

The Manual Muscle Test: Moving Towards Standardization

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Overview

- Adaptations to MMT procedure
- Standardization of MMT for IMACS
- Examples of MMT procedure

Why Modify the MMT?

- Multiple versions of the MMT exist
- Differences in scoring criteria and test administration
- Continued use as a primary outcome measure

MANUAL MUSCLE TESTING PROCEDURES

Key to Muscle Grading

	Function of the Muscle	Grade		
No Movement	No contractions felt in the muscle	0	0	Zero
	Tendon becomes prominent or feeble contraction felt in the muscle, but no visible movement of the part	1	1	Trace
Test Movement	MOVEMENT IN HORIZONTAL PLANE			
	Moves through partial range of motion	1	2-	Poor-
	Moves through complete range of motion	2	2	Poor
	ANTIGRAVITY POSITION	3	2+	
	Moves through partial range of motion			
Test Position	Gradual release from test position	4	3-	Fair-
	Holds test position (no added pressure)	5	3	Fair
	Holds test position against slight pressure	6	3+	Fair+
	Holds test position against slight to moderate pressure	7	4-	Good-
	Holds test position against moderate pressure	8	4	Good
	Holds test position against moderate to strong pressure	9	4+	Good+
	Holds test position against strong pressure	10	5	Normal

Standardization of the MMT for IMACS

JGIM 2004, Vol. 19, July 2004, pp. 626-634
DOI: 10.1093/jgim.2004.19.626
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International Consensus on Preliminary Definitions of Improvement in Adult and Juvenile Myositis

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Objective. To use a core set of outcome measures to develop preliminary definitions of improvement for adult and juvenile myositis as a step toward defining criteria for therapeutic trials.

Methods. Twenty-nine experts in the assessment of myositis achieved consensus on 102 adult and 182 juvenile paper patients profiles as clinically improved or not improved. Ten hundred twenty-seven candidate definitions of improvement were developed using the experts' consensus ratings as a gold standard and their judgment of clinically meaningful change in the core set of measures. Seventeen additional candidate definitions of improvement were developed from classification and

score were developed using logistic regression analysis. Adult and pediatric working groups ranked the 15 top-performing candidate definitions for face validity, clinical sensibility, and some others, to which the sensitivity and specificity were 23.3% in adult, pediatric, and combined data sets. Minimal group technique was used to achieve consensus formulas.

Results. The definition of improvement consensus to the adult and pediatric working groups that ranked highest was 3 of any 6 of the core set measures improved by $\geq 20\%$, with no more than 2 worse by $\geq 25\%$; which could not include manual muscle testing to assess



IMACS

International Myositis Assessment & Clinical Studies Group

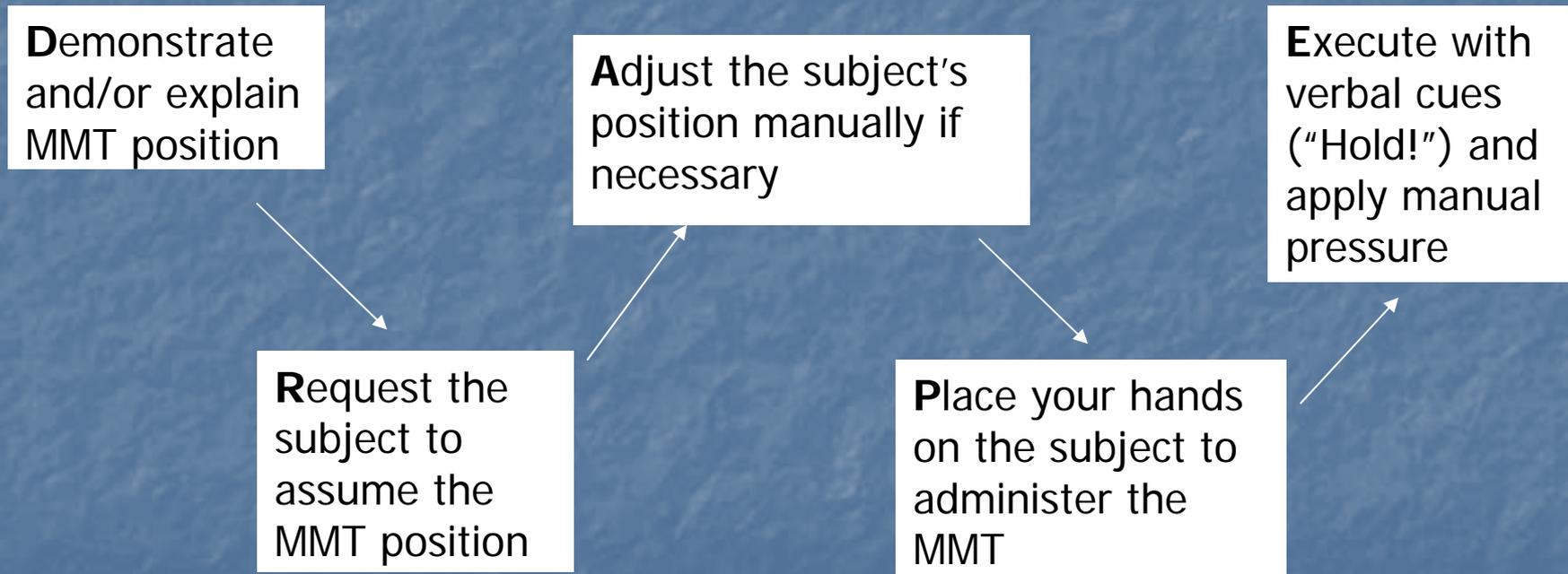
Standardization of the MMT for IMACS

Muscle Groups	
Axial Muscles (0 – 20)	
Neck Flexors**	
Neck Extensors	
Proximal Muscles (0 – 160)	
Trapezius	
Deltoid middle**	
Biceps brachii**	
Gluteus maximus**	
Gluteus medius**	
Iliopsoas	
Hamstrings	
Quadriceps**	
Distal Muscles (0 – 80)	
Wrist Extensors**	
Wrist Flexors	
Ankle dorsiflexors**	
Ankle plantar flexors	
MMT8 score** (0 – 80)	
Total MMT24 score (0 – 260)	

Standardization of the MMT for IMACS

Muscle Groups	TESTING POSITIONS	
	Anti-Gravity	Gravity Eliminated
Trapezius (shoulder elevators)	Sitting	Supine
Deltoid middle (shoulder abductors)	Sitting	Supine
Biceps brachii (elbow flexors)	Sitting	Sidelying
Wrist extensors	Sitting (pronation)	Sitting (neutral)
Wrist flexors	Sitting (supination)	Sitting (neutral)
Iliopsoas (hip flexors)	Sitting	Sidelying
Quadriceps femoris (knee extensors)	Sitting	Sidelying
Ankle dorsiflexors	Sitting	Sidelying
Neck flexors	Supine	Sidelying
Gluteus medius (hip abductors)	Sidelying	Supine
Neck extensors	Prone	Sidelying
Gluteus maximus (hip extensors)	Prone	Sidelying
Hamstrings (knee flexors)	Prone	Sidelying
Ankle plantarflexors	Prone/Standing	Sidelying

Standardization of the MMT for IMACS



The Manual Muscle Test



Wrist extensors

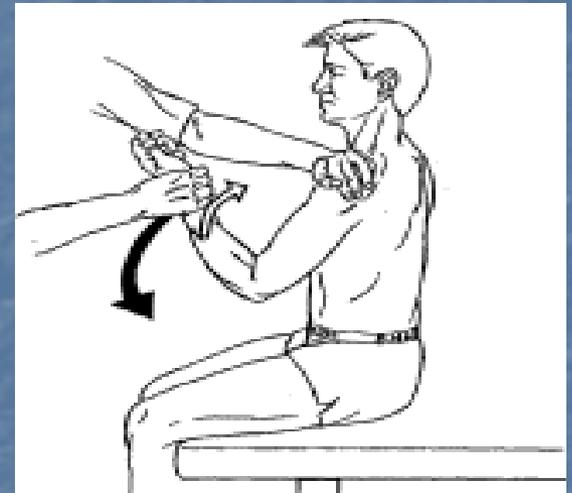
The Manual Muscle Test



Shoulder Abduction

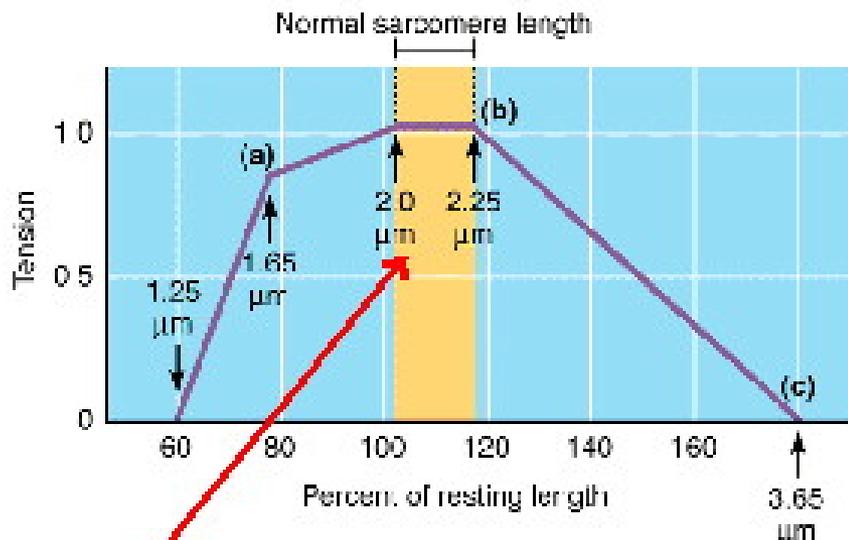
Modifications: Elbow Flexors

- Elbow joint angle during
 - Near maximal flexion, or...
 - ...near midrange?
- ✓ We have elected to perform MMT near the midrange of the joint



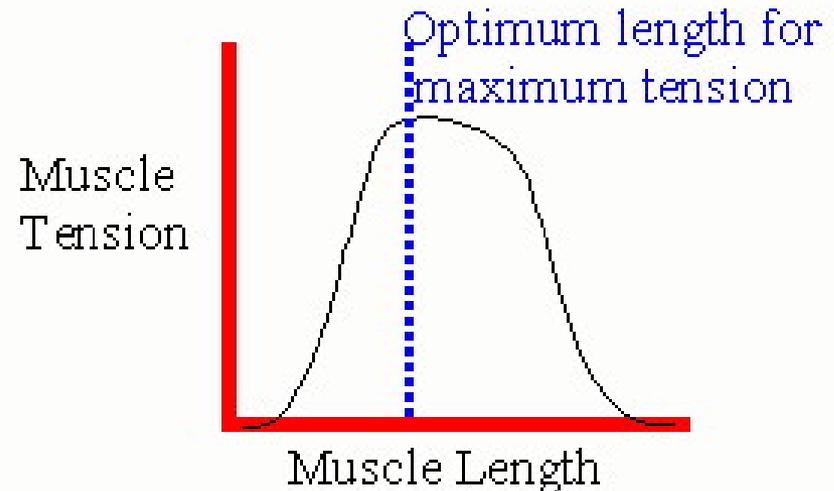
Relationship of Tension to Muscle Length.

The Sarcomere



At this length there is maximum overlap of myofilaments producing maximum number of crossbridges and maximum amount of tension.

Whole Muscle



This applies to the entire muscle as well as to individual sarcomeres.

The Manual Muscle Test

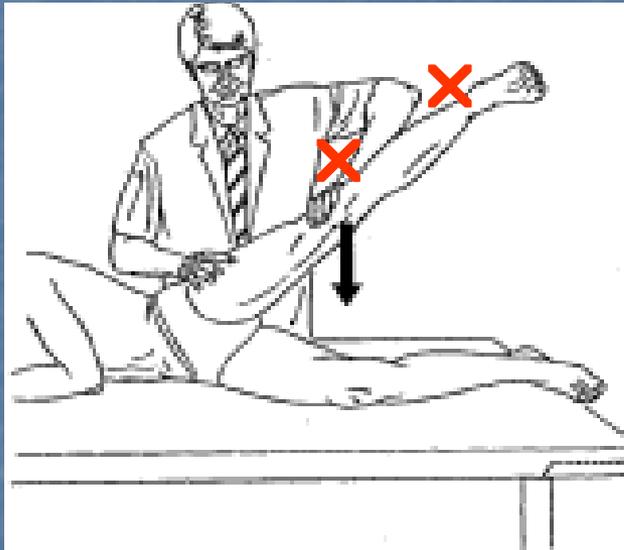


Knee extensors

A MMT “Golden Rule”

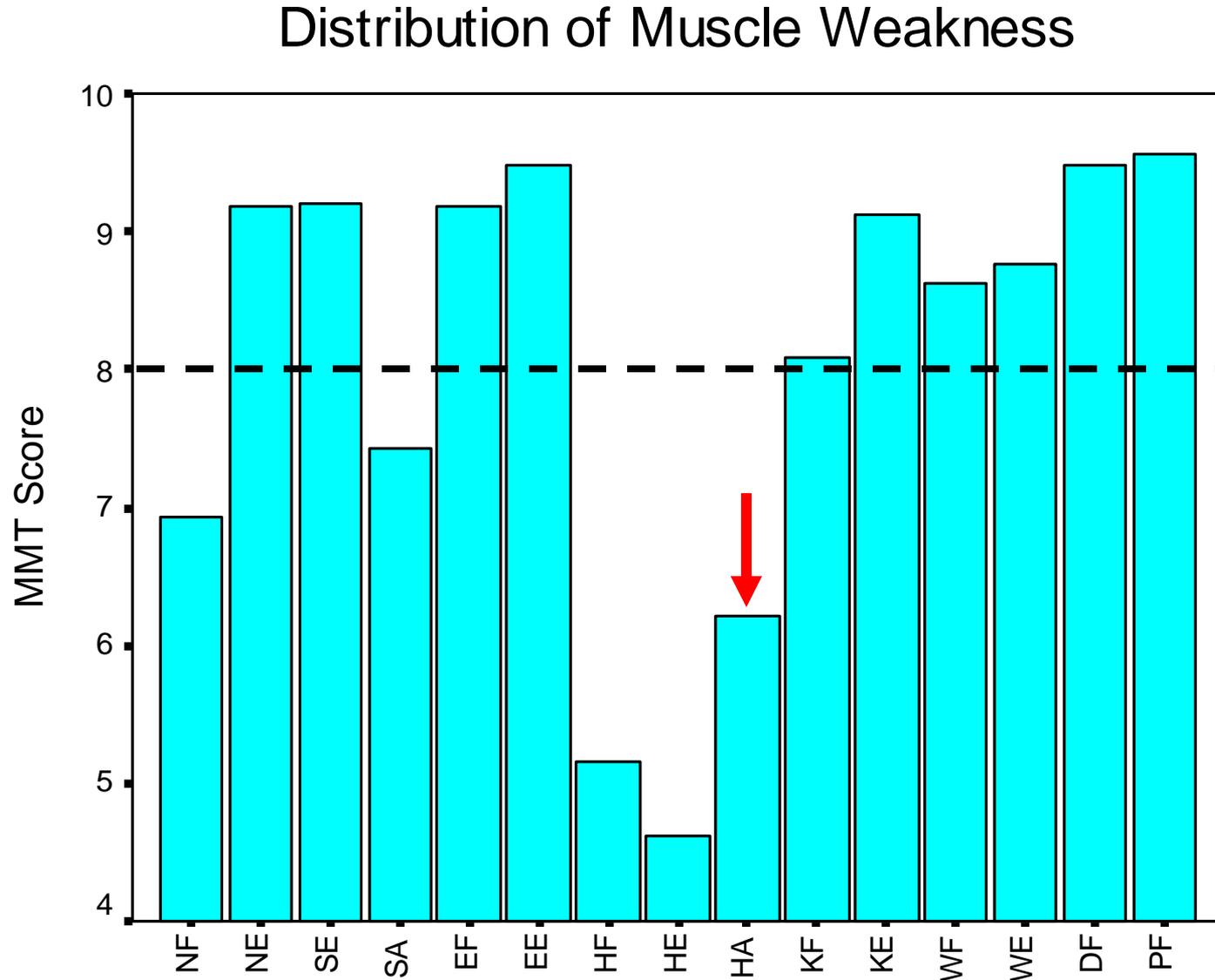
Manual contact: hand placement is proximal to the next distal joint of the target muscle group.

Modifications: Hip Adductors



Hand placement varies based on MMT method

Modifications: Hip Adductors



The Manual Muscle Test



Hip extensors

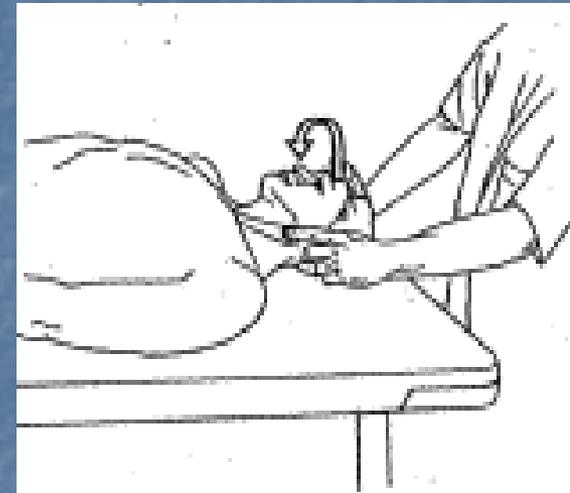
The Manual Muscle Test



Ankle dorsiflexors

Modifications: Cervical Flexors

- Testing method for muscles too weak for AROM
 - Sign of muscle contraction or...
 - movement in horizontal plane?
- ✓ We continue to use the MMT scoring criteria (horizontal plane of motion)



Coda: The Trouble with Measuring Ankle Plantarflexion Strength

- Triplanar motion of the ankle/foot complex
- 2nd Class Lever: bias towards power (vs speed)
- Muscle architecture: multipennate fibers



Is the MMT Score Associated with Peak Ankle Plantarflexion Force?

- IBM subjects, N = 41, 29 males, 12 females, age 61.6 ± 7.3 years, disease duration 8.9 ± 4.3 years

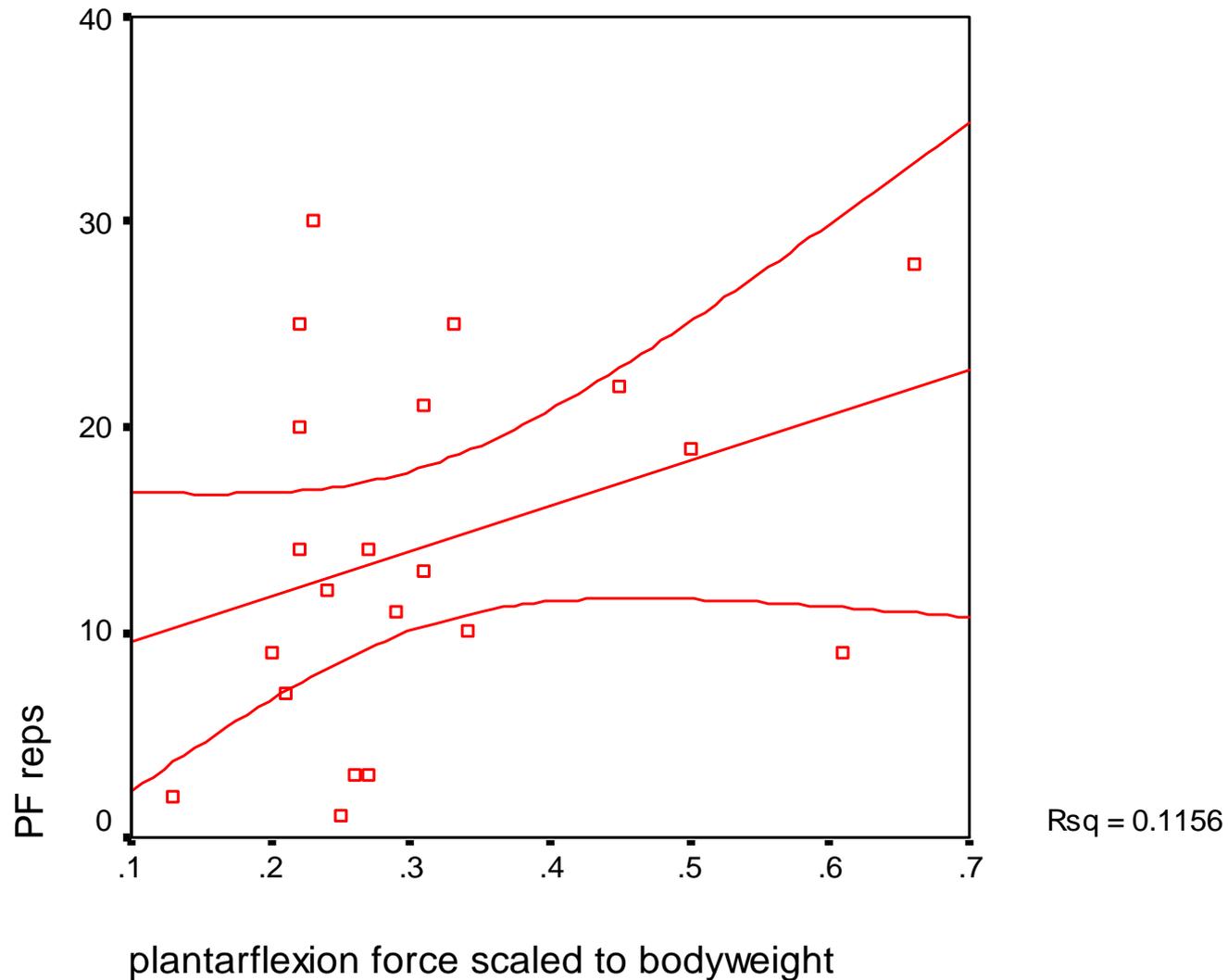
WEAK	Kendall	Worthing.
PF Peak force	.70 $r < .01$.70 $r < .01$

- Isometric plantarflexion

- MMT scoring:
 - Kendall method (break test)
 - Worthingham method (heel raises)

STRONG	Kendall	Worthing
PF Peak force	.01 $r = .99$.29 $r = .20$

Repeated Heel Raises and Peak Ankle Plantarflexion Force



Is the MMT Score Associated with Peak Ankle Plantarflexion Force?

- Both MMT scoring criteria are suited for weak subjects
- Ability to complete the task, not task repetition, is associated with strength
- Worthingham MMT scale has a lower ceiling effect than the Kendall MMT scale

COMBINED	Kendall	Worthing
PF Peak force	.49 r < .01	.66 r < .01