

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

Introduction to Physical Therapy Procedures

RHS 221

Manual Muscle Testing

Theory – 1 hour

practical – 2 hours

Dr. Ali Aldali, MS, PT

Tel# 4693601

Department of Physical Therapy

King Saud University

Objectivity and Reliability in Muscle testing

- Assessment must be reliable and objective, and the results must be valid.
- **Reliability** is the extent to which comparable results are achieved every time a test is repeated. If a muscle test is repeated by one or more therapists who obtain the same grade every time, then the test is reliable.
- The key to reliability for MMT is to follow the standard procedure, performing the test in the same way each time and in the same way that other therapists perform it.
- Reliability is increased if the therapist gives clear instructions to the patient.

Objectivity and Reliability in Muscle testing

- Assessment procedure **objectivity** means that the findings are reported without **distortion** by personal **opinion** or feelings.
- In MMT, the most difficult area in which to be objective is deciding whether the resistance the patient can **tolerate** is minimal, moderate, or maximal.
- If the patient's weakness is **unilateral**, the therapist should test the **opposite** side and use the result as the baseline for normal. If the patient has **bilateral** involvement, the therapist must rely on **experience** in testing other patients to know what is normal for a particular muscle in a person of a given age, sex, size, and occupation.

“Fundamentals of musculoskeletal assessment techniques,
By M. Lynn Palmer”

Validity in Muscle testing

- ❑ **Validity** means that a test actually measures what it is supposed to measure. In MMT, therapists are testing the strength of a specific muscle. For a muscle test to be valid, the therapist must know the location and function of the muscle being tested and the location and function of surrounding muscles.
- ❑ Validity of assessment means that therapists evaluate exactly what they say they are going to and that the results are correct, or true.

Gross Muscle Screening

- A quick screening evaluation of a patient is an important component of the entire evaluation process; it gives a picture of the patient's status and is a basis for planning effective treatments. The therapist performs subjective and objective assessments by taking a history and hears the patient's complaints, then he performs a general evaluation to determine which specific evaluation procedures are indicated.
- Muscle Screening Test is not a detailed determination of strength; it simply classifies levels of strength as either normal or weak.

**“Fundamentals of musculoskeletal assessment techniques,
By M. Lynn Palmer”**

TABLE 1.1 Evaluation Procedures for Muscle Screening Tests

POSITION OF PATIENT	MUSCLE GROUP TESTED	INSTRUCTION TO PATIENT	THERAPIST'S ACTIONS
Supine	1. Neck and trunk flexors	1. Hold arms straight in front of body. Raise head and shoulders off table. Hold.	1. None
	2. Hip flexors	2. Keep legs straight. Raise both legs off table simultaneously. Hold.	2. None
	3. Hip abductors	3. Abduct legs to each side. Hold.	3. Attempt to bring legs together.
	4. Hip adductors	4. Keep legs together. Hold.	4. Attempt to separate legs.
	5. Hip extensors	5. Flex hips and knees, keeping soles of feet on table. Raise hips from table.	5. None
	6. Shoulder adductors	6. Bring hands together in front of chest, elbows straight. Hold.	6. Attempt to separate arms into horizontal abduction.
	7. Shoulder flexors and scapular upward rotators	7. Flex shoulder to 90 degrees, elbows straight. Hold.	7. Attempt to push arms into extension.
	8. Shoulder extensors and scapular downward rotators	8. Same as 7.	8. Attempt to push arms into flexion.
	9. Shoulder horizontal abductors	9. Same as 7.	9. Attempt to push arms into horizontal adductions.
Supine or sitting	10. Shoulder abductors	10. Abduct shoulder to the side to shoulder level, elbows straight. Hold.	10. Attempt to push arms down to sides into shoulder adduction.
	11. Shoulder adductors	11. Same as 10.	11. Attempt to push arms over head into shoulder abduction.
	12. Shoulder medial rotators	12. Hold arms at sides, elbows bent, forearms in neutral position. Hold.	12. Attempt to push arms outward into lateral rotation.
	13. Shoulder lateral rotators	13. Same as 12.	13. Attempt to push arms in toward body into medial rotation.
	14. Elbow flexors	14. Bend elbows to 90° and hold.	14. Attempt to push forearms toward table into elbow extension.
	15. Elbow extensors	15. Same as 14.	15. Attempt to push forearms toward shoulders into elbow flexion.
	16. Supinators	16. Turn palms up and hold.	16. Attempt to turn palms down into pronation.
	17. Pronators	17. Turn palms down and hold.	17. Attempt to turn palms up into supination.
	18. Wrist extensors	18. Bring hand up and hold.	18. Attempt to flex the wrists.
	19. Wrist flexors	19. Bring hand down and hold.	19. Attempt to push palms away from body into wrist extension.
	20. Finger flexors	20. Squeeze my fingers. Hold.	20. Place index and middle fingers in patient's hands; attempt to pull fingers out.
	21. Finger extensors	21. Straighten fingers. Hold.	21. Attempt to push fingers into flexion.
	22. Palmar interossei	22. Adduct fingers. Hold.	22. Attempt to pull fingers into abduction.

Gross Muscle Screening

- The following are **guidelines** for a muscle screening test:
 1. The patient (pt) is directed to complete the test motion before the therapist provides resistance.
 2. **Resistance** is applied and released **gradually**, not **quickly**.
Resistance is usually applied **distally** to the joint tested.
 3. The pt should perform most motions **bilaterally** in the same time. Bilateral motion provides the therapist the opportunity to compare one side with the other.
 4. Test position should be as patient's **comfort**.
 5. Good **stabilization**.

Muscle Performance

- ❑ It can be measured using a number of parameters, these include:
- ❑ Strength
- ❑ Endurance
- ❑ Power

Muscle Imbalance

In simple terms, a **muscle imbalance** occurs when you have overdeveloped and **tight** muscles in one area of your body while the opposing muscles are weak and stretched out of their normal position. These imbalances can happen anywhere on the body and often develop as the result of the routine things you do while on the job, playing sports, or engaging in other activities you enjoy.

Here are just a few conditions that can develop as a result of muscle imbalances: **IT** band syndrome, **SI** joint syndrome, sciatica, **frozen shoulder**, **knee pain**, **hip pain**, and all forms of **back pain**.

Definition of Contracture deformity

- ❑ A contracture is a **tightening** of muscle, tendons, ligaments, or skin that prevents normal movement.
- ❑ A contracture develops when the normally elastic (stretchy) connective tissues are replaced by inelastic (nonstretchy) fiber-like tissue. This makes it hard to stretch the area and prevents normal movement.
- ❑ Contractures occur primarily in the skin, underlying tissues, muscle, tendons, and joint areas. The most common causes are scarring and lack of use (due to immobilization or inactivity).

Common Causes

- ❑ Inherited disorders (such as muscular dystrophy)
- ❑ Injury (including burns)
- ❑ Nerve damage
- ❑ Reduced use (for example, from immobilization)

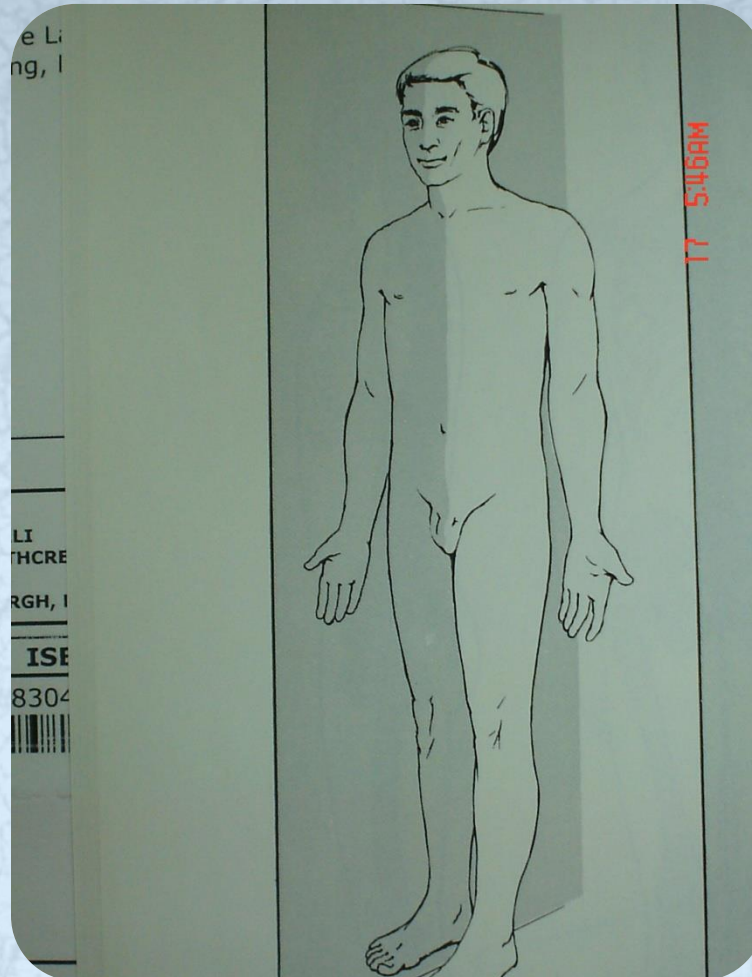
The anatomical position

- Planes of the Body.
- The anatomical reference position of the human body is an erect **standing** posture with **feet** just slightly separated, **face** forward, **arms** hanging at sides, the **elbow** straight **palms** forward and **fingers** and **thumb** in extension and facing forward. This is the position of reference for definitions and descriptions of body planes and axes.
- In general, there are two types of motions; **Translation**, which occurs in either a **straight** or curved line, and **Rotation**, which involves a **circular** motion around a pivot point.

The anatomical position

- There are three traditional planes of the body around three corresponding **axes** (medial-lateral, anterior-posterior, vertical):
 1. **Sagittal plane**: known as the anterior – posterior plane, is vertical and extends from front to back(anterior to posterior), divides the body into right and left halves of equal size.. The motion of flexion and extension occur in the sagittal plane. All motions take place **around a medial - lateral axis**.

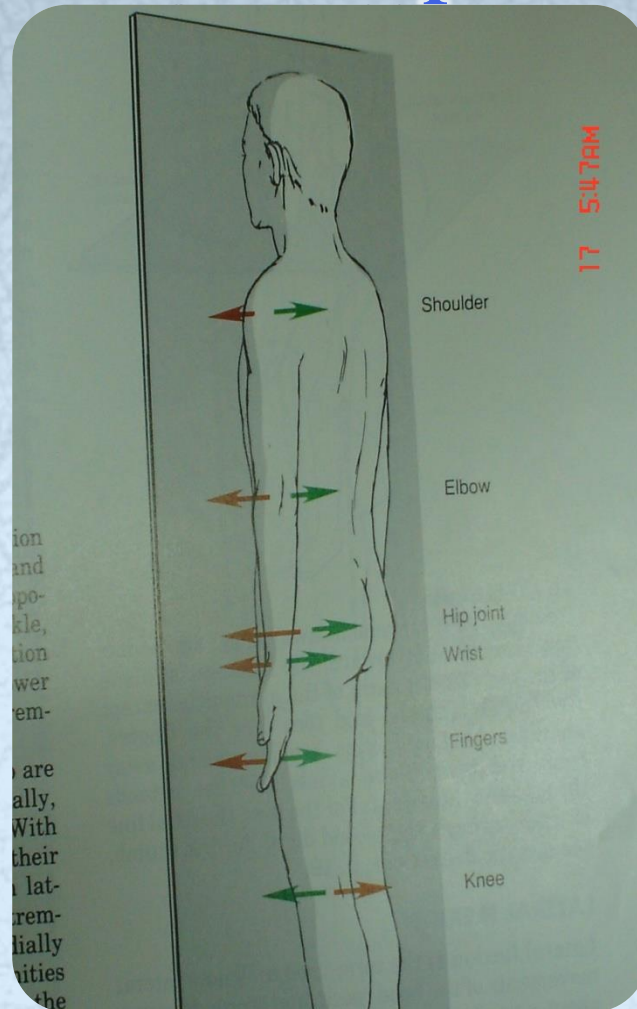
Sagittal plane



The anatomical position

2. **Coronal plan**: known as the **frontal plane**, is vertical and extends from side to side ,divides the body into front and back halves equally... The movements of abduction and adduction take place **around an anterior-posterior axis**.

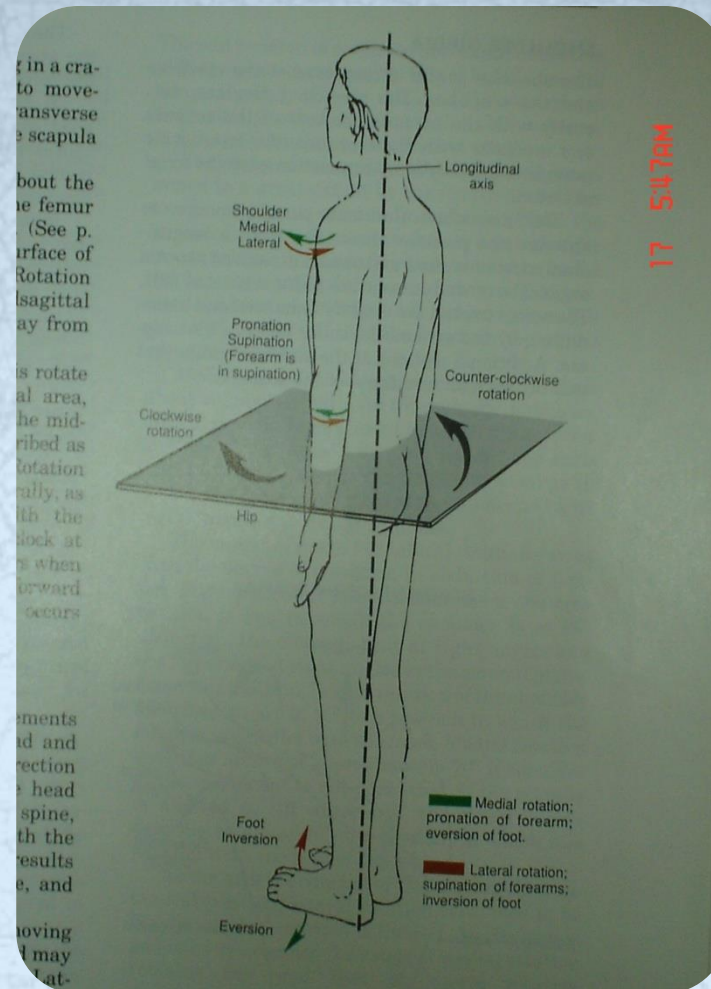
Coronal plane



The anatomical position

3. Transverse (Horizontal) plan: divides the body into upper (cranial) and lower (caudal) portion. The motion of rotation occurs around a vertical axis (proceeds in a cranial to caudal direction).

Transverse plane



Musculoskeletal system

- It composed of **striated muscles**, various types of connective tissue and the skeleton.
- The bones of the skeleton are joined together by **Ligaments**, which are strong, fibrous bands or sheets of connective tissue. Ligaments are classified as capsular, extracapsular and intracapsular.
- Skeletal muscle fibers are classified primarily into two types: type I (red slow twitch) and type II (white fast twitch).
- Type I fibers seem to predominate in some postural muscles, such as the erector spinae and soleus. Type II fibers often predominate in limb muscles, where rapid, powerful forces are needed.

Musculoskeletal system

- Skeletal muscle constitute approximately 40% of body weight and are attached to the skeleton by aponeuroses, fasciae, or tendon.
- Aponeuroses are sheets of dense connective tissue and white in color; the external and internal oblique muscles are attached to the linea alba by aponeuroses.
- Fasciae is two types: superficial, which lies beneath the skin and permits free movement of the skin. Deep, which envelopes and separates muscles.
- Tendon are white, fibrous bands that attach muscle to bones.

Types of joints

** Types of joints according to:

- | | | |
|-----------------------|----|---------------------------|
| 1. <u>Functional:</u> | or | 3. <u>Degree freedom:</u> |
| -movable jt. | | Six movements |
| -slight movable jt. | | 2 Degree freedom: |
| -immovable jt. | | Four movements |
| 2. <u>Structures:</u> | | 1 Degree freedom: |
| -synovial jt. | | Two movements |
| cartilaginous jt. | | |
| -fibrous jt. | | |
| • Assignment? | | |

Arthrokinematics

- The motions occurring at the joint surfaces.....
- Is the term used to refer to the movement of joint surfaces.
- They described as *slide* (or glides), *spins*, and *rolls*.
- The direction of the rolling and sliding components of a roll-slide will vary depending on the shape of the moving joint surface.
- If a *convex* joint surface is moving, the convex surface will roll in the same direction as the angular motion of the shaft of the bone but will slide in the opposite direction.
- If a *concave* joint surface is moving, the concave surface will roll and slide in the same direction.

Muscular strength

- ❑ The maximal amount of **tension** or **force** that a muscle or muscle group can voluntarily exert in one maximal effort, when type of muscle contraction, **limb velocity**, and **joint angle** are specified.
- ❑ Muscle strength test is used to determine the **capability** of muscle or muscle groups to **function** in movement and their ability to provide stability and support.

Muscular endurance

The ability of a muscle or a muscle group to perform **repeated** contractions, **against** resistance, or **maintain** the an isometric contraction for a **period** of time.

Types of muscle contraction

- Isometric contraction

This is a contraction in which no movement takes place, because the **load** on the muscle **exceeds** the tension generated by the contracting muscle. This occurs when a muscle attempts to **push** or **pull** an **immovable** object.

- Static contraction:

This is when there is tension developed in the muscle but no movement occurs, the origin and insertion of the muscle do not change position, and the muscle length does not change.

- Isotonic contraction:

The muscle develops constant tension against a **load** or **resistance**. Isotonic contractions are further divided into two types:

Types of Isotonic contractions

1. Concentric contraction:

Tension is developed in the muscle and the **origin** and **insertion** of the muscle move **closer together**, the muscle shortens.

2. Eccentric contraction

This is a contraction in which the muscle increases in length (lengthens) as it resists a load, such as lowering a weight down in a slow, controlled fashion.

Range of motion

- ROM is the arc of motion that occurs at a joint or a series of joint.
- **Active** range of motion(AROM): is the arc of motion attained by a subject during unassisted voluntary joint motion. Its provides the examiner with information about the subject's willingness to **move**, **coordination**, **muscle strength**, and joint ROM.
- **Passive** range of motion(PROM): is the arc of motion attained by an examiner **without** assistance from the subject. The subject remains relaxed and plays no active role in producing the motion. Its provides the examiner with information about the **integrity** of the joint surfaces and **extensibility** of the joint capsule, and associated ligaments, muscles, fascia, and skin.

Goniometry

- The term goniometry is derived from two Greek words, gonio, meaning angle, and metron, meaning measure. Therefore, goniometry refers to the measurement of angles created at human joints by the bones of the body.

“measurement of joint motion” by Cynthia C. Norkin, 4th edition, 2009.

- General principles for measuring Joint Range of Motion:
 1. Passive Range. (Understanding the starting or ending ROM)
 2. Starting Position. (Understanding the anatomical position of 0 degree)
 3. Alignment. (the Goniometer is aligned on the lateral side of the test joint)
 4. Axis. (the axis/fulcrum of the Goniometer)
 5. Moving Arm. (aligned parallel and lateral to the long axis of the moving body segment)
 6. Stationary (fixed) Arm. (aligned parallel and lateral to the long axis of the fixed body segment)

Uses of the Goniometry

- ❑ Determining the presence or absence of impairment.
- ❑ Establish a diagnosis.
- ❑ Developing a prognosis, treatment goals, plan of care.
- ❑ Evaluating prognosis or lack of rehabilitative goals.
- ❑ Modifying treatment.
- ❑ Motivating the subject.
- ❑ Researching the effectiveness of therapeutic techniques(for example, measuring outcomes following exercises, medication, and surgical procedures).

Range of muscle work

- ❑ The range in which a muscle work refers to the muscle changing from a position of full stretch and contracting to a position of maximal shortening.
- ❑ The full range is divided into parts, outer, inner, and middle range.

Outer range:

Is from a position where the muscle is on full stretch to a position half way through the full range of motion.

Inner range:

is from a position halfway through the full range to a position where the muscle is fully shortened.

Cont. Range of muscle work

Middle range:

Is the portion of the full range between the mid-point of the outer range and the midpoint of the inner range.

Muscle length test

Muscle length testing is done to determine whether the muscle length is limited or excessive, i.e., whether the muscle is too short to permit normal range of motion, or stretched and allowing too much range of motion.

Muscle Weakness

Muscle weakness should be treated in accordance with the basic cause of weakness (lack of use, overwork, fatigue or strain).if due to lack of use; then **exercise**, if due to overwork and fatigue; then **rest**, if due to stretch and strain; then **relief** of stretch and strain before the stress of additional exercise.

Every muscle is a prime mover in some specific action. No two muscles in the body have exactly the same function. When any one muscle is paralyzed, stability of the part is impaired or some exact movement is lost.

Causes of Muscle weakness

- ❑ Muscle strain
- ❑ Pain/reflex inhibition
- ❑ Peripheral nerve injury
- ❑ Nerve root lesion (myotome)
- ❑ Upper motor neuron lesion
- ❑ Tendon pathology
- ❑ avulsion

Terms used in description of muscle strength test

- Patient
- Fixation refers to the stability of the body or body part.
- Strength testing.
- Test position (the optimal position). Pt and therapist position.
General position such as **Supine**, **Side-lying**, **Prone**, **Sitting**, and **Standing**
- Test movement.(a movement of the part in a specified direction and though a specific arc of motion).
- Pressure and resistance.(the **external force** that is applied by the examiner to determine the strength of the muscle; from F+ and up) the placement, direction, and amount of pressure or resistance.
- Substitution.(result from a muscle attempting to compensate for the lack of strength in another muscle or group of muscles.
- Gravity.
- Weakness, shortness, and contracture.

Steps of accurate muscle Test procedures/ lab.

1. Surface Anatomy:

- a. action.
- b. prim mover.
- c. origin and insertion.

2. Synergist/ Accessory muscles:

3. nerve supply.

4. ROM

5. Fixation

6. Factor limiting of motion

7. Effect of weakness and contracture

8. Substitution

9. Testing procedures:

- 1. pt position
- 2. Therapist position:
 - a. inner hand
 - b. outer hand
- 3. instructions or command
- 4. palpation location.

2nd assignment

** Define Terms:

- ❑ Types of joints?
- ❑ Example of One joint muscle?
- ❑ Example Two joint muscles
- ❑ What is the Break test?
- ❑ Active/Passive range of motion?
- ❑ Fixation?
- ❑ Resistance?
- ❑ Agonist/Antagonist muscle?
- ❑ Substitution?

Questions?

Thank you