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# Research Round-up: Manual Muscle Testing


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# Research Round-up

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Manual muscle testing was developed in response to the need to assess muscle strength losses during the polio outbreak in early part of the 20th century. The development of this original method is credited to Wilhelmine Wright and Robert W. Lovett, MD. Wright presented this method in 1912 in the *Boston Medical Surgical Journal*,<sup>1</sup> and Lovett expanded the description of the testing method in 1916 in the *Journal of the American Medical Association*.<sup>2</sup> The development of quantifying muscle strength by rating force generated against external resistance was an important development in objectifying assessment methods of the time.

Today, manual muscle testing remains the mainstay of muscular assessment in the medical community, including physical therapy and medical schools. Florence Kendall along with her husband Henry Otis Kendall, refined testing positions in the 1940s. The manual muscle testing taught today incorporates the anti-gravity testing methods of Wright and Lovett, with the refinement of Kendall. Kendall stresses that the skill of the examiner is paramount in accurately grading muscle strength.<sup>3</sup> Trace muscle contractions (grade 1) are discernable from no muscle contraction (grade 0) based on visual inspection and palpation skills of the examiner. Grade 2, poor muscle contraction, is differentiated from grade 3 by position; both grades require full motion but grade 2 is in a gravity eliminated position while grade 3 is anti-gravity. A grade 4 muscle contraction cannot sustain test positions against maximal resistance, while a grade 5 denotes that ability to sustain the test position against maximum resistance. This common clinical method of assessing muscle strength has limitations that today's technology can overcome.

The limitations of manual muscle testing arise from the subjective nature of the testing. Because the tester must provide the external resistance, this force may be variable between testers. The variability results in interrater reliability values that are unacceptable given other more reliable methods. Several research studies document interrater reliability at levels considered only fair.<sup>4-6</sup> The second issue related to subjectivity is the strength of the individual tested. Reports suggest that larger muscle groups, such as those in the lower extremity generate greater forces than smaller muscle groups, and therefore what constitutes a good level of strength may be difficult to differentiate from a normal level of strength. This lack of sensitivity between antigravity muscle strength grades (grades 3-5) is the primary limitation of accuracy in manual muscle testing. Because a tester may not be able to break a large muscle in testing, manual muscle testing has a ceiling effect where the best strength is graded a 5, yet functional strength deficits may be present. Lastly, muscle strength is graded on an ordinal scale and cannot express the gradations of strength between each level. The difference between grade 1 and grade 2 is not the same as the difference between grade 4 and grade 5. An objective measure of strength that demonstrates high levels of reliability, good validity, sensitivity, and accuracy should be encouraged.

The physical therapy profession has been seeking a tool to measure muscle strength accurately for the last 4 decades.

In 1980, Saraniti et al<sup>7</sup> reported on an early electromechanical device to quantify muscle force production, the manual muscle testing unit. This unit is described as a piezoelectric load cell that converts mechanical energy to electrical energy, and then computes force in kilograms. Since this publication, numerous other studies have examined the usability of hand-held dynamometry in the clinic, and investigated the reliability and validity of this tool. The psychometric properties of hand-held dynamometry are good to excellent, and have been recommended for use in the assessment of individuals with cancer by the Oncology EDGE Task Forces for breast and prostate cancer.<sup>8,9</sup> Because the positions to test muscle strength with a dynamometer are the same as those for manual muscle testing, adopting the use of hand-held dynamometry in the clinic is a simple process.

Given the progress in the development of hand-held dynamometers, the relatively low cost (under \$1,000), and the expectations of the physical therapy discipline to provide accurate and objective measures, the adoption of these tools in the clinical setting should be standard practice. By accurately assessing force production, the clinician can compare strength to established norms, make clinical decisions about strengthening exercise, and document progress.

## REFERENCES

1. Wright WG. Muscle training in the treatment of infantile paralysis. *Boston Med Surg J*. 1912;167:567-574.
2. Lovett RW, Martin EG. Certain aspects of infantile paralysis and a description of a method of muscle testing. *JAMA*. 1916;66:729-733.
3. Kendall FP, McCreary EK, Provance PG. *Muscles: Testing and Function*. Baltimore, MD: Williams & Wilkins; 1993.
4. Ciesla N, Dinglas V, Fan E, Kho M, Kuramoto J, Needham D. Manual muscle testing: a method of measuring extremity muscle strength applied to critically ill patients. *J Vis Exp*. 2011(50). pii: 2632. doi: 10.3791/2632.
5. Hough CL, Lieu BK, Caldwell ES. Manual muscle strength testing of critically ill patients: Feasibility and interobserver agreement. *Crit Care*. 2011;15(1):R43. doi: 10.1186/cc10005. Epub 2011 Jan 28.
6. Jepsen J, Laursen L, Larsen A, Hagert CG. Manual strength testing in 14 upper limb muscles: a study of inter-rater reliability. *Acta Orthop Scand*. 2004;75(4):442-448.
7. Saraniti AJ, Gleim GW, Melvin M, Nicholas JA. The relationship between subjective and objective measurements of strength. *J Orthop Sports Phys Ther*. 1980;2(1):15-19.
8. Fisher MI, Davies C, Beuthin C, Colon G, Zoll B, Pfalzer C. Breast Cancer EDGE Task Force Outcomes: clinical measures of strength and muscular endurance: a systematic review. *Rehabil Oncol*. 2014;32(4):6-15.
9. Fisher MI, Davies CC, Colon G, Geyer H, Pfalzer L. Oncology Section EDGE Task Force on prostate cancer outcomes: a systematic review of strength and muscular endurance measures in prostate cancer. *Rehabil Oncol*. 2015;33(2):37-44.