



Which test is best? Strength testing neurological rehabilitation

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Introduction

Muscle weakness is the primary impairment affecting people with neurological conditions. Despite its significance to both clinicians and patients, the gold standard measure is largely restricted to laboratory settings for research purposes. Therefore, measuring muscle strength in a clinical setting is a common challenge. Our current tests often lack specificity, they are not clinically feasible nor responsive to important changes in function.

Aims

- To compare the most common measures of leg muscle strength for their:
1. Psychometric properties including discriminative ability, susceptibility to floor or ceiling effects and test-retest reliability.
 2. Clinical utility, rated according to the Tyson and Connell (2009) framework.

Methodology

Thirty-six adults (>18 years) with leg muscle weakness as a result of an upper motor neuron syndrome diagnosis were included. In order to capture a spread of ability, participants were stratified by the Functional Ambulation Classification (FAC), with six in each category. Participants underwent two testing sessions and performed all five measures of muscle strength in a randomised order. Tests included:

1. Manual muscle testing of knee extensors (MMT)
2. Hand-held dynamometry of knee extensors (HHD)
3. 1 Repetition Maximum leg press (1RM)
4. Load cell test leg press (LC)
5. Functional sit to stand test (STS)

Results & Discussion

Test	Discriminative	Retest reliability	Ceiling effect	Floor effect
MMT	X	✓	X	✓
HHD	X	✓	✓	✓
Load cell	✓	✓	✓	✓
1RM	X	✓	✓	X
STS	X	✓	✓	X

Table 1. Summary of psychometric properties.

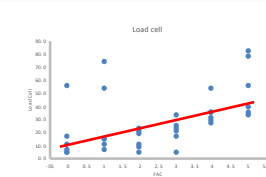


Fig 1. Load cell discriminative ability.

The LC leg press test was the superior measure when compared for its discriminative ability, ceiling and floor effects (Table 1). Of all the tests, it demonstrated the best relationship (Fig 1) between higher FAC and a greater leg strength score (kg). However, LC leg press test (Fig 2) showed only moderate clinical utility, behind MMT and STS (Table 2). STS showed the largest floor effect with 14 participants (39%) unable to complete the test.

Test	Time	Cost	Equipment	Portability	Total
MMT	3	3	3	3	12
HHD	3	1	2	3	9
1RM	1	1	2	1	5
STS	3	3	3	3	12
LC	2	2	2	2	8

Table 2. Comparison of clinical utility.



Fig 2. Load cell, attached to leg press.

Conclusions

While our findings show the LC leg press test to be the most appropriate test for this cohort, it is clear that a perfect clinical measure of lower limb muscle strength does not exist. Clinicians must balance the clinical utility of MMT and field testing (STS), alongside the more psychometrically sound LC test and HHD and continue to bridge the gap between current gold-standard measurements and practical clinical options.