

## TONIC REFLEXES IN MAN

### COMMUNICATION II. EFFECT OF UNSTABLE POSITION OF THE BODY ON THE

#### A. A. UKHTOMSKII TONIC REFLEX

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It is known that muscle tone which is based on tonic reflexes ensures adaptational reactions of the human body directed towards counteracting the force of gravity and maintenance of an erect posture.

In the present work an attempt was made to trace the influence of an unstable position of the human body on muscle tone; the proprioceptive tonic reflex described by A. A. Ukhtomskii in 1925 [1] and studied by other workers [2, 3, 4, 5] was chosen as an experimental tool.

#### EXPERIMENTAL METHOD

In studying the effect of an unstable position on the extent of change in the tone of skeletal muscles the magnitude of tonic reflexes was first determined with the subject in a stable position; the subject's body was then placed in an unstable position. A total of 53 experiments was carried out on students of the Institute of Physical Culture.

The stable position of the body was changed in the following ways.

1. A stable position was achieved by standing on skates in a special wooden stand with the weight resting on the whole sole of the boot. After recording the reflex to a push in the stable position, the same reflex was recorded with the subject standing on skates on a smooth glass surface, i.e., in an unstable position.

2. During the experiment the subject was standing on a hard surface over which a sheet of rubber was stretched. On termination of the repulsion the hard surface was lowered by pressing a lever and the subject descended together with the rubber sheet (within the limits of its elasticity), passing suddenly into an unstable position at the moment of onset of the Ukhtomskii reflex.

The myotopographic technique was used for recording the repulsion and the reflex response.

#### EXPERIMENTAL RESULTS

The data yielded by the first method showed that on passing from a stable position of the body to an unstable one the tone of extensor muscles of the extremities was increased. This was particularly marked in the case of subjects who had never before stood on skates.

When the body was in an unstable position during repulsion the tonic reflexes were considerably enhanced. Thus, when the reflex displayed by the subject V. G. while standing in the special stand with the usual area of support is compared with that displayed while standing on skates it is seen that the raising of the arm increased by 40° (Fig. 1).

A sudden displacement from a stable position prior to repulsion is associated with an involuntary raising of both arms which is represented on the myogram by a vertical rise in the trace (Fig. 2). If, however, the subject is first pushed away from vertical support then the displacement from a stable position at the moment

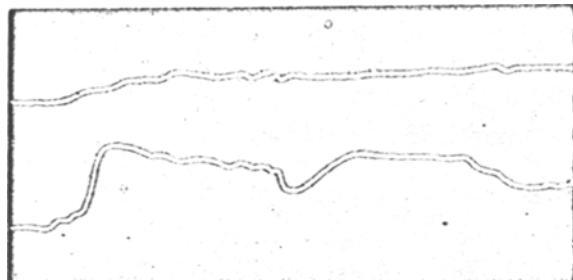


Fig. 1. Change in the tone of the deltoid muscle of the shoulder girdle while in an unstable position (standing on skates); subject V. G. Records from above down: myogram of the left deltoid muscle, myogram of the right deltoid muscle.

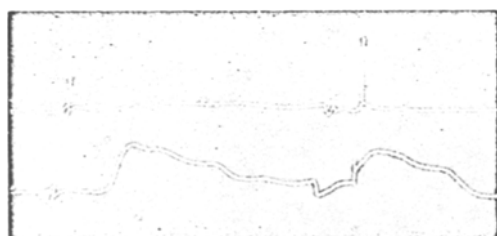


Fig. 2. Change in the tone of deltoid muscle of the shoulder on sudden displacement of the subject from a stable position. Records from above down: myogram of the left deltoid muscle, myogram of the right deltoid muscle; ↓ moment of displacement from a stable position.

of the body is made unstable. Experiments were performed on man. The change of the tonic condition of deltoid muscles was observed. The proprioceptive tonic A. A. Ukhtomskii reflex served as a model. The method of myotonography was used for recording.

of onset of the reflex produces considerable increase and prolongation of the tonic reflex (raising of the arm increased by 30-40°). Those subjects who do not show a visible tonic reflex reveal increased tone in the deltoid muscle of the arm being repulsed when the supporting surface is suddenly lowered; this is expressed in the myogram (Fig. 2) by a tonic afterdischarge following the involuntary raising of the arms (vertical rise of the trace).

The difference in the changes of tone of the deltoid muscle during standing on skates and on solid surface is less in students of the Institute of Physical Culture than in untrained subjects; this is evidently due to the fact that the former have already developed motor skills with appropriate changes in muscle tension. An important part is played by regulation of skeletal muscle tone in the process of learning and training, with increasing perfection and precision with respect to proportioning tonic tension of the muscles involved in a given movement.

The proprioceptive tonic reflex described by A. A. Ukhtomskii can thus be used as one of the components of the whole system of tonic reflexes of skeletal muscles for the study of the mechanism of changes in muscle tone under conditions of unstable position of the body.

It may be concluded on the basis of the data obtained that an unstable position of the body or sudden displacement of the body from a stable position increases the tonic reflex. In cases in which this reflex was not previously visibly apparent, increased muscle tension was found in the arm pushing away when the body was displaced from the stable position.

## SUMMARY

It was established that the tone of extensor muscles of the extremities is increased when the position

## LITERATURE CITED

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• In Russian.