CHARACTERISTICS OF THE COURSE OF ACTIVE REST IN INDIVIDUALS OF ADVANCED AGE

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The central mechanism of the increase of work capacity under active rest is generally recognized at present [2, 3, 4, 6, 8, 12, 14, 17, 18]. The majority of investigators explain the increase of work capacity in the tired hand during the rest period, accompanied by the work of the other hand, as a result of the restorative role of inhibition which develops during the active rest period in the centers of the opposite group of muscles [2, 3, 4, 8, 14, 18].

The aim of the present work was to study the effect of active rest on the work capacity of individuals of advanced and old age. Comparison of the course of active and passive rest during this stage of life can be utilized for the working out of a rational regime of work and rest. In addition, such investigations may offer data for the characterization of changes in the restorative role of inhibition on the example of Sechenov phenomenon.

Our studies were based on numerous works which had come out from the I. P. Pavlov laboratory [1, 10, 11, 15, 16] and which point to the weakening of the internal inhibition process during the senescence of the organism, as well as on the premise developed by V. V. Frol'kis [19] on the weakening of the restorative role of inhibition while its protective character is preserved under certain functional changes.

METHOD OF INVESTIGATION

For the study of active rest we employed ergographs [7] which enabled us to evaluate the performance of flexors not of one finger only, but of the whole wrist. A special calculating device enabled us to evaluate the performed work.

The studies were carried out at the base of Kiev-Svyatoshinskii Home for the Aged on 12 females and 16 males of advanced age. Control observations were conducted on eight young men.

A total of 36 individuals was examined. According to age they were divided as follows: from 20 to 35 years—8, from 65 to 70—4, from 70 to 80—15, over 80—9 individuals.

A total of 186 observations were carried out. All observed individuals belonged to a group selected for study by the Institute of Gerontology and were thoroughly examined by the Institute clinicians. For control we used the data of the work of I. V. Muravov [7] which had been carried out according to the same method on 29 individuals aged from 18 to 28 years.

For the characterization of the effect of active and passive rest on work capacity we employed the following method of observation: the tested individual carried out some work for two minutes under the control of the metronome, by performing 34 or 45 work movements per minute. This rhythm was easily mastered. This work

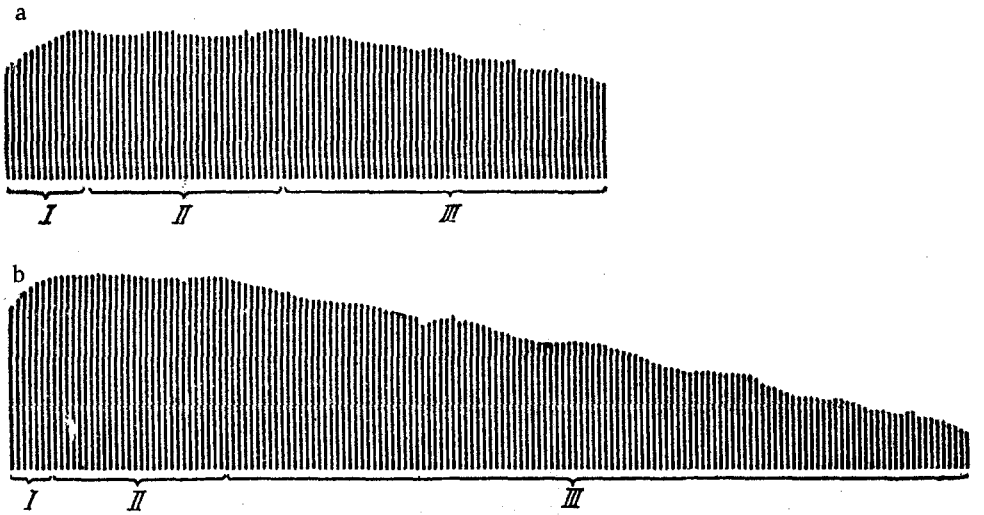
was followed by one minute pause during which, depending on the conditions of the test, an active or passive rest was suggested. Another two minute work followed, then a two minute pause followed by a three minute work.

In accordance with the law of power relations, three types of exertion were selected: slight, medium, and strong, the determination of which was effected on the basis of indicators of manual dynamometry. Slight exertions constituted 5-10% of maximum force of the wrist expressed in kilograms, medium—10-17%, strong—20%.

In establishing the duration of active rest, we employed the data of S. P. Narikashvili and Sh. A. Chakhnashvili [9] who had demonstrated in their special studies that an increase of active rest duration from 10 to 100-120 seconds progressively increases its restorative effect. Subsequent increase of active rest duration over 2-3 minutes does not contribute to the improvement of restoration of functions. On the basis of these data, we limited the duration of active rest to one minute.

RESULTS OF INVESTIGATION

In the course of our studies we observed a difference in the course of the fatigue curve and in the character of the ergogram in individuals of advanced age as compared to young people (see figure).



Ergographic fatigue curves in individuals of various ages. a) Tested S., 81 years old; b) tested B., 35 years old. I) "Breaking-in" period; II) period of stable work capacity; III) period of reduced work capacity.

As seen in the cited figure, in old people the breaking-in period is extended and the period of stable work capacity lasts longer than in young people, but the maximal level of contractions and the total work performed have a smaller range. Extension of the period of stable work capacity was observed also by O. F. Maksimova [5] and K. D. Predtechenskii [13].

The extension of the breaking-in period can be regarded as the result of slower engagement of the mechanisms of maximal work capacity in old people.

One characteristic feature is often observed in the ergographic studies of the aged. A number of those tested under conditions of high physical stress stated that they were unable to continue their work at this rate; however, after an interval of 10 to 20 seconds their work continued at a high level, and the tested individuals observed no disagreeable sensations. Apparently, in these cases some special mechanism prevents old people from developing an intense fatigue.

In the first series of tests we studied the effect of active and passive rest on the restoration of work capacity when the right hand was under medium physical stress. In these tests, the load on the left hand during active rest equalled 50% of a fatiguing load. The tested individual was given three work loads of two minutes each with one minute intervals of active or passive rest.

Thus, during the work schedule the tested had two rest intervals, the sequence of which was determined by the conditions of the experiment.

As an illustration, we cite in Table 1 the result of observation of G., female.

TABLE 1

Effect of Active and Passive Rest on the Muscular Work Capacity

Date of examination	Examined individual	Age (in years)	Type of rest	Load on left hand	Load on right hand	Work, during the two minutes prior to rest	Work, during the two minutes after first rest	Work, during the two minutes after second rest	Restorative effect of the first rest period	Restorative effect of the second rest period
				in kg		in kg/m			in percentages to the first work	
June 23, 1959	G.	91	Active	2	4	25.36	23.92	15.68	94.3	62
June 24, 1959		91	Passive	–	4	28.53	24.52	21.4	86	75
March 8, 1955	M.	20	Active	4	6	42.34	39.71	32.33	93.8	76.3
March 16, 1955		20	Passive	–	6	37.06	30.22	22.8	81.5	61.5

As seen in Table 1, active rest after the first two minute work produces a more pronounced restorative effect than passive rest, but when it follows the second workout its restorative role is considerably inferior to that of passive rest.

Thus, a slight increase of fatigue in the aged from additional two minute work led to the loss of the positive effect of active rest. For comparison, in Table 1 the data cited are obtained in a young man whose active rest, following the second work period, continues to produce an effective restoration of work capacity as compared to the passive rest period.

It is worth noting that in four out of 28 tested individuals the repeated work was more effective after an active as well as a passive rest period. This fact cannot be connected with the past occupational characteristics of the individuals. However, in these instances the general possible work capacity as determined by their work up to intense fatigue, was smaller than in other tested individuals. This fact permits us to assume that in this case we are dealing with a stable character of the stimulation process in the nervous centers, and with reduced inhibition. The work, therefore, is performed at a high stimulation level but the total work capacity is reduced due to the weakness of inhibition and its effect on the restoration processes.

Consequently, in the evaluation of work capacity in the aged it is important to consider two factors: the intensity of the current work and the total possible work capacity.

In the next group of experiments the load during active rest was raised to 75-80% on the right hand. This load-increase produced in all tests a lower work capacity after an active rest than after a passive rest period. Four individuals, of the age up to 70 years, were an exception.

In the test series with large loads, in nearly all cases, with the exception of one instance, active rest as a rule produced a considerably smaller restoration effect than passive rest (Table 2).

Table 2 shows results of observations on S. Following a two-minute workout with a large load, the active rest (load was equal to only 50% of the load on the right hand), in contrast to two minute work with medium load, loses its advantage over the passive rest, whereas in young people even under these weight categories active rest

was almost always more effective than the passive one. This is attested by the result of examination of K. cited in Table 2. Following two minute work with eight kg, active rest, carried out with 10 kg, proves to be much more effective than passive rest.

Hence, on the basis of the above-cited test-results in which the load was changed on the working group of muscles, as well as during the active rest period, one can arrive at the conclusion that active rest in the aged leads to a positive effect only within certain very narrow limits of optimal loads, i.e., with age, the range of the positive effect of active rest is markedly reduced.

TABLE 2

Effect of Active and Passive Rest on the Muscular Work Capacity

Date of examination	Name of examined	Age (in years)	Type of rest	Load on left hand (in kg)	Load on right hand (in kg)	Work during the two minute period prior to rest (in kg/m)	Work during the two minute period after rest (in kg/m)	Restorative effect of rest (in percentage to the first work)
July 9, 1959	S.	81	Active	3	6	20.58	9.0	43.7
July 1, 1959		81	Passive.....	–	6	32.16	15.42	48
April 6, 1955	K.	19	Active	10	8	38.39	31.38	81.7
April 8, 1955		19	Passive.....	–	8	33.65	20.23	61.1

We mentioned earlier that the majority of authors connect the effect of active rest with the fact that an inhibition process develops during this period in the centers of the opposite group of muscles. This inhibition stimulates the restoration process with the result that an increased work capacity is created. The fact of reduction of the positive effect of active rest in aged, established in our tests, can be explained by the weakening of the inhibition effect on the restoration process at this stage of life.

It is worth noting that repeated exercises led to a well expressed training of muscular work capacity. This was particularly noticeable in the tested individuals who have been regularly attending the tests.

Thus, for example, in G. (age 91) on the 7th exercise the work capacity rose 2-3 fold, as compared to the initial figure. Of particular importance is the fact that during the training period the restorative role of active and passive rest increases. This high rate of increased work capacity, in the course of repeated exercises and training, attests to the considerable potential possibilities of increasing work capacity in advanced and old age.

The obtained facts may serve as a basis for the extensive use of measured physical exercises in this age period.

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All abbreviations of periodicals in the above bibliography are letter-by-letter transliterations of the abbreviations as given in the original Russian journal. *Some or all of this periodical literature may well be available in English translation.* A complete list of the cover-to-cover English translations appears at the back of this issue.
