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MEASUREMENT OF FORCE OF PRINCIPAL MUSCLE GROUPS

[No author given]

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The measurements are performed on a special stand which allows determination of the isolated action of a specific group of muscles while completely excluding the influence of other muscles. /1*

The stand consists of a metal frame, 200-205 cm long and 60-70 cm wide, firmly supported on six legs 50-60 cm long. A freely sliding vertical post, 80 cm tall, with a transverse movable bench, is fastened to the side tubes of the frame; during the measurements, the bench supports the sensor of an electro-dynamometer or mechanical dynamometer. Inside the frame, there is a wooden bench with a headrest at one end and an adjustable footrest at the other. The bench has a number of holes for belts which are used to hold down the body of the subject. Belt loops to hold down the shoulders run from the middle of the bench toward the headrest.

Method of Measuring the Force of Individual Muscle Groups

Measurements are made during the flexion and extension of the wrist, forearm, shoulder, neck, trunk, hip and shin, lowering and raising the shoulders, and dorsal and plantar flexion of the foot.

In measurements made on the stand described above, it is extremely important to fasten the subject's body so that movements of all groups of muscles except those being measured are completely excluded. During each measurement, the straps holding the dynamometer in place on the part of the body being measured must be kept tight and the exact angle of flexion of the extremity being measured in the original position must be observed. Failure to observe these rules will produce a significant variation of the results and will not allow objective parameters to be obtained. /2

*Numbers in the margin indicate foreign pagination.

In all the measurements, the dynamometer strap is placed in the middle of the corresponding portion of the extremity. This method of measurement allows a slight decrease in the difference in application of force in persons with extremities of different lengths.

During each movement, it is sufficient to give the subject two trials and to record the better result.

Measurement of Force During Movements of the Wrist

Original position: seated on the edge of the bench. The hand being measured is supported by the forearm on the surface of the bench, the radiocarpal joint is at the level of the edge of the bench and fastened down by a strap; the strap which links the wrist with the dynamometer is on a level with the metacarpophalangeal joints. A dynamometer is fastened to a plank which links the legs of the stand (or is fastened to the floor). The force is registered with the wrist moving upward. When measuring flexion, the palm is turned upward while it is turned downward when measuring extension.

Measurement of Force During Movements of the Forearm

Original position: supine. The subject's body is fastened down at three points - chest, pelvis and legs. The shoulders are held down by straps and the heels rest on the transverse plank. The upper arm of the hand being measured is placed next to the trunk and held down by a strap while the forearm is placed vertically with respect to the surface of the bench. The dynamometer strap is placed on the middle of the forearm (between the axes of frontal rotation of the radiocarpal and ulnar joints).

When measuring the force required to flex the forearm the vertical post is placed at the foot end, and when measuring the extension force it is placed at the head end. /3

Measurement of Force During Movements of the Shoulder

The original position for measurement of force during flexion and extension of the shoulder: supine. Subject's body fastened down at three points: chest, pelvis, legs; the shoulders are held down by straps and the legs rest on the cross plank. The upper arm of the hand being measured is vertical. The

hand is bent at the elbow with the wrist against the head. The dynamometer strap is placed on the middle of the upper arm (between the axes of frontal rotation of the elbow and shoulder joints).

In recording the force of flexion the vertical post is located at the foot end, while it is placed at the head end when measuring the extension force.

To measure the force involved in raising and lowering the shoulders in the original position, the subject is supine. The upper arm is bent out at right angles to the side and rests on the instrument platform with the lower arm bent at the elbow. The dynamometer strap is on the middle of the upper arm. The dynamometer is attached inside the lateral post of the vertical frame.

When measuring the raising of the shoulders, the vertical post is at the head end while it is at the foot end when the lowering of the shoulders is measured.

Measurement of Force During Movements of the Trunk

Original position for recording the force of muscles involved in flexing the trunk: seated on the bench (trunk perpendicular to the plane of the bench), with the back against the vertical post. The legs are extended and held down by straps. The pelvis is supported on the movable cross plank. The strap which connects to the dynamometer holds the subject's body at the level of the tenth-twelfth thoracic vertebra. /4

In measuring flexion, the original position is seated with the face against the vertical post, legs extended, held down by straps and resting on the movable plank. The dynamometer strap holds the subject's body at the level of the 10th-12th thoracic vertebra.

Measurement of Force During Movements of the Neck

The original position for recording the force of muscles of the neck during flexion is seated with the back against the vertical post. The subject's body is fastened by straps at two points — at the hips and shoulders, with the latter excluding the possibility of using the muscles of the trunk for movement. The belt connected to the dynamometer is placed above the arcus superciliaris. To measure the force of the muscles during flexion of the neck, the original

position is seated with the face against the vertical post. The legs and shoulders of the subject are held down by straps. The strap connected to the dynamometer holds the head in the vicinity of the external occipital eminence.

Measurement of Force During Movements of the Foot

Original position: supine. The trunk and free leg are fastened by straps while the shoulders are restrained by other straps. The free leg is supported on the cross plank. The hip of the leg being measured is elevated and supported by a strap at the knee joint against the cross beam of the vertical post; the leg has a loop of a strap attached to it at the talocrural joint, which is fastened in turn to the frame of the instrument and does not allow the leg to be raised above the cross beam of the post when measuring the plantar flexion or lower than 20-25 cm when measuring dorsal flexion. The dynamometer belt is located in the vicinity of the articulation of the tarsus with the toes. /5

In measuring dorsal flexion of the foot the dynamometer sensor is fastened to the frame of the instrument.

When measuring plantar flexion the dynamometer is fastened to the cross beam of the vertical post.

Measurement of Force During Movements of the Shin

Original position: prone. The body and free leg are fastened by belts. The foot of the free leg is supported on the cross plank of the instrument frame while the shoulders are held down by belts. The shin of the leg being measured is placed vertical to the plane of the table and the hip is held down by a strap applied at the knee joint. When measuring the force in flexion movements the vertical post of the instrument frame is located at the foot end of the subject while in the case of extension movements it is located at his head. The dynamometer strap is placed on the middle of the shin (between the frontal axes of rotation of the tarsal and knee joints).

Measurement of Force During Movements of the Hip

Original position: supine. The subject's body is held down by straps, (chest, pelvis, free leg). The heel of the free leg is supported on the cross beam while the shoulders are held down by straps. The hip of the /6

measured leg is elevated to a vertical position with the knee bent. When measuring the force of the muscles during flexion the vertical post of the instrument is located at the foot end of the subject, while when recording extension it is located at his head. The strap connected to the dynamometer is placed on the middle of the hip (between the frontal axes of rotation of the knee and tarsal joints).

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