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BRIEF COMMUNICATION

A Simple Recording Grip Strength Device[1]

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CABE, P. A., H. A. TILSON, C. L. MITCHELL AND R. DENNIS. *Simple recording grip strength device.* PHARMAC. BIOCHEM. BEHAV. 8(1) 101–102, 1978. – A simple-to-construct, inexpensive recording strain gauge device which may be used to obtain graded measurements of forelimb grip strength in rats and mice is described.

Grip strength Muscular dysfunction

IN THE evaluation of chemical agents, it is frequently of interest to test for the presence of neuromuscular dysfunction. Devices available to measure such effects typically suffer from one or more disadvantages. For example, the rotorod [1] is frequently used to assess motor function, but it is relatively expensive and usually requires pretraining of subjects for best results. An upper limit on the time spent on the rotorod is often required and this may result in a ceiling effect in which some subjects never fall off, thereby making statistical analysis difficult. Although devices such as the inclined screen or plane [2] are relatively inexpensive, they appear to be insensitive to subtle muscular deficits and result in categorical data, to which the more powerful parametric techniques are not applicable. The deficiencies in existing methods have led us to develop a simple device to measure graded changes in the forelimb (grip) strength of laboratory animals.

METHOD

Apparatus

The device we have developed consists of a Plexiglas frame which holds a push-pull strain gauge (Chatillon, Model DPP–0.5 kg; available from J. A. King and Co., 2620 High Point Road, Greensboro, NC 27420) in a horizontal attitude (Fig. 1b). The frame consists of a base (approximately 20 × 30 × 1.2 cm) which is bolted or clamped to the table or bench top and which supports a vertical plate (approximately 5 × 15 × 1.2 cm) reinforced with a triangular brace. Other dimensions or support arrangements would work equally well. As shown in Fig. 1, the strain gauge (Fig. 1a) is attached via pretapped holes in the body of the instrument to an inverted L-shape arm (approximately 5 cm wide, with legs of 10 and 15 cm) which itself is bolted to the vertical plate. A grasping ring 45 mm across consists of 0.093 in. (2.3 mm) brass rod soldered into a hexagonal aluminum standoff. The threaded standoff is screwed onto an extension arm supplied with the strain gauge, such that the grasping ring is fixed in a horizontal plane.

Procedure

In use, the strain gauge is zeroed and set to record a pulling force. The animal is held by the tail with one hand about midway along the length of the tail and the animal's body supported by the other hand. Holding the animal about 10–15 cm away from and above the ring, the hand is dropped from under the animal. Typically, rodents will reflexively sprawl, extending all four limbs and flexing the head and body upward. The animal is then lowered by the tail toward the ring until it grasps the ring. At this point, the tail is lowered until the body is horizontal and the animal is pulled away from the ring with a smooth steady pull, until it releases the ring (Fig. 1b). The strain gauge will remain fixed at its maximum deflection, which is the force required to break the animal's grip; it has been our practice to take 3 readings for each animal, not counting those in which it holds the ring with only one forepaw or jerks the ring. An average of 3 permissible readings is recorded as the grip strength score.

DISCUSSION

The strain gauge described in this communication is available in several models differing in the range of force measured and the gradations between steps. In our laboratory, we have used the Model DPP–0.5 kg strain gauge, which measures up to 0.5 kg of force at 5 g intervals, to

[1] Mention of components by brand name should not be taken to imply endorsement by the National Institute of Environmental Health Science, the National Institutes of Health, or the U.S. Department of Health, Education and Welfare.

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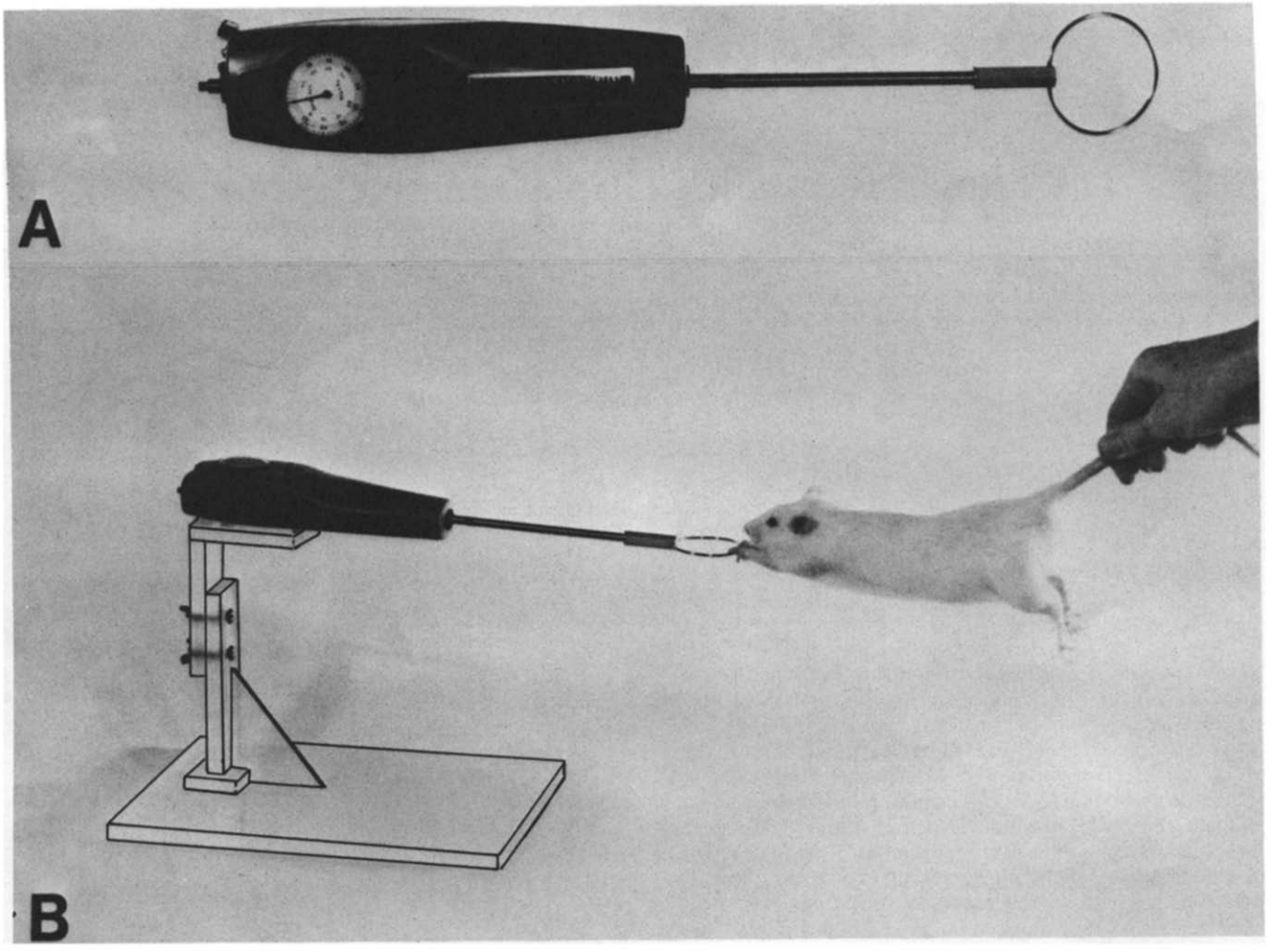

FIG. 1. (A) The Chatillon Model DPP–0.5 kg strain gauge with extension and grip ring attached. This top view shows the location of the dial indicator and reset slide switch. (B) The grip strength meter in use. The edges of the clear plastic frame have been inked in this illustration to enhance its visibility.

determine the effects of repeated administration of polybrominated biphenyls (PBBs) on the grip strength of mice and rats [3]. In this study, the device detected differences in the force pulled by treated and untreated rats, showed males to be stronger than females, and older animals to be stronger than younger ones. This model was near the lower level of sensitivity for mice, while pilot studies with rats over 500 g in body weight indicated that a model with a higher range (Model DPP 1 kg) would be more appropriate.

The apparent sensitivity, relatively low cost and graded measurements provided by the strain gauge device are clear advantages over traditional devices like the rotorod and inclined screen or plane. Moreover, the strain gauge technique permits repeated measures of an index of neuromuscular function that is uncomplicated by learning factors. The strain gauge device appears to have a great deal of potential in the assessment of neuromuscular dysfunction.

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