



# Manual Muscle Test Considerations for Assessing Strength in Myositis

Hello. (**did you want to introduce yourself first?**) **I would like to take a few minutes to** review the standardized manual muscle testing procedure **that is** used in therapeutic trials and clinical care of myositis patients.

Perhaps the most prominent clinical manifestation of idiopathic inflammatory muscle disease is muscle weakness. Muscular weakness is typically assessed and documented by a clinical evaluation of strength. “Strength” represents a broad construct of muscle performance, but for **this** presentation, **it will be defined as** the peak isometric torque exerted by a given muscle group.

There are a variety of methods available to assess impairments of muscular strength that range from computer-assisted dynamometry to manual techniques. **There are advantages and disadvantages to both.** I would like to focus on the manual muscle test **because international myositis groups have reached consensus to use MMT as a primary measure of strength in myositis clinical trials.** **It is easy to use, has been partial validated in adult and juvenile DM and PM patients,** and **it has been used** extensively as an outcome measure **in prior** myositis trials.



## Overview

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- The 10-point manual muscle test scale
- Pitfalls to be avoided when administering the MMT
- Muscle groups included in the abbreviated MMT subsets
- Administration of the MMT

We will begin by briefly reviewing the 10-point manual muscle test scale. Then, the pitfalls to avoid when administering the manual muscle test will be described. The muscle groups that **comprise abbreviated** manual muscle **tests will** be presented. Finally, the tester and subject positions used during the course of the manual muscle test will be **demonstrated**.



# The Manual Muscle Test

MMT GRADES			
Normal	10	5	5
Good +	9	4+	}
Good	8	4	
Good -	7	4-	
Fair +	6	3+	}
Fair	5	3	
Fair -	4	3-	}
Poor +	3	2+	
Poor	2	2	
Poor -	1	2-	}
Trace	T	1	
Zero	0	0	0

(Kendall, 1993)

**The MRC 0 – 5 scale was developed xxx. In the past, clinicians documented the large range of muscle weakness observed within intervals of the 5-point scale with a “plus” or “minus” designation. Because these “plus” or “minus” designations were not formally defined, an expanded 0 – 10 scale was developed in 1993 by Florence Kendall in order to provide additional defined gradations for manual muscle test scoring.**

**(I wonder if this slide should be redone- I am going to insert a duplicate slide- see the next one with a different, more simple option here).**



# The Manual Muscle Test

MMT GRADES			
5	5	Normal	10
	4+	Good +	9
4	4	Good	8
	4-	Good -	7
	3+	Fair +	6
3	3	Fair	5
	3-	Fair -	4
	2+	Poor +	3
2	2	Poor	2
	2-	Poor -	1
1	1	Trace	T
0	0	Zero	0

(Kendall, 1993)

**The MRC 0 – 5 scale was developed xxx. In the past, clinicians documented the large range of muscle weakness observed within intervals of the 5-point scale with a “plus” or “minus” designation. Because these “plus” or “minus” designations were not formally defined, an expanded 0 – 10 scale was developed in 1993 by Florence Kendall in order to provide additional defined gradations for manual muscle test scoring.**

**(here it is redone. I would still consider getting rid of the word descriptor scale- it does not gel with what you are speaking and is used less commonly.**



## MMT Pitfalls

- Related to MMT:
  - Inadequate operational grade definitions
  
- Related to Tester:
  - Allowing subject compensatory strategies
  - Improper positioning
  
- Related to Patient:
  - Cooperation, effort

Despite the improvements of the manual muscle testing grading system, pitfalls remain with test administration and score interpretation.

**Consistent measures of muscle strength for subjects with mild impairment is often challenging. The manual muscle test grades for 6 through 9 lack mutually exclusive criteria between grades. The element of “time” is also an ill-defined parameter of the manual muscle test. The duration a subject must exert a resistive force during the test, the length of time required to maintain the testing position to achieve a manual muscle test grade of 5 out of 10, and the elapse of time required for an extremity to descend from the testing position to the starting position to attain a manual muscle test grades of 4 out of 10 are unclear. Based on the experience in our department, holding the limb in place for 3 seconds before allowing the limb to descend is an appropriate duration.**

Additionally, the tester may be a source of error. Inconsistent or insufficient commands by the tester will confound the results of the manual muscle test. Strict standardization of the testing procedure and appropriate operational definitions are required to demonstrate the intratester and inter-tester reliability necessary for clinical trials. **However, the patient’s the age, stature, and condition should be considered prior to the administration of the manual muscle test.**

Perhaps the most obvious pitfall to administering a reliable manual muscle test is the use of compensatory movement strategies utilized by the subject during the course of a test. These movements are specific to the muscle group tested.



## Abbreviated MMT Subsets

### SUBSET 1

- Cervical flexors (Neck flexors)
- Shoulder abductors (Deltoids)
- Elbow flexors (Biceps)
- Hip extensors (Gluteus maximus)
- Knee extensors (Quadriceps)
- Ankle dorsiflexors (Tibialis anterior)
- Hip abductors (Gluteus medius)\*
- Wrist extensors (Extensor carpii ulnaris and radialis)\*

\*In subset 2, hip flexors (iliopsoas) and wrist flexors (flexor carpi ulnaris and radialis) are used instead

To simplify performing the **manual muscle test**, an abbreviated manual muscle test was developed and validated. Eight muscle groups tested unilaterally, called the MMT8, had similar construct validity and reliability and were as sensitive to change as a group of 24 muscles tested bilaterally **in adult and juvenile dermatomyositis and polymyositis**. (will discuss subset 2 vs. 1- these top subsets were selected through consensus techniques for face validity and performance characteristics- here are the top 2 MMT subsets)



## Shoulder abduction

*Deltoid*



Place the **patient** in a sitting position with the shoulder at 90 degrees abduction and neutral glenohumeral rotation. Place the elbow in flexion to verify the rotation. It may be extended prior to the application of force. A counterforce is rarely needed during this test, but **you may apply** stabilization at the upper trapezius.

Apply resistance just proximal to the elbow joint, moving in the direction of shoulder adduction. A common compensation during this test is external glenohumeral rotation to use the elbow flexors as ancillary shoulder abductors. It is also important to note that a patient may not exhibit weakness during the manual muscle test, but still cannot perform full range shoulder abduction. **This may be due** to limited scapular motion and a relatively weak supraspinatus muscle.

In general, for weaker patients with muscle strength grades **0 to 2 using the 0 to 10** grading scale, each muscle test is conducted in the horizontal plane with gravity minimized and will **usually** require the subject to be moved into sidelying position. Here, in testing shoulder abduction, the **patient** will be positioned in supine to perform the test in the horizontal plane. The tester will support the arm to minimize the friction between the arm and the testing surface, and provide stabilization at the upper trapezius, and instruct the patient to fully abduct the arm.

## Elbow flexion



*Biceps*

The **patient** is positioned sitting with the elbow in 90° flexion, and the forearm in full supination. The **patient** will be stabilized **at the posterior aspect of the arm, proximal to the elbow**.

Apply resistance just proximal to the wrist, moving the elbow **in the direction of** extension. Compensations during this test may include extension of the hips and trunk, shoulder flexion, and excessive wrist flexion.

**For the weaker patient**, the subject will remain seated, with the shoulder abducted to 90 degrees to perform the test in the horizontal plane. The tester will support the arm at the humerus and the wrist, and then instruct the patient to flex the elbow.



The wrist extension test may be performed with the **patient** positioned sitting with the elbow in 90° flexion, the forearm in pronation, and the wrist in extension. The forearm will be stabilized just proximal to the wrist.

Apply resistance at the second through fifth metacarpals, moving the wrist in the direction of flexion. Compensatory movement during the test may include finger extension and elbow flexion.

**For the weaker patient**, the test position in the horizontal plane, is altered by placing the wrist in the neutral position and maintaining the forearm stabilization. **Instruct the** patient to extend the wrist.



The wrist flexion test may be performed with the subject positioned sitting with the elbow in 90° flexion, the forearm in supination, and the wrist in flexion. Similar to the wrist extension test, **stabilize** the forearm just proximal to the wrist.

Approaching the ulnar side of the hand, the tester will apply resistance at the second through fifth metacarpals across the palmar surface, moving the wrist in the direction of extension. Compensatory movement during the test may include finger and elbow flexion.

**For weaker patients, the** test position in the horizontal plane is altered by placing the wrist in the neutral position and maintaining the forearm stabilization. The tester will instruct the patient to flex the wrist.

## Hip flexion

### *Iliopsoas*



The subject is positioned sitting, with the arms providing external support on the table, and the hip in flexion. Stabilization may be provided at the cervicothoracic region of the back in the presence of trunk weakness; **If there is extensive trunk weakness, perform the test in supine.**

**Apply** resistance just proximal to the knee moving the hip in the direction of extension. A common compensation is hip external rotation and abduction to maximize the hip flexion action of the sartorius muscle.

**For weaker patients,** sidelying will be the selected position. With the knee flexed at 90 degrees, the tester will support the knee and lower leg, stabilize the pelvis, and instruct the patient to flex the hip.

## Knee extension

*Quadriceps*



This test is performed sitting, with the arms providing external support on the table, and the knee with about 5 degrees of flexion to ensure that the joint is not fully locked. The position of the trunk may vary slightly due to the length of the hamstrings. **Stabilize** just proximal to the knee joint at the posterior thigh to ensure that the femur is parallel to the floor.

**Apply** resistance just proximal to the anterior aspect of the ankle, moving the knee in the direction of flexion.

**For weaker patients**, the test in the horizontal plane will require the subject to be moved into sidelying. With the knee flexed at 90 degrees and the hip in full extension, the tester will support the knee and lower leg, and instruct the patient to extend the knee. Possible compensations in this position include rotating the trunk towards the testing surface or internally rotating the hip to change the plane of motion and allowing the knee to passively extend.

## Ankle dorsiflexion

### *Ankle dorsiflexors*



This test is performed sitting, with the arms providing external support on the table, and the foot in dorsiflexion and inversion.

Resistance will be applied proximal to the metatarsal heads on the dorsalmedial aspect of the foot, with the counterforce just proximal to the malleoli on the posterior aspect of the leg. **Your** resistance will move the foot in the direction of plantarflexion and eversion.

**For weaker patients**, the modified version of this test is typically performed in supine with the knees and hips fully extended and the lower leg supported just proximal to the ankle. **Instruct** the patient to move **the** foot toward **the** head.

## Cervical flexion

### *Neck flexors*



To begin the test of cervical flexion, **place the patient in a supine position and instruct the patient to position the head and neck into flexion.**

Both the head and the neck are positioned into flexion to begin the test. The tester applies resistance at the forehead in the direction of capital and cervical extension and may offer additional stabilization across the abdomen. **The patient may lift the head off of the testing surface without tucking the chin towards the chest when the capital flexors are weak.**

**For the weaker patient,** the tester will support the head to prevent cervical sidebending, provide stabilization at the anterior shoulder **as needed**, and instruct the subject to flex their head and neck.

## Hip abduction

*Gluteus medius*

(position to be altered)



The **patient** is positioned in sidelying, with the contralateral leg flexed at the hip and knee, the ipsilateral leg extended at the knee, with the hip slightly protracted and in abduction. **Provide the** stabilizing force at the pelvis.

**Apply** resistance just proximal to the lateral aspect of the knee, attempting to move the hip into adduction. The **patient** may compensate for weakness during the test by using ipsilateral hip elevation and external rotation at the hip coupled with hip flexion.

**For weaker patients**, the test in the horizontal plane will require the subject to be moved into supine. With the knee fully extended, the tester will support the lower leg to minimize external resistance caused by the testing surface, and instruct the patient to abduct the hip.

## Hip extension

*Gluteus maximus*



Wrong pic..

The **patient** is positioned prone, with 90° knee flexion (if possible) and the **testing surface** raised to the level of the tester's waist. **Stand on the ipsilateral side and apply** resistance just proximal to the popliteal fossa with a stabilizing force applied to the pelvis.

The flexed knee induces active insufficiency of the hamstrings, thus minimizing the ability of the hamstrings to assist hip extension. Therefore, the most common compensation is to extend the knee to recruit this muscle group for hip extension. Additionally, excessive tightness of the rectus femoris and iliopsoas may reduce the range of motion available at the hip joint and necessitate alternate testing positions.

**For weaker patients**, the test in the horizontal plane will require the subject to be moved into sidelying. With the knee flexed at 90 degrees, the tester will support the knee and lower leg, stabilize the pelvis, and instruct the patient to flex the hip.



## Summary

- Manual muscle testing has frequently been used as a core set measure in myositis clinical trials and has been partially validated for use in adult and juvenile DM and PM.
- MMT tester performance is improved by understanding the pitfalls of testing and adhering to standardized testing procedures.

Muscle strength is a key parameter to assess in **patients with myositis**. Manual muscle testing has frequently been used as a core set measure in myositis clinical trials and has been partially validated for use.

The top subsets of the MMT8 have been demonstrated throughout the course of this presentation due to their preliminary validation for use in clinical trials of adults and children **with dermatomyositis and polymyositis**.

**Administration of the manual muscle test** is improved by understanding the pitfalls of testing and adhering to standardized testing procedures as presented here.



## Useful References

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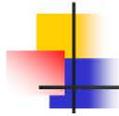
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Put Kendall ref 2<sup>nd</sup>, esp since you mention it on 1 slide...



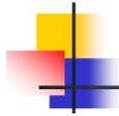
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