CONTINUOUS LOCAL MYOTONOGRAPHY IN MAN

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Recordings were made with a detector element (weight 7 g) glued to the skin above the area of muscle to be investigated, a tensometric amplifier, and a recorder. A probe located in the center of a ring is inserted into the muscle and causes deformation of the sensing element.

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Various methods of myotonography have been described in the past [1, 2]. I suggest a method of continuous local recording of the muscle tone during tonic and tetanic contractions, both at rest and during movements. The apparatus consists of a detector element (Fig. 1), sensitive to changes in muscle tension, a tensometric amplifier receiving the signals obtained, and the recording system proper. The detector is made of organic glass, has the dimensions indicated, and weighs 7 g. The base of the body is glued by the whole of its circumference to the skin surface above the part of the muscle for investigation. In this way the detector is able to move in accordance with changes in its shape. A probe, perpendicular to the surface of the muscle, is provided inside the body of the detector between the contact plate and the skin. The probe is longer than the height of the detector body (see Fig. 1), and the projecting part is inserted into the muscle. An ejecting force, determined by the degree of tension in the muscle, acts on the base of the probe inserted into the muscle. This force is balanced by the elasticity of the skin supporting the base of the detector and by the deformation of the contact plate. Equilibrium between these forces is defined as the initial level of the muscle tone. During measurement of the tension in the muscle, in the case of an increase, for example, the probe will be ejected with greater force. This force will cause additional deformation of the contact plate and produce traction on the skin. Deformation of the contact plate is detected by the tensometric sensing element glued to its outer surface and included in a tensometric bridge as an arm with

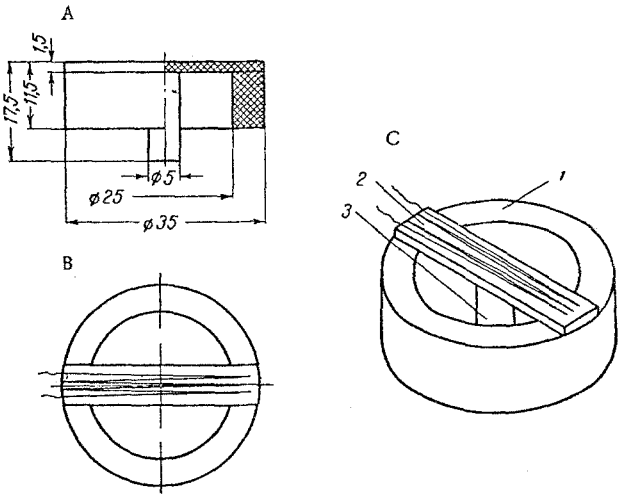

Fig. 1. Diagram of the detector element. Front view (A), plan (B), and general appearance (C). 1) Body of detector, 2) contact plate to which are glued the tensometric resistor and connecting leads, 3) probe for insertion into muscle.

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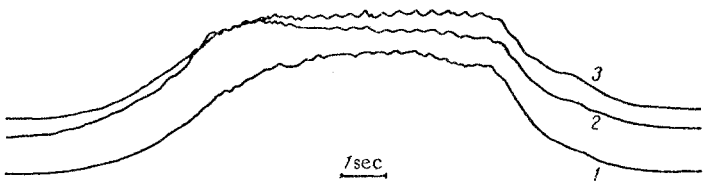

Fig. 1. Changes in tension of various parts of the biceps brachii muscle during maximal isometric contraction. 1) Dynamogram; 2) tonogram of the long head (detector placed laterally on belly of muscle); 3) tonogram of short head (detector placed medially on muscle belly).

variable resistance. After amplification, this signal is recorded on an oscillograph. Traction on the skin caused by an increase in the force of expulsion of the probe from the muscle must be regarded as an unfavorable factor lowering the sensitivity of the detector. To ensure that the useful signal is detected more fully by the contact plate, the length of the probe is not chosen arbitrarily, but in accordance with the elastic properties of the skin above the muscle to be tested. In man, the elasticity of the skin is subject to considerable individual variation, and it depends on age and on the part of the body concerned. However, although the absolute magnitudes of the skin deformation resulting from traction may vary widely, the character of the deformation is consistent enough. Initially the sensitivity of the detector will be reduced. Within a certain range of stresses it will work under optimal conditions, for the forces expelling the probe will be balanced mainly by deformation of the contact plate.

Tonograms from different points of the biceps brachii muscle during isometric contraction are shown together with the dynamogram in Fig. 2. The force developed by the muscle may be seen to be brought about by differences in the degree of tension of different parts of the muscle. The actual dynamic pattern of distribution of the level of muscle tension is determined not only by differences in the tension of different parts of the same muscle, but also by the constant variation in the degree of this tension.

LITERATURE CITED

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2. E. Marey, La Methode Graphique dans les Sciences Expérimentales, Paris (1885).