

**RELATION BETWEEN THE REACTION TIME
AND AMPLITUDE CHANGES OF THE H-REFLEX
EVOKED AFTER IMPERATIVE SIGNAL
FROM MUSCLES ANTAGONISTS
OR NONPARTICIPATING MUSCLES
IN A FORTHCOMING VOLUNTARY MOVEMENT**

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In previous studies (Tzekov, Gerilovski, 1974a; Tzekov, 1982 in press) we established that the prebase events at segmental spinal-cord level show dynamic changes during the latent period of the motion reaction. In addition the characteristic relation between the RT and amplitude changes (AC) of the H-reflex is preserved when the reflex is evoked by muscles-agonists of the forthcoming VM. In the cases when H-reflex is evoked by muscles-antagonists or by muscles nonparticipating in the forthcoming VM such a characteristic relation is not registered (Tzekov, Gerilovski, 1974b). These our results do not coincide with those of Krilov (1979) who suggests that the changes of the monosynaptic reflexory irritation at spinal-cord level during RT carry a nonspecific character.

Therefore, in continuation of our investigations we decided to study the relation between the RT and AC of the H-reflex, evoked after setting of imperative signal from muscles-antagonists and muscles which do not take part practically in the forthcoming VM. This is the object of the present work.

Material and methods

The experiments were carried out with 4 young men who participated both experimental seria. The first series was with evoking of the H-reflex by muscles-antagonists of the forthcoming VM, whereas the second one — by muscles practically nonparticipating in the realization of the motion task. In order to compare in a better way the results, H-reflex was evoked by *M. gastrocnemius lateralis dextri* in both cases; the motion action in the first series was a dorsal flexion of the foot of the subject. This foot in the movement activated a muscle-antagonist. In the second series the forefinger of the right hand was raised from the switch and as a result the same muscle did not participate practically in the voluntary motion act.

The experiments in both seria were carried out in two unsequential days. The subjects sat in a chair in a dark room and answered with a maximum speed to one of the two possible ways in relation to the series of participation. H-reflex was evoked only once 50 msec after each imperative signal. The signal requiring a motion answer was from a blitz-lamp through a red filter. The possibility of its appearance was equal to 1.

The established amplitudes of the single H-reflexes were compared with the amplitude of a control H-reflex evoked several times in a relaxed state without setting of light signals. The increase of the magnification of the reflexes' amplitudes in relation to the average one of the controls was read. The RT were worked by grouping according to the increase or decrease (in this aspect) of the amplitude of the corresponding H-reflex. The extra details of the methods were published in previous our reports (Tzekov, Gerilovski, 1974a and 1974b; Tzekov, 1982, in press).

Results and discussion

The received results are presented in 2 graphs.

Fig. 1 shows the changes of RT as a function of AC of H-reflex when the latter was evoked by muscles-antagonists of the forthcoming VM. Having in mind

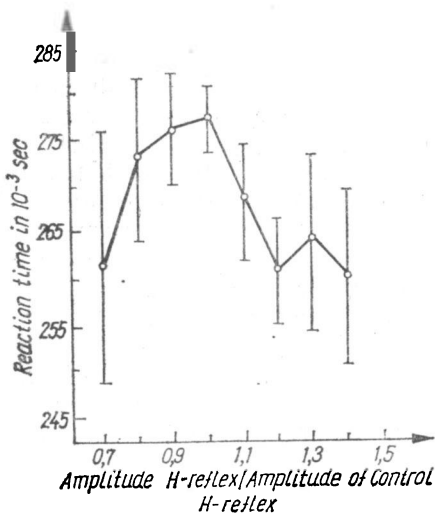


Fig. 1

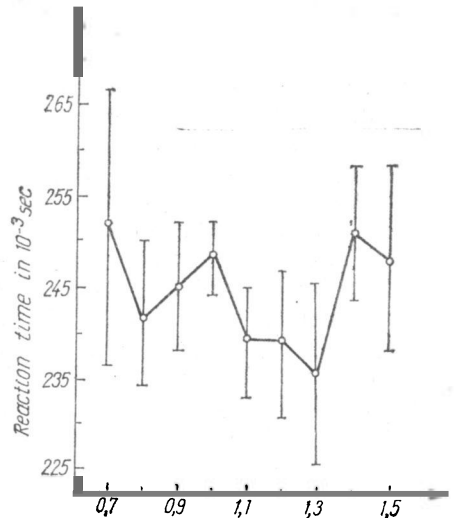


Fig. 2

that there is no statistically reliable difference between initial points and apex of the presented curve (the value of the ration between amplitudes of H-reflexes and control reflexes is 1.1) we accept that the curve has a declined direction. Or, in other words, the increase of the amplitude of the H-reflex shortens the RT.

Similar relations can be established by fig. 2.

Graph 2 present the results from the second experimental series. The direction of the curve also shows that the increase of the amplitude of the H-reflex in the case when evokation is performed by muscles with practically no participation of the forthcoming VM, the RT is shortened: second experimental series.

Therefore, it can be concluded, that a nonspecific increased irritation of the monosynaptic reflexory activity, coming before any VM, also influences the duration of RT. Analysing our previous data and the present results we presume that against the background of a common nonspecific change of the monosynaptic reflexory irritation, in the conditions of a preliminarily set motion task, the

specific changes are rather well outlined, These specific changes contribute to the predilectionable motoneuronic pool of the muscles-agonists for the forthcoming VM. As nonspecific changes affect numerous muscles and are a result of the action of stimulus (startle-reaction) (Landis, Hunt, 1939) of attention, waiting of the signal, readiness for realization of any movement after a signal, etc. (Kotz, 1975.) This increase of the amplitude of a monosynaptic H-reflex, in the terminology of Kotz "background", depends on the complexity of the set task.

In this aspect our data differ from those of Krillov (1979) and Krillov et al. (1980a, b). We could hardly accept that the presence of characteristic changes of the curve of relation between RT and AC of a H-reflex, evoked by muscles-agonists of a forthcoming VM, can be a result only of nonspecific deviations of the monosynaptic reflectory irritation including the so-called startle-reaction.

According to our opinion the explanation of the dependence between RT and AC of H-reflexes, evoked by corresponding muscles of contralateral lower extremity as an answer of the set motion task, can be found in the additional investigations of this problem. All that will be the object of our next studies.

REFERENCES

1. Коц, Я. М. Организация произвольного движения. М., Наука, 1975. — 2. Крылов, И. Н. *Физиол. ж. СССР*, 1979, 12, 1815—1824. — 3. Крылов, И. Н., Н. А. Рокотова. В: Проблемы физиологии движений. Л., Наука, 1980а, 57—68. — 4. Крылов, И. Н., Н. А. Рокотова, Н. Ф. Суворов. В: Проблемы физиологии движений. Л., Наука, 1980б, 69—84. — 5. Цеков, Ц. Под печат. — 6. Цеков, Ц., П. Герилловски. В: Науч. сес. ВМИ — Варна, V. Варна, 1973, Варна, 1974, св. 1, 72—75. — 7. Цеков, Ц., Л. Герилловски. В: Симпозиум по физиология на труда, и ергономия. Сб. трудове. С., 1974, св. 1, 108—111. — 8. Landis, C., W. A. Hunt. The startle pattern. New York, Farrar and Rinchart Inc., 1939.

ЗАВИСИМОСТЬ МЕЖДУ ВРЕМЕНЕМ РЕАКЦИИ И АМПЛИТУДНЫМИ ИЗМЕНЕНИЯМИ Н-РЕФЛЕКСА, ВЫЗВАННОГО ПОСЛЕ ИМПЕРАТИВНОГО СИГНАЛА МЫШЦАМИ-АНТАГОНИСТАМИ ИЛИ НЕУЧАСТВУЮЩИМИ В ПРЕДСТОЯЩЕМ ВОЛЕВОМ ДВИЖЕНИИ МЫШЦАМИ

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РЕЗЮМЕ

Исследования проводились в двух опытных сериях. При первой из них подопытные лица отвечали дорсальной флексией стопы одной ноги при появлении сигнала блиц-лампы, а при второй — поднятием указательного пальца правой руки от ключа. Каждая из опытных серий длилась два последовательных дня, а каждая программа на один день включала 120 световых сигналов, распределенных в три блока. Н-рефлекс вызван однократно в ответ на каждый императивный сигнал 50 мсек после его провоцирования в обеих опытных сериях. В первой серии эта мышца является антагонистом предстоящего волевого движения, а во второй она практически не принимает участия в его осуществлении.

Полученные результаты указывают на сокращение длительности времени реакции при обеих опытных сериях с увеличением амплитуды Н-рефлекса по сравнению с контрольным Н-рефлексом в покое. Не отмечена характерная зависимость, установленная в более ранних исследованиях, когда Н-рефлекс вызывался мышцами-агонистами предстоящего волевого движения. Это дает основание полагать, что на фоне неспецифических изменений возбудимости сегментарного аппарата спинного мозга существуют и специфические изменения, относящиеся к мотонейронному резерву будущих агонистов волевого движения.