MAKE-TEST AND *BREAK-TEST* IN ISOMETRIC MUSCLE STRENGTH MEASUREMENT OF KNEE EXTENSORS MUSCLES IN ELDER WOMEN

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ABSTRACT

The purposes of this study were to compare the forces produced by knee extensors during two kinds of muscle strength tests (knee at 90 degrees of flexion) and to determine the reliability of each test procedure with two retestings. A hand-held dynamometer was used to perform the tests on 30 elder women. It was founds that the forces produced by knee extensors during break-test *were significantly larger than the forces produced in* make-test *($p < 0.001$). The test and the first retesting of both procedures was reliable, but the second retesting showed decreased values in spite of the test and first retesting values, indicating fatigue. The* make-test *seems to be more indicated for elder people. In this same sample, non reliable data was obtained in the third measurement while doing three sequential measurements.*

KEY WORDS: muscle strength; evaluation; method; physical therapy

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INTRODUCTION

CAROMANO, Fátima Aparecida. Make-test e break-test na mensuração da força isométrica dos músculos extensores do joelho em mulheres idosas. *Salusvita,* Bauru, v. 23, n. 3, p. 423-427, 2004.

Assessment of the muscle strength by manual muscle testing (MMT) gives important information that is relevant in the understanding of the performance of an individual and its functional evaluation. This test has been validated and is established as a routine examination. The association of the strength muscle test with tensiometer adds a numeric value to the test, in kgF, which gives less subjective more accurate information. In Brazil, the isokynetic dynamometer is commonly restricted to laboratorial use due to its costs, despite its accuracy. The hand-held dynamometer measures the muscle or muscular group isometric strength in different amplitudes of the range of movement of the segment (WATKINS, 1996).

The trustworthiness of data obtained by means of a hand-held dynamometer depends on the equipment's calibration, the examiner's skill and the device positioning in accord to the biomechanics of the investigated muscle (or muscular group) (NICHOLAS, 1978).

The manual muscle testing, when performed with a hand-held dynamometer, can be done by two different techniques: *make-test* and *break-test*.

The *make-test* evaluates the individual's force applied in the hand-held dynamometer. The *break-test* consists in evaluating the maximum force the individual is able to resist. To accomplish this test, the physical therapist applies peak force against the individual's limb, until its stability breaks off (WATKINS, 1996). The reliable data generated from these two procedures was validated for several authors (WILES, 1983; CLARKE; 1954, BOHANNON, 1988).

Bohannon (1988) assessed these two procedures on the evaluation of the strength of the elbow flexors in adult women. He found statistically significant differences between data from the two procedures. The forces produced in *break-test* were significantly greater than the ones produced in *make-test*. Bohannon demonstrated the reproducibility of the test and asserted that we cannot prefer one a test over another, and that both tests are reproducible in two retestings. The application of these two measurement techniques in different populations have not been evaluated yet.

The objectives of the present study were to evaluate the strength of the knee extensors muscle in elder women with a hand-held dynamometer in two different situations, the *make-test* and the *break-test* and to evaluate the reproducibility of such tests in this population.

MATERIALS AND METHODS

Thirty volunteers ranging from 65 to 69 years old (67.0±3.1 years), 71 to 76 kg (74±5.3 kg) and 153.5 to 168.9 cm height (161.0±4.8 cm) participated in this study. All of them were healthy female individuals, active female in the community and they do no practiced any physical activities. The study was developed in LaFi-ReaCom (Behavioral Reactivity Physical Therapy Laboratory) of the Physical Therapy School of the School of Medicine of University of Sao Paulo. A hand-held dynamometer (Lafayette Instrument – model 01160) and a goniometer were used in the study.

After signing a post-informed consent term, each participant was positioned seated on divan, her upper limbs crossed over the trunk, the knees in 90º flexion (KENDALL, 1979). The physical therapist remained on the left side of the volunteer to provide support to the thigh. The hand-held dynamometer was positioned on the antero-inferior region of the leg. A second physical therapist remained behind the individual to confirm that the individual was not dislocating the trunk posteriorly during the test. Each individual produced peak force, sustaining it, at least, for five seconds. The hand-held dynamometer was previously calibrated and its precision was 0.05 kg. The first protocol was randomly determined by means of two dices, a black (*break-test*) and a white (*make-test*) in a bag. Each participant selected a dice before her tests, determining the sequence. Among the 30 participants, 17 started with the *make-test* protocol and 13 started with the *break-test* protocol. The participants were submitted to three measurements of the strength of the right knee extensors muscle with three minutes of rest between the first and the second and between the second and the third measurements, in order to avoid fatigue. After 20 minutes, new tests were run using the other procedure, with the same number of intervals.

The two-way analysis of variance (ANOVA) was used to determine whether there was difference among the sequence of measurements in the *break-test* and *make-test*. The coefficient of correlation of Pearson was used to determine the relation between the forces produced in *break-test* and *make-test* and to determine the reproducibility two procedures.

RESULTS

The colleted data in the first, second and third measurements in *break-test* and *make-test* can be seen in TABLE 1. The statistics analysis demonstrated that there was a statistically significant difference between the force produced in the two procedures. The force produced by quadriceps in the *break-test* was greater (r = 0.793 – 0.801 p = 0.01) than the force produced in the *make-test*. The ANOVA also showed that there was no significant difference between the force produced in the first and the second measurements, but there was a statistically significant decrease among the first measures and the third measure.

TABLE 1 – Descriptive statistics about the forces produced by quadriceps during three consecutive measurements in make-test and in break-test.

Protocol	Measure	Average force (kgF) n = 30	Standard deviation	Variation
Make-test	1º	21.23	2.98	17.67 – 29.04
Make-test	2º	21.31	2.53	17.05 – 28.99
Make-test	3º	19.01	2.29	14.86 – 24.98
Break-test	1º	27.04	3.76	17.34 – 36.49
Break-test	2º	26.98	3.55	17.03 – 37.22
Break-test	3º	22.15	3.50	14.06 – 32.55

kgf – kilogram-force

DISCUSSION

These findings are consistent with those of Bohannon (1988) concerning the reproducibility of the two first measurements that were made. We believe that the third measurement was smaller than the first because of fatigue of participants. Moreover, participants were elder women, whereas in Bohannon study participants were adults. The reproducibility of the two consecutive tests in a same procedure was cited by Bohannon (1987), Wiles (1954) and Clarke (1983). This study indicates that the *break-test* is more indicated to healthy individuals whereas the *make-test* is more indicated in a pathologic or aging conditions. Nevertheless, it is up

to the researcher or clinician to select the better procedure for each situation, according to their own experience. This study also showed that three measurements can be biased in muscle strength evaluation in old-age population.

CONCLUSION

The results of the present study suggest that the *break-test* is followed by a large production of force than the *make-test* and the measurements of both tests are reproducible in a sequence of two consecutives assessments. It was also demonstrated that a third measurement in both procedures may be tiresome to elder people, leading to unreliable results.

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