Careful assessment of criterion measures is an important problem in experimental design. Without reliable estimates of criterion strength measures in pre- and posttreatment situations the investigator may be plagued by the influence of extraneous variables which contaminate true treatment effects. The identification of extraneous and contaminating variables merits careful attention in research on isometric strength.

Work on reliability aspects of isometric strength measurement has drawn attention to the possible contamination of criterion measures due to competitive situation, knowledge of results, time of day, and possible skill learning. Even more important, the realization that rate of gain in isometric strength is related not only to the intensity of the training stimulus but to an inherent "strength limit" made necessary a careful reassessment of strength development principles previously formulated.

The assessment of criterion strength measures, it is hoped, is achieved without any effect on the criterion variable itself. Unfortunately, research done on humans frequently results in the distressing complication that the measurement schedule itself has an observable treatment effect. An investigator may take special precautions to diminish the effect of known extraneous variables by standardizing the test position of muscle groups, measuring at the same time of day, giving a suitable number of trials for reliability, and so on. In spite of all these and other possible precautions, however, the measurement schedule may still introduce factors which are not pertinent to research goals. Measurement schedules can affect criterion strength measures in three principal ways: (a) induce strength development per se; (b) elicit psychological-motivational learning; and (c) a combination of (a) and (b).

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**Purpose of the Study**

The purpose of the present study was to examine the effects of test-retest measurement schedules upon isometric endurance scores. Although work has been done considering measurement reliability of absolute isometric strength, little is known about possible effects involving successive or serial isometric contractions.

**Methodology**

As part of an investigation studying possible effects of proprioceptive neuromuscular facilitation techniques, twenty male subjects (S's) were measured for isometric wrist flexion strength of left and right limbs. A pair of cable tensiometers was mounted securely on a table to provide right angle intersections with two padded forearm rests. S's were seated and grasped a handle attached to each cable with the left and right hands respectively. The wrist was kept in 45 degree dorsiflexion for all S's by adjustment in cable length via chain links. The forearms and wrists were stabilized by padded canvas straps. Tensiometer dials were shielded during actual trials but S's were informed of scores made immediately after each trial during the rest period.

Trials were standardized to five seconds of maximum effort with a 30-second rest period after every trial. Initial criterion measures were secured on separate unilateral and for a simultaneous bilateral flexion series. At one session S's were given 20 trials on simultaneous bilateral flexion. At least three hours later on the same day, S's were given 20 trials of separate unilateral wrist flexion for each of the limbs. The order of test conditions for the separate unilateral and the simultaneous bilateral series was rotated among S's. On the initial test day, then, each S was given 20 five-second trials with interspersed 30-second rest periods on each wrist separately, plus a similar series of simultaneous bilateral flexion. Thus, each wrist underwent two separate series of 20 five-second maximal contractions.

Based on the reasoning that the training stimulus on one day is completely dissipated in fourteen days, S's were released for two weeks before being measured again. The practice of allowing a lapse of two weeks before remeasurement has previously been shown to be a satisfactory method for securing criterion absolute strength measures free of non-pertinent measurement schedule effects4. Under this plan, pre-treatment criterion measures are secured on a single day. After a two weeks time lapse, an identical retest schedule revealed no measurement effects upon absolute strength measures. The plan worked for a series of five 5-second maximal wrist flexions with 1-minute rest periods and the question here was whether the lapse of two weeks would work as well with an extended series of contractions with shorter rest periods.

Two weeks after the initial measurement sessions S's again reported. The S's were randomly assigned by pairs into two matched groups on the basis of the sum of the first five unilateral right and left measures. Group I (right) then took a series of 20 trials as before with the right wrist and Group II (left) did the same with the left wrist. In the complete study S's then reported three times weekly for a period of four weeks completing series of trials under various conditions designed to elicit proprioceptive neuromuscular facilitation effects.

**Results**

The data considered in this report includes the initial criterion measures and the retest situation two weeks later. Changes from initial to