USE OF A RECORDING DYNAMOMETER IN CLINICAL MEDICINE

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There are many occasions in clinical medicine when the study of muscle strength and function is important. Disorder of the motor functions may be reflected in different ways, many of which are amenable to some system of recording.

Simple recording dynamometers have been used in this clinic during the past three years, and have been referred to in connexion with studies of muscle recovery in poliomyelitis (Russell, 1952). The machine used was designed by Dr. E. H. J. Schuster (later models have been made by H. G. East and Co., Longworth Road, Oxford) and is illustrated in Figs. 1 and 2. Two or more strengths of spring are available, and the maximum grip which can be recorded is 90 lb. (41 kg.). The normal grip is occasionally greater than this but will

soon fatigue below the maximum figure on sustained contraction. The recording paper is moved by clock-work, and two speeds are available. Both hands may be tested together, with the recording pens (ball-pointed) side by side or one above the other.

Examples of Records Taken

Such records may be of value in following the course of a parietic condition from day to day, but a single record is often informative, and may demonstrate varieties of motor disorder of which the following are examples.

All records read from left to right. When both hands are tested together the record of the right hand is either to the left of or above the left, and may overlap it to a varying extent according to the particular machine used. The records may be taken by asking the patient to make a maximum contraction with both hands and to "hold it" while the recording pens are concealed from the patient by holding a sheet of paper in front of his eyes. Another type of record is obtained by asking the patient to make rapid repeated contractions. Sometimes each hand is tested separately.

Fig. 3 gives the appearance which may be taken as normal for a maximum contraction maintained for about 80 seconds, and illustrates a normal fatigue curve.

FIG. 1.—Recording dynamometer in use.

FIG. 2.—Dynamometer with top plate removed to show design.

FIG. 3

FIG. 4

FIG. 5

FIG. 6

FIG. 3.—Normal: both hands recording together. R=right; L=left. FIG. 4.—Slight myasthenia. FIG. 5.—Myotonia congenita. FIG. 6.—Small lesion of the right parietal lobe.

FIG. 7

FIG. 8

FIG. 9

FIG. 10

FIG. 7.—Right frontal tumour. FIG. 8.—Rheumatic chorea. FIG. 9.—Left hemiballismus. FIG. 10.—Congenital choreo-athetosis.

Disease of Muscle.—Fig. 4 gives the record of a slight case of myasthenia gravis in which fatigue develops more rapidly than normal. Fig. 5 is from a patient with myotonia congenita who made repeated maximum contractions. The failure of full relaxation is well seen in the early part of the record, and then "works off."

FIG. 11

FIG. 12

FIG. 13

FIG. 14

FIG. 11.—Wilson's disease. FIG. 12.—Early parkinsonism on right (upper). FIG. 13.—Hysterical paralysis of right hand (R). Left grip (L) unaffected. FIG. 14.—Hysterical paralysis of right hand: left grip also hesitant.

Focal Cerebral Lesions.—Focal lesions of one or other cerebral hemisphere may lead to contralateral paresis which is slight and can only be demonstrated by some mechanical device. Fig. 6 illustrates the effect of a small cerebral thrombosis in the right parietal lobe for which slight astereognosis of the left hand was the only obvious sign. Fig. 7 was the tracing produced by a patient with a right frontal tumour causing adverse fits. Lateralizing signs were inconspicuous and the recorded degree of weakness of the left grip surprised those in charge of the case.

Disorders of Motor Functions.—Dynamometer recordings of motor disorders give many interesting pictures of the various forms of disintegration of motor function. In unilateral cerebellar lesions the dynamometer demonstrates some paresis, and, in addition, the record of rapidly repeated contractions is more slow and irregular than on the normal side. Remarkable records are obtained in patients with chorea. Fig. 8 is the record of a child of 10 years with severe rheumatic chorea attempting to grip steadily, but sudden relaxations are very frequent and make sustained contraction impossible. In cases of Huntington's chorea the same characteristics are present to a lesser degree, and Fig. 9 shows a somewhat similar feature from a case of left hemiballismus in a patient aged 70 caused by a vascular lesion in the right subthalamic region. Cases of congenital spastic diplegia with choreo-athetosis also give a tracing of this pattern (Fig. 10). Fig. 11 is recorded by a young man severely disabled by Wilson's disease: it shows a failure to maintain the grip and the irregularity with sudden relaxations of the type seen in chorea. Fig. 12 is from an early case of Parkinson's disease affecting the right side only. There is little difference between the two hands as regards maximum strength and speed of repeated contractions, but the tracing shows a distinct slowing and irregularity of the change from relaxation to the next contraction on the affected side. Severe disorders of motor function can also be demonstrated in advanced cases of disseminated sclerosis. Rapid weakening of the initial maximum contraction is often a striking feature of these cases and is mingled with a varying degree of irregularity of the tracing.

Hysteria and Malingering.—Functional weakness of one hand is common, and repeated records with the dynamometer have much value in diagnosis and treatment. The record obtained may also be of legal value in compensation cases. Hysteria and malingering are indistinguishable from each other. Fig. 13 shows practically no movement of the hysterical right hand and a normal curve for the left. Fig. 14 is somewhat similar, but here there is also some interference with contraction of the normal hand (left). Contraction with the left hand alone, however, was quite

normal. Repeated records have sometimes helped to clarify the disability when there is a mixture of organic disease and hysteria. The types of curve obtained in various psychological conditions have not been investigated further, but might well prove to be fruitful.

Such recording devices are also useful in the clinical study of rheumatic conditions, not only for recording the degree of loss of function but also for identifying the added psychological disability which is often present in arthritic diseases.

REFERENCE

Russell, W. R. (1952). *Pollomyelitis*. Arnold, London.

The second edition of the *Unesco Directory of International Scientific Organizations* (H.M.S.O., price 13s. 6d. net), published a short time ago, is a useful reference book for the scientist of whatever discipline. Two hundred and sixty-four organizations are described, classified under the three main headings: "Basic Sciences, Applied Sciences, and Miscellaneous," "Agricultural Sciences, Engineering Sciences, and Medical Sciences," and lastly "Miscellaneous," a group which includes organizations whose activities either enter into a number of different scientific fields or, while not being entirely scientific, are of interest to scientists. Under the Medical Section there are listed 76 international and 16 regional organizations. Where relevant, the following information is given about each organization: official name and address; nature and aims; governing body, officers, and membership; commissions set up within the organization; special facilities such as laboratories, research centres, or libraries; financial resources; meetings and voting; publications; relations with other international organizations; short history and bibliography; any useful supplementary information. The manuscript of the *Directory* was completed by the end of June, 1953, but the *Directory* itself was not on sale in Britain until the middle of May, 1954. This has naturally dated some of the information about meetings and officials, but it does not seriously diminish the usefulness of the *Directory*.