

# A single-center, prospective, cross-sectional study to evaluate the reliability and validity of the Modified Manual Muscle Test for persons with multiple sclerosis

Nanco van der Maas, Institut für Physiotherapieforschung, Biel; Regula Steinlin Egli, Physiotherapie Langmatten, Binningen; Dr. med. Markus Dsouza, Universitätsspital Basel; Deborah Vogt, PhD, Clinical Trial Unit, Basel.

## Background

In MS patients, testing of muscle function can be confounded by many factors like spasticity and ataxia, which are not considered by the existing tests and may cause biased test results. The most used test in MS, the 6 level Neurostatus Muscle test, cannot measure small change that is important in the valuation in physical therapy. Steinlin Egli described a Modified Manual Muscle Test (MMMT), that respects spasticity and has 12 levels. It may provide a reliable and valid muscle function test for MS patients that is more sensible for change than the Neurostatus Muscle Test.

## Aim of the study

We evaluate the inter- and intra-rater reliability of the Modified Manual Muscle Test in MS and the validity of the Modified MMT according to the criteria of the Neurostatus EDSS manual muscle test and the microFET2 handhold dynamometer.

## Methods

This is a single-centre, prospective cross-sectional study with a test-retest design. The primary endpoint is the ordinal MMT level. The intra-class correlation coefficient (ICC) of the ranked MMT levels will be estimated. We aim to show that the MMT results are clinically relevant with a high level of ICC.

The secondary endpoints include the Neurostatus EDSS levels, the muscle strength as measured by the microFET2 dynamometer, fatigue using a numeric rating scale (NRS) and spasticity with the Modified Tardieu scale. Subgroup analyses will determine whether the MMT is less sensitive to the influence of spasticity than the Neurostatus.

Six examiners, three MS-therapists and three neurologists, tested 28 patients with MS in 3 days. The examiners were blinded to the results of the other examiners. All test persons were blinded to their test results. The order of the examiners and the test they used (MMMT or Neurostatus) were randomized.

## First results

### Demographic data

ratio women	0.68
mean age	60
min - max age	37 - 81
ratio 40 - 60 years	0.46
standarddeviation	11.73
n	28
mean years of illness	21.00

### EDSS

	EDSS
median	4
range	2.5 - 6.5

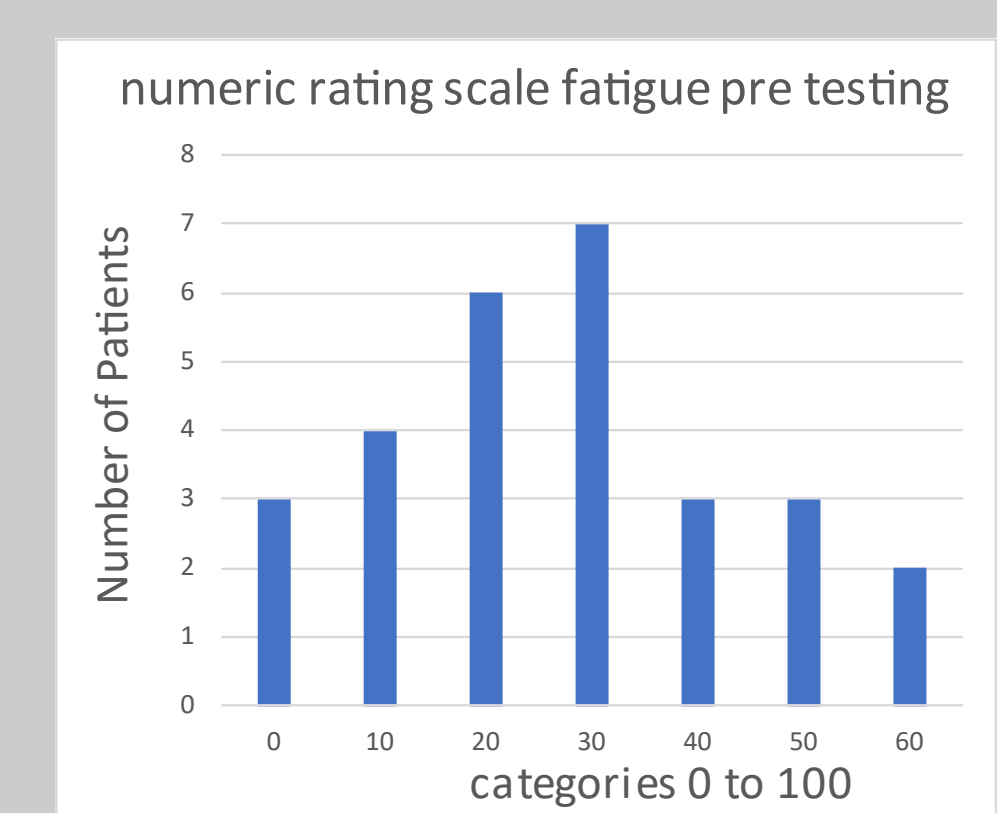
### Description of the population

#### Fatigue Scale for Motor and Cognitive Functions FSMC

no motor fatigue	<22	4
slight motor fatigue	>=22 and < 27	0
moderate motor fatigue	>=27 and <32	2
sever motor fatigue	>=32	21

The probands are older and suffer longer of MS than a representativ MS population. They mainly have a severe motor fatigue.

### Description of actual fatigue with numeric rating scale pre testing



### Data quality

#### Missing Data

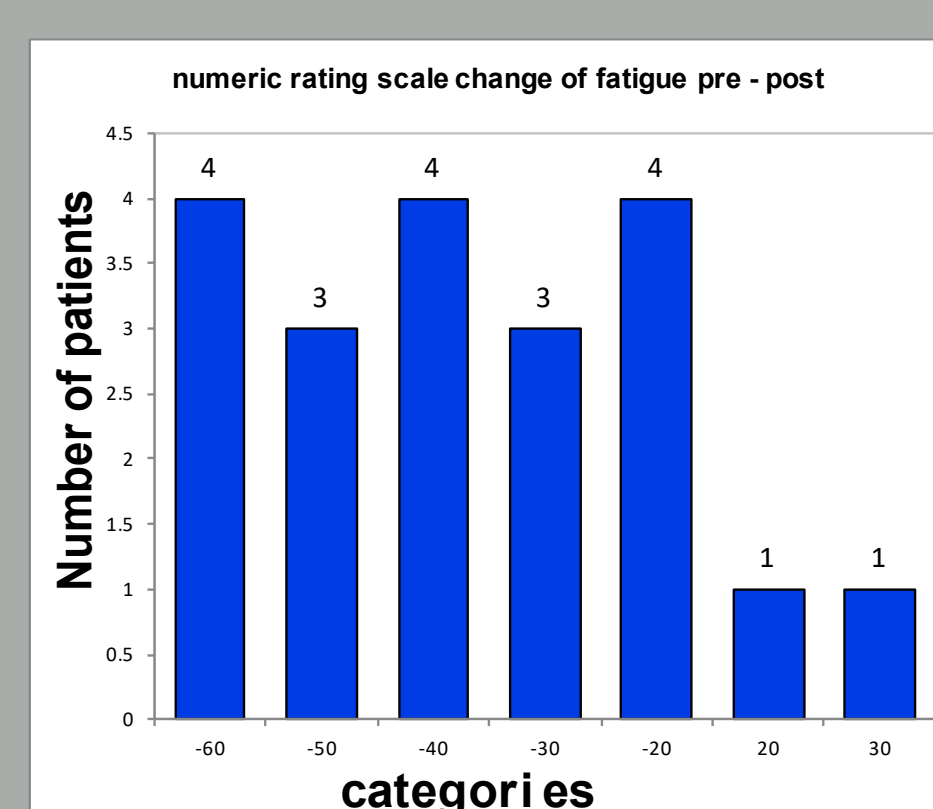
FSMC	3.70%
Modified tardieu scale	0.00%
Max isometric force	0.20%
MMMT	1.39%
Neurostatus muscle test	3.67%

Drop out: 1 because of pain

#### Tester

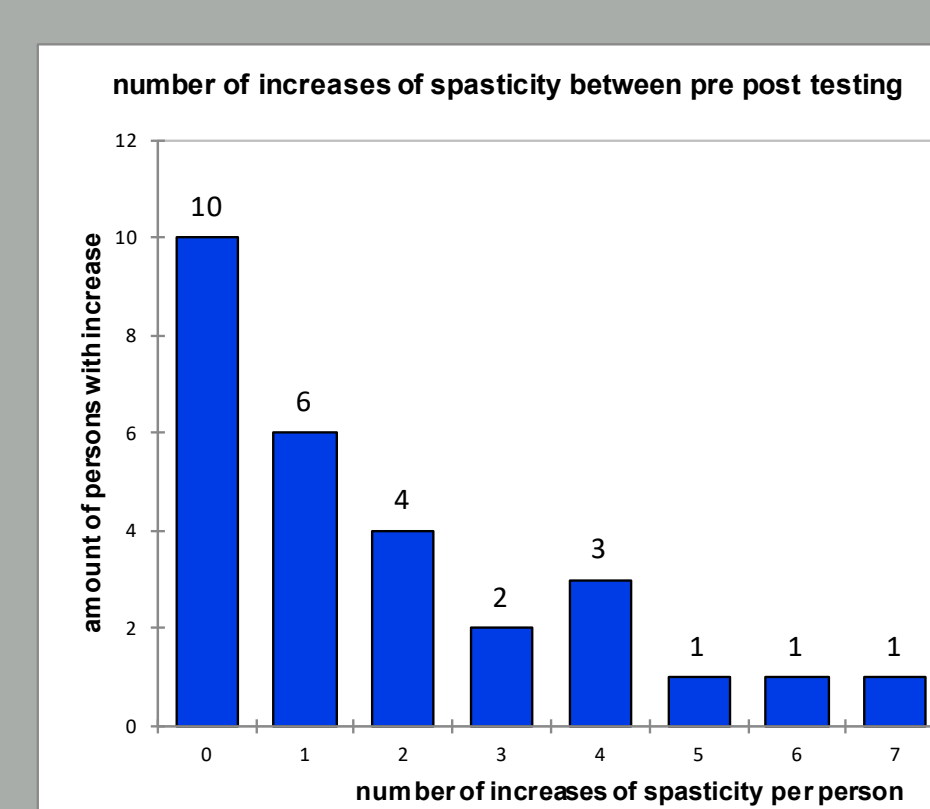
Test/ tester	physiotherapist			sum	neurologist			sum
	1	2	3		4	5	6	
MMMT	15	13	14	42	14	12	16	42
neurostatus muscle test	14	14	14	42	15	15	12	42

### Fatigue



Population shows a clear increase of fatigue between pre-testing and post-testing fatigue. Results should be corrected for fatigue.

### Spasticity



Description of increases in spasticity due to testing measured with the Modified Tardieu Scale

### Indication of test- retest reliability and validity

	MMMT	Neurostatus
Foot dorsal flexion	0.82	0.81
Hip flexion	0.78	0.69
Elbow flexion	0.81	0.79

Mean of the significant correlations in spearman r, not corrected for fatigue