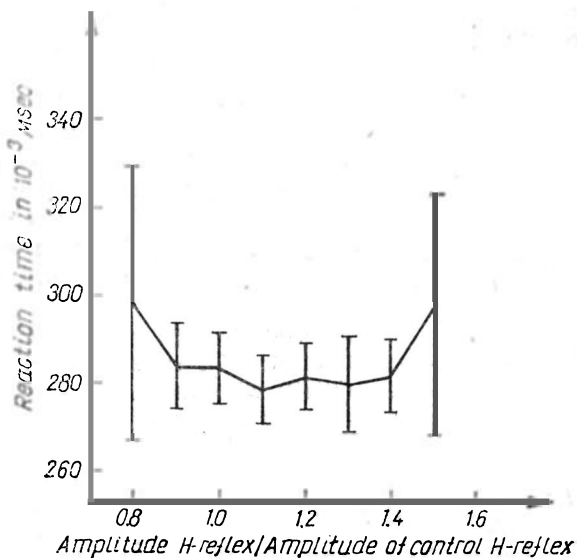


Fig. 1. Mean values of RT of 3 subjects as function of AC of H-reflex (rational relation between amplitudes of H-reflexes and amplitude of control H-reflex)

That is why we accept most probably that the established relations can be a result of supraspinal influences upon motorneural pool from the reticular formation. All this is in accordance with the data of Nyscnbaum-Requin and Paillard (1970) of experiments by using cats. The authors established that after creation of conditioned motor reaction in the animals and a sequential irritation by live electrodes upon the reticular formation with electricity (various intensity) before this reaction was registered that its latent period could be shorter or longer due to the intensity of the electrical irritation. They established also an optimal intensity of electricity which determined the shortest latent period of the motor reaction. In other words the authors depicted a V-like curve of the relation between the latent period of the motor reaction and the intensity of the electricity which irritated the reticular formation. The investigators presumed that their results determined the relation between the level of readiness and level of effectiveness. Schlosberg (1954) suggested that the present non-linear relation between the level of effectiveness and level of activation could be discussed as a stage of optimization of activity with proper conditions of functioning of the acting system.

The fact that all changes are concentrated mainly on the motoneuron pool of the muscles-agonists of FVM allowed us to accept their specificity in disagreement with Krilov (1979) who suggested that the changes were non-specific reaction spreading over many muscles before any voluntary movement.

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ЗАВИСИМОСТЬ МЕЖДУ ВРЕМЕНЕМ РЕАКЦИИ И АМПЛИТУДНЫМИ ИЗМЕНЕНИЯМИ Н-РЕФЛЕКСА, ВЫЗВАННОГО МЫШЦЕЙ ПРОТИВОПОЛОЖНОЙ НОГИ В УСЛОВИЯХ ПРОСТОЙ ДВИГАТЕЛЬНОЙ ЗАДАЧИ

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РЕЗЮМЕ

Для опытов использованы три лица, которые по предварительной инструкции отвечали с максимальной скоростью на световой сигнал блиц-лампы с красным фильтром. Движение состояло в поднятии пяты правой ноги с пола. При этих условиях *m. gastrocnemius lateralis dexter* являлся одним из агонистов предстоящего волевого движения. Н-рефлекс вызван *m. gastrocnemius lateralis sinister* т. е., противоположной ноги, притом 50 мл/сек после подачи светового сигнала, требующего двигательного ответа. Каждый двигательный ответ связан с однократным вызыванием рефлекса. Время реакции определялась в зависимости от амплитудных изменений Н-рефлекса.

Зависимость между временем реакции и амплитудными изменениями Н-рефлекса не была установлена. Такая зависимость была установлена при другой опытной постановке, когда рефлекс вызывался мышцами-агонистами предстоящего волевого движения. Результаты этого и других исследований приводят к выводу, что в условиях простой двигательной ситуации существует специфическая подготовка (предварительная настройка) мотоневронного пула мышц — агонистов предстоящего волевого движения.