

**DEPENDENCE BETWEEN REACTION TIME
AND AMPLITUDE OF H-REFLEX EVOKED
BY MUSCLES-AGONISTS OF FORTHCOMING VOLITIONAL
MOVEMENT IN CONDITIONS OF VARIABLE FOREPERIODS**

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The amplitude changes of H-reflex studied in conditions of a fixed preliminary period and variable foreperiod are different. Gerilovski and Tzekov (1971) report a decrease of the amplitude of H-reflex, evoked by muscles-agonists of a forthcoming volitional movement, in the second half of a fixed preliminary period, equal to 1000 msec. Requin (1969) reports similar data of T-reflex amplitude in close experimental situations. Gerilovski and Tzekov (1969) find that foreperiods of 100—1000 msec differ, concerning the amplitude of H-reflex evoked by muscles-agonists of a forthcoming volitional movement: the shorter the foreperiods are, the higher the amplitude is. Foreperiods of 900—1000 msec cause lower amplitudes of the reflex. This amplitude-decrease coincides with the high values of the conditional possibility (p) of the appearance of a signal requiring a motional (motor) response.

Tzekov and Gerilovski (1970) establish that 66% of the investigated objects, in conditions of a fixed preliminary period of 1000 msec, have a direct moderately underlined correlation-dependence between the reactional time and H-reflex amplitude changes. This dependence is individually manifested and expressed mainly in the intervals of a decreased amplitude of H-reflex.

Presuming the aforementioned data, concerning the investigation of the correlational dependence between the reactional time and amplitude changes of H-reflex in conditions of a variable foreperiod, the object of the present study is namely its establishment.

Methods

The experiments were carried out with 4 men, age 20—25 years. They sat relaxed on a chair and being instructed in advance they answered with maximum velocity to the second of two identical light signals of a blitz-lamp. The first signal was warning, while the second one was motor; the object was obliged to raise one of his heels above the floor. The foreperiods (intervals between the two signals) varied between 100 and 1000 msec with an initial step of 100 msec. The ten foreperiods were distributed equally and accidently in each everyday experimental programme. Each object was subjected to 6 one-day signal programmes. The reactional time was measured from the signal-set requiring a motor response until the heel-raising by a switch connected to an electronical watch (TC-2).

The H-reflex was evoked by *m. gastrocnemius lateralis* of the leg which takes part in the motor response and by irritation of *n. tibialis posterior* in the crural fossa of the same leg with the frontal part of a rectangular electric impulse (1 sec duration). The H-reflex was evoked once for each light pair of signals simultaneously with the signal which requires a motor response (or 100 msec before it). The one-day signal programme was divided into 2 blocks and consisted of 110 foreperiods. Before and after each block the H-reflex was evoked 4 times without requiring light signals, i. e. without performing of motor response. The mean amplitude value of the H-reflexes, measured in each block, was considered to be the average control value of H-reflex amplitude for the corresponding block. The amplitude of every H-reflex, evoked once in a definite foreperiod was compared to that of the control H-reflex and the resulting ratio was calculated. The reactional time of the corresponding light pair was related to this ratio and a correlation-dependence was found. The results of the foreperiods whose H-reflex was evoked 100 msec before the signal requiring a motor response; also their dependence was found. The results of the foreperiods whose H-reflex was evoked 100 msec before the signal requiring a motor response, were worked out separately from those results with foreperiods whose H-reflex was evoked simultaneously with the same signal.

Results and discussion

The results can be seen on Fig. No 1 and No 2. The curves of both graphs have almost the same progress. No statistical differences are established

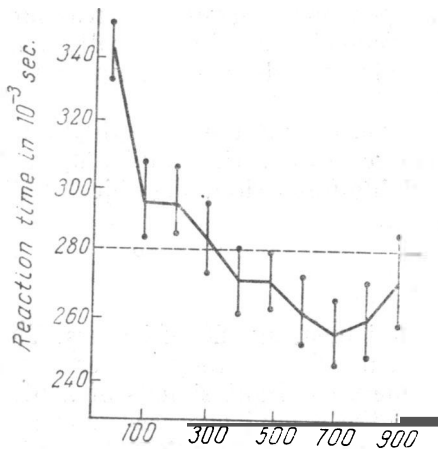


Fig. 1: Average values of the reactional time of the 4 investigated objects as a function of the foreperiod

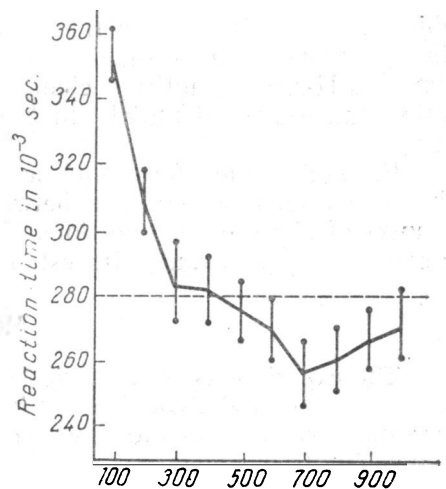


Fig. 2: Average values of the reactional time of the 4 investigated objects as a function of the duration of the foreperiods

when the reactional times of the foreperiods with evocation of H-reflexes 100 msec before or simultaneously with the signal requiring a motor response are compared. The foreperiods of 100 msec are not considerably different,

compared to both above. These results suggest that evocation of H-reflex 100 msec before the signal requiring a motor response does not interfere with the reactional time more differently than the evocation of the same reflex simultaneously with the signal. It is very possible, that under our experimental conditions, the electroskin irritation (for evocation of H-reflex) play an unimportant role in elongation of the reactional time. Such influence is present when the reflex is evoked in the last 200 msec before the signal requiring a motor response in the conditions of a fixed preliminary period of 1000 msec (Tzekov, Gerilovski — 1971). In other words, the signal importance of the electric impulse causing a H-reflex is less expressed.

From psychological point of view, the character of both graphs' curves suggests that the change of reactional times can be explained by the theory of "expectation" (Elithorn, Lawrence — 1955). Our experiments show the shortest reactional time with a foreperiod of 700 msec. It is longer than the average foreperiod of our investigation (550 msec), where according to the theory we could expect the shortest reactional times, but anyway, it is quite close to that. In longer foreperiods (800, 900, 1000 msec) the pure delay of the reactional time is more considerable, but it is still statistically unreliable compared to that of a foreperiod of 700 msec (Table 1).

Table 1

Correlative dependence between the reactional time and amplitudinal changes of H-reflex

| Foreperiods (msec) | H. P. | S. S. | I. Z. | G. A. |
|--------------------|-------|-------|-------|-------|
| 100 | 0.03 | -0.89 | -0.19 | -0.29 |
| 200 | 0.17 | -0.20 | -0.31 | -0.45 |
| 300 | 0.10 | 0.18 | -0.01 | 0.13 |
| 400 | -0.41 | -0.54 | -0.52 | -0.19 |
| 500 | 0.00 | -0.33 | -0.48 | 0.14 |
| 600 | 0.10 | 0.00 | -0.46 | -0.07 |
| 700 | 0.49 | -0.14 | -0.16 | 0.09 |
| 800 | -0.25 | -0.27 | -0.59 | -0.35 |
| 900 | 0.19 | -0.58 | -0.35 | 0.42 |
| 1000 | 0.34 | -0.33 | -0.09 | 0.35 |

Table 1 presents the coefficients of correlation between the reactional times and their corresponding amplitude changes of H-reflex evoked 100 msec before the signal requiring a motor response. It is obvious that the short foreperiods (up to 600 msec) show an inverse correlative dependence. It can be suggested that in these foreperiods the irritative influence of the warning signal upon the degree of the monosynaptic reflective irritability at a segmental level is still definitely expressed. The longer foreperiods of our study (700—1000 msec) have a direct ($1/2$ of the investigated object) or indirect (the rest $1/2$, reverse and slightly expressed correlative dependence). These results can be contributed to prevailing suppressive (50%) or irritative (the rest 50%) central influences (Table 2).

Correlative dependence between the reactional time and amplitudinal changes of H-reflex

Table 2

| Foreperiods (msec) | H. P. | S. S | I. Z. | G. A. |
|--------------------|-------|-------|-------|-------|
| 100 | 0.19 | -0.85 | -0.21 | 0.13 |
| 200 | -0.05 | -0.38 | -0.02 | 0.02 |
| 300 | -0.35 | 0.33 | -0.21 | -0.08 |
| 400 | 0.05 | 0.07 | 0.15 | -0.19 |
| 500 | 0.32 | -0.11 | 0.03 | -0.26 |
| 600 | 0.17 | -0.13 | 0.04 | -0.11 |
| 700 | 0.33 | 0.51 | -0.50 | -0.10 |
| 800 | 0.15 | 0.15 | -0.13 | -0.22 |
| 900 | 0.18 | 0.24 | 0.12 | 0.14 |
| 1000 | 0.01 | 0.33 | -0.36 | 0.04 |

Table 2 presents the correlation-coefficients between the reactional times and their corresponding amplitude changes of H-reflex evoked simultaneously with the signal requiring a motor response. In that case, a moderately expressed correlative dependence is established with 2 of the 4 investigated objects in the short as well as in the long foreperiods. One of the objects performs a direct and another one — an indirect, reverse dependence in the long foreperiods.

In conclusion, it can be generalized, that under conditions of foreperiods with various duration, the correlative dependence between the reactional time and amplitude changes of H-reflex is better expressed than that under the conditions of a fixed preliminary period of 1000 msec. (Tzekov, Gerilovski — 1970). This difference is considerable when H-reflex is evoked 100 msec before the signal requiring a motor response. Presuming that the amplitude decrease of H-reflex under conditions of foreperiods is slighter performed only in the longest (900—1000 msec) periods, makes us suggest that the same decrease with a fixed preliminary period of 1000 msec (Gerilovski, Tzekov — 1971) can not be contributed only to the preparation of a quicker response.

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**ЗАВИСИМОСТЬ МЕЖДУ ВРЕМЕНЕМ РЕАКЦИИ И АМПЛИТУДОЙ
Н-РЕФЛЕКСА, ВЫЗВАННОГО МЫШЦАМИ-АГОНИСТАМИ
ПРЕДСТОЯЩЕГО ПРОИЗВОЛЬНОГО ДВИЖЕНИЯ В УСЛОВИЯХ
ПЕРЕМЕННОГО ПЕРИОДА ОЖИДАНИЯ**

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Р Е З Ю М Е

Установлена корреляционная зависимость между временем реакции и амплитудой перемен Н-рефлекса, вызванного мышцей-агонистом предстоящего произвольного движения.

Опыты проведены в условиях периодов ожидания различной продолжительности. Исследуемые лица отвечали с максимальной скоростью на второй из двух одинаковых световых сигналов блиц-лампы, поднимая пятю одной ноги с пола. Периоды ожидания варьируют от 100 до 1000 мсек шагом 100 мсек. Все десять периодов ожидания распределены в опытной постановке в течение одного дня независимо друг от друга, равновероятно и случайно. Н-рефлекс вызван *m. gastrocnemius lateralis* ноги, который принимает участие в двигательном ответе. Раздражающий сигнал, которым вызван Н-рефлекс, подавался однократно для каждой пары световых сигналов одновременно с сигналом, требующим двигательный ответ или 100 мсек перед этим. Время реакции замерялось электронными часами (ЧС-2).

Эвокирование Н-рефлекса 100 мсек до сигнала, требующего двигательного ответа, или одновременно с ним, не отражается на сокращение длительности времени реакции. Оно резко сокращается периодом ожидания 100 мсек и становится наиболее коротким при периоде ожидания 700 мсек. При более длительных периодах ожидания (800, 900 и 1000 мсек) время реакции снова становится более длительным. Коэффициенты корреляции между временем реакции и амплитудами перемен Н-рефлекса, хотя и лучше выявленные чем те, которые проводились в условиях фиксированного предварительного Н-рефлекса, равного 1000 мсек, являются умеренно выраженными и не проявляют однонаправленной тенденции у отдельных исследуемых лиц.

Автор, принимая ввиду ход кривых амплитудных перемен Н-рефлекса при фиксированном предварительном периоде, равном 1000 мсек, а также и тех, которые были получены при переменных периодах ожидания до 1000 мсек, учитывая наряду с этим стойности коэффициентов корреляции между временем реакции и амплитудными переменными, делает вывод, что уменьшение амплитуды рефлекса при фиксированном предварительном периоде, равном 1000 мсек, не может быть связано только с подготовкой более быстрого двигательного ответа.