

ONE POSSIBILITY TO IMPROVE "PIORKOWSKI" US-6 TEST INFORMATION VALUE IN ESTIMATION OF THE PSYCHOPHYSIOLOGICAL STATE

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The psychophysiological apparatus "Piorkowski" US-6 test presents a device for presentation of light signal from 10 different positions at equal time intervals in a random sequence. The task consists in pressing the corresponding button before signal position changing. One hand is used only according to the choice of the subject examined. The frequency of signal position altering as well as the time required for task solution is preliminarily determined. The following frequencies are possible: 60/min, 75/min, 93/min, 107/min, 125/min, and 150/min with the corresponding intervals of: 30 sec, 60 sec, 90 sec, 120 sec, and to the n^{th} power. The frequencies of 107/min and 125/min between 1 and 2 min long are used with healthy subjects and athletes (5). The psychophysiological state of the individual tested is estimated according to the number of successful reactions for the definite time period.

We consider the evaluation of the psychophysiological state according to one parameter only rather general and insufficiently informative but the work in a continuous regimen a disadvantage of the method used as formation of automatism of reaction-response is provoked (4). The introduction of discrete working regimen with this apparatus, in our opinion, could inhibit automatism formation but the series of intermediate results could enable test performing as a process and thus improve its information value (2).

Proceeding from these considerations we decided to modify the present method for work with "Piorkowski" US-6 test.

Material and Methods

Our study covered a total of 179 patients with hypertension, stage-1 and stage-2, during their hospitalization in the Clinic of Thalassotherapy, Physiotherapy and Rehabilitation of the Higher Institute of Medicine, Varna*. We used the frequency 107/min that proved to be optimal in more than 80 per cent of the subjects when applying "Piorkowski" US-6 test**. We had preliminarily established that in cases of experiment duration longer than 4 min the following phenomena occurred: fatigue and pain in the hand (in 12 per cent of the cases); complaints of vertigo, headache and visual disorders (in 9 per cent); reduction of will to collaboration – absent-mindedness, disengagement and even refusal of participation (in 21 per cent). That is why in order to keep a maximum information value we carried out the assessment with 4-min duration. This time interval was divided into 8 discrete intervals of 30 sec each. There was a 0.9–1.2 sec long gap between every 30-sec long interval. The results obtained during test performan-

* We consider the selection of the group of experimental subjects as an example variant only. This is based on the lack of convincing data about the existence of qualitative psychophysiological differences between the patients with hypertension and the general population.

** The number of successful reactions and not -- reaction time is read in "Piorkowski" US-6 test, i.e. test sensibility is the highest one when frequency used is maximally close to borderline reaction capacities of the subject studied.

ce were read for every single interval that enabled the usage of a series of parameters with test interpretation.

All these parameters are appropriate to a 30-sec interval.

Results and Discussion

Some of these parameters are presented on fig. 1.

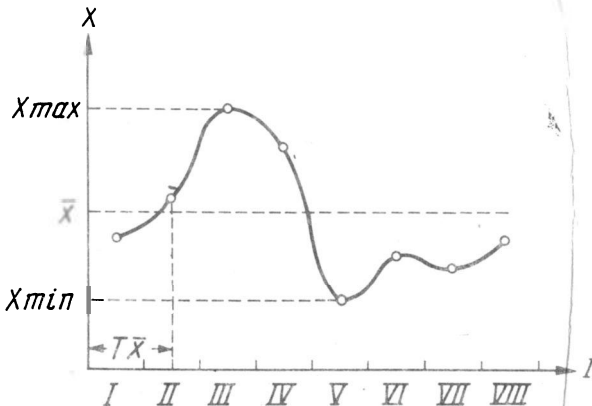


Fig. 1. Suggested indexes for interpretation of results from "Piorkowski" US-6 test.
 X – number of successful reactions; \bar{x} – mean value of successful reactions; I – interval number

a) "H" – mean harmonic quantity (6, 8). This index characterizes the apparent mental work capacity.

b) "x" – mean arithmetic of successful reactions registered during definite intervals.

c) "Vh" – variation coefficient characterizing stability during test performance. We suggest this coefficient by using the properties of harmonic quantity. "Vh" is calculated according to the formula:

$$Vh = H : x \times 100\%.$$

We can suppose that "Vh" informs us about the equilibrium and mobility of both excitation and suppression processes in the higher nervous activity when interpreting "Piorkowski" US-6 test (4).

d) "Xmax" – the greatest number of successful reactions registered in some of the 8 intervals of the assessment. "Xmax" is related to maximum attention concentration and characterizes the strength of excitation process. (It is analogous to the index "Concentration of attention" in Schulte's test) (7, 8).

e) "Xmin" – reciprocal to the index "Xmax". This parameter is related to the phenomenon "dominance running low" (10) or it results from interference of excitation process (3).

f) "TXmax" – number of intervals from the beginning of test performance and the interval where "Xmax" is reached inclusive.

g) "TX" – number of intervals from the beginning of test performance and the first interval where "x" is reached, inclusive.

The last two parameters are related to adaptation time of the subject studied to test performance. We consider this time a "working-in phase". We prefer to determine this working-in phase by means of the parameter "TX" because, in our opinion, the parameter "X" characterizes more reliably the optimal working regimen as compared with the parameter "Xmax" during "Piorkowski" US-6 test performance.

We examined the linear correlation between the parameters suggested on the basis of the results of 100 randomly selected subjects (table 1). There is a strong positive linear correlation between the following parameters: "H", "X", "Xmax", "Xmin", and "Vh". Linear correlation is insignificant between these parameters mentioned and both "TX" and "TXmax". Correlation is very high between "TX", and "TXmax", i.e. these individuals who work in earlier achieve earlier maximal work capacity.

Table 1

Linear correlation coefficient (r) rates in the parameters proposed for interpretation of the results from "Piorkowski" US-6 test

Parameter	H	x	TXmax	Tx	Vh	Xmax
H						
x	1.00					
TXmax	-0.05	-0.05				
Tx	-0.02	-0.03	0.48			
Vh	0.63	0.61	0.10	0.05		
Xmax	0.97	0.98	-0.09	-0.06	0.58	
Xmin	0.97	0.97	-0.03	-0.01	0.57	0.92

In order to establish the significance of working-in phase for determination of apparent mental work capacity in the case of "Piorkowski" US-6 test we divided the subjects studied into groups according to their "TX" values (table 2). Reliability of differences between parameter values in different groups was investigated by means of Wilcoxon-Mann-Witney criterion (1). Statistically significant differences ($p < 0.05$) of values between single subgroups were established. Therefore, subjects who work in at different intervals should receive a differing evaluation of mental work capacity demonstrated by them.

On the basis of these data we suggest the usage of common rating for individual evaluation of apparent mental work capacity when performing "Piorkowski" US-6 test. For this purpose, every parameter should be normalized after percentiles' method (9) (table 3). Common rating presents a sum of evaluations of single parameters supposed. We accept that one should inter-

Table 2

Mean values of the parameters proposed in the subjects examined ($n = 179$) divided into groups according to the working-in interval

Interval	n	H $\pm \sigma$	x $\pm \sigma$	TXmax	Vh $\pm \sigma$	Xmax	Xmin
I st	66	25.1 \pm 12.9	25.7 \pm 12.6	2.8 \pm 2.1	95.5 \pm 7.1	32.3 \pm 12.3	19.0 \pm 12.0
II nd	55	31.2 \pm 12.9	31.7 \pm 12.6	3.8 \pm 1.9	96.8 \pm 7.3	37.4 \pm 11.6	25.2 \pm 13.0
III rd	43	28.1 \pm 14.3	28.4 \pm 14.2	4.9 \pm 1.7	97.8 \pm 3.5	34.0 \pm 11.1	22.0 \pm 13.9
IV th	13	22.4 \pm 15.0	22.9 \pm 14.9	5.6 \pm 1.3	96.0 \pm 4.2	28.1 \pm 10.8	17.1 \pm 14.7

Note: Two patients who had not worked-in after the 5th interval were not

Table 3

Rating according to percentiles (P₁₀, P₂₅, P₇₅, and P₉₀) and basic evaluation of single parameters after the method modified by us

Parameter	Rating				
	very low	low	medium	high	very high
H	up to 6.4	6.5–14.5	14.6–40.0	40.1–43.5	over 43.5
x	up to 7.0	8.0–16.0	17.0–40.0	41.0–44.0	over 44.0
Vh	up to 90.6	90.7–96.8	96.9–99.5	99.6–99.8	over 99.8
Xmax	up to 13.0	14.0–24.0	25.0–45.0	46.0–48.0	over 48.0
Xmin	up to 4.0	5.0–9.0	10.0–33.0	34.0–39.0	over 39.0
Tx	after IV th	IV th	I st	III rd	II nd
rating	1	2	3	4	5

prete these parameter singly because of their different physiological determination when one draws conclusions about the psychophysiological state of subjects studied.

We can conclude that the modified method suggested by us uses more completely the advantages and reduces some unwanted effects of "Piorkowski" US-6 test which improves its information value.

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ОБ ОДНОЙ ВОЗМОЖНОСТИ ПОВЫШЕНИЯ ИНФОРМАТИВНОСТИ ТЕСТА „ПИОРКОВСКИ” УС-6 ПРИ ОЦЕНКЕ ПСИХОФИЗИОЛОГИЧЕСКОГО СОСТОЯНИЯ

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РЕЗЮМЕ

Авторами предложена модифицированная методика работы при помощи теста „Пиорковски” УС-6, которая дает возможность динамически проследивать его выполнение в сравнительно оптимальном периоде времени. Применяется дискретный режим работы, что по мнению авторов препятствует созданию автоматизма при ответной реакции исследуемых лиц. Авторами применены дополнительные показатели, посредством которых возможна более детальная оценка психофизического состояния исследуемых лиц.