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# Introduction to Physical Therapy Procedures

RHS 221

Manual Muscle Testing

Theory – 1 hour

practical – 2 hours

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Department of Rehabilitation Health Sciences

**Physical Therapy** program



# Manual Muscle Testing

- **Screening:** not a formal assessment but a method to allow the therapist to determine quickly which muscle groups need further testing.
- **Gravity Eliminated:** client moves the extremity or body part parallel to the floor(horizontal) - can be supported by a mean (therapist, powder board).
- **Against Gravity:** type of movement that occurs when a client is moving the extremity or body part perpendicular to the floor because the force of gravity is exerted down toward the floor.



# 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.
- **The purpose** of a **muscle screening test** is to determine quickly a level of muscle strength..



# Guidelines for a 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. The command, **“Hold”** to the pt precedes the application of resistance when using the **“Break Test”**?
  3. **Resistance** is applied and released **gradually**, not **quickly**. **Resistance** is usually applied **distally** to the joint tested.
  4. 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.
  5. Test position should be as patient’s **comfort**.
  6. Good **stabilization**.



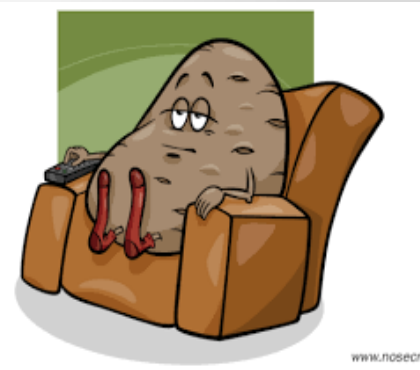
# Muscle Performance

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





# Muscle Imbalance



www.nosecre

In simple terms, a **muscle imbalance** occurs when you have overdeveloped and **tight (Contracture)** 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**.



## ➤ PRINCIPLES OF MMT:

- 1) Position
- 2) Stabilization
- 3) Demonstration
- 4) Application of Grades
- 5) Application of Resistance
- 6) Checking normal strength
- 7) Objectivity
- 8) Documentation





## 1) POSITION :

### ❖ PATIENT POSITION:

- Patient is positioned Eliminated or Against gravity. (Patient depend upon testing on muscle or muscles group).
- Do not change patient position **repeatedly**.
- The patient should be as free as possible from discomfort or pain for the duration of each test. It may be necessary to allow some patients to move or be positioned differently between tests.
- Patient position should be carefully organized so that position changes in a test sequence are minimized. The patient' s position must permit adequate stabilization of the part or parts

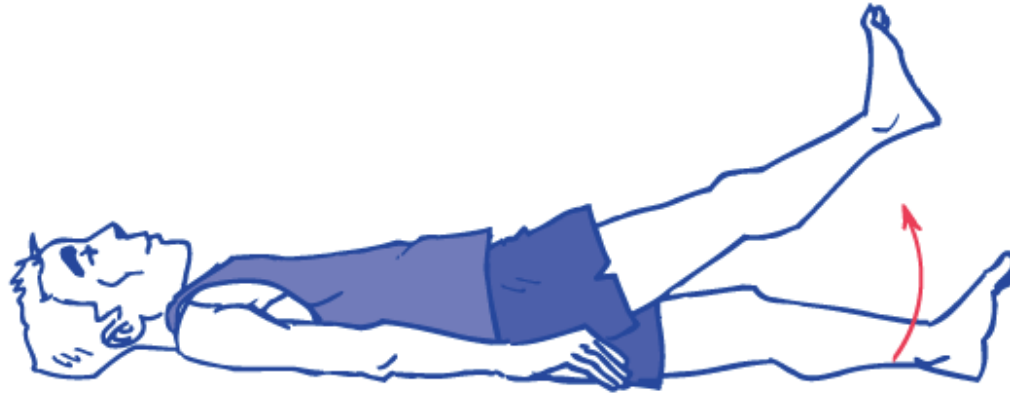


### ❖ **JOINT POSITION:**

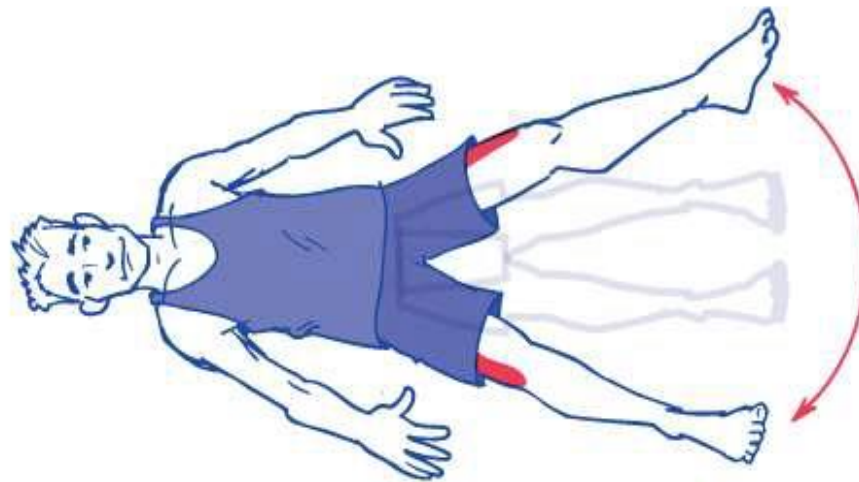
- The joint position is also changed depend upon their performance.
- Distal part of the joint is moved.
- Place the joint in Antigravity position- Grade 3
- Place the joint in Horizontal position – Grade 2



**Example:**



**Against  
gravity**



**Eliminate  
d gravity**



## 2) **STABILIZATION :**

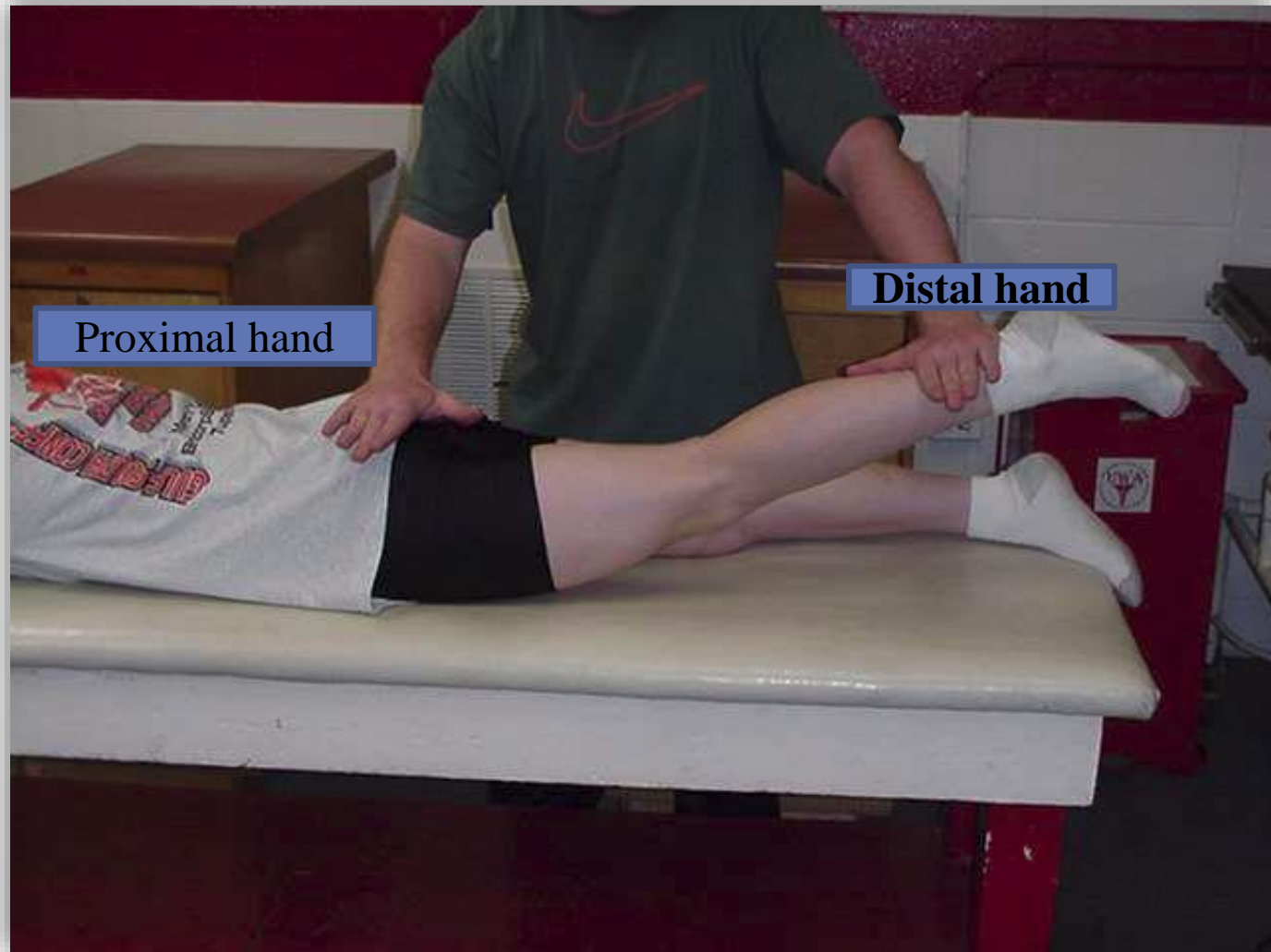
- Patient could stabilize our self during performed Antigravity position.
- The hand placement of the therapist is important.

### **HAND PLACEMENT:**

- I. PROXIMAL HAND** – At Origin of muscle & proximal joint giving stabilization.
- II. DISTAL HAND** – Distally offering resistance or Assistance depend upon performance.



**Example:**





**Example:**





### 3) **DEMONSTRATION:**

- ❖ Demonstrate the desired movement.
- ❖ Therapist demonstrate the application of movement or performance to the patient.

### 4) **APPLICATIONS OF GRADES:**

- ❖ Always start with GRADE 3 (If you start to examine the muscle power, first you should test the grade 3).
- ❖ Isolation of muscle could be tested.



## 5) **APPLICATIONS OF RESISTANCE:**

- ❖ Resistance is applied slowly & gradually.
- ❖ Increasing or decreasing manual resistance.
- ❖ Increasing length of weight arm.
- ❖ Apply presence opposite to the line of pull (Grade 4,5)
- ❖ Apply force distally.
- ❖ It varies between the persons.
- ❖ Use long lever to applied resistance whenever it possible.





#### 6) **CHECKING NORMAL STRENGTH:**

- ❖ Therapist to check the strength of the muscle normal side first.

#### 7) **OBJECTIVITY:**

- ❖ Therapist ability to palpate and observe the tendon or muscle response in very weak muscles.

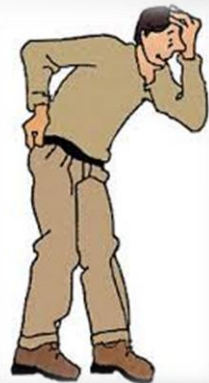
#### 8) **DOCUMENTATION:**

- ❖ Examiners complete testing documentation or Record first.
- ❖ This will help for next step of treatment applications.
- ❖ And help for checking improvement of treatment.



# 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).





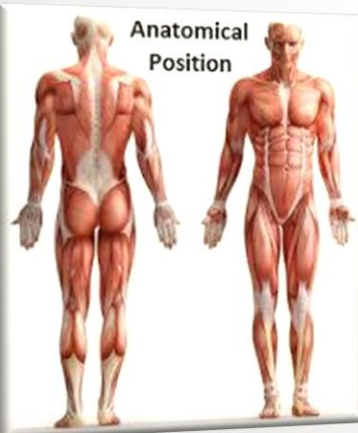
# Common Causes

- 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.



“Muscle Testing and Function with Posture and Pain by Kendall,  
5<sup>th</sup> edition,2005”



# The anatomical position

- There are **3** traditional **planes** of the body around three corresponding **axes** ( medial-lateral, anterior-posterior, vertical):

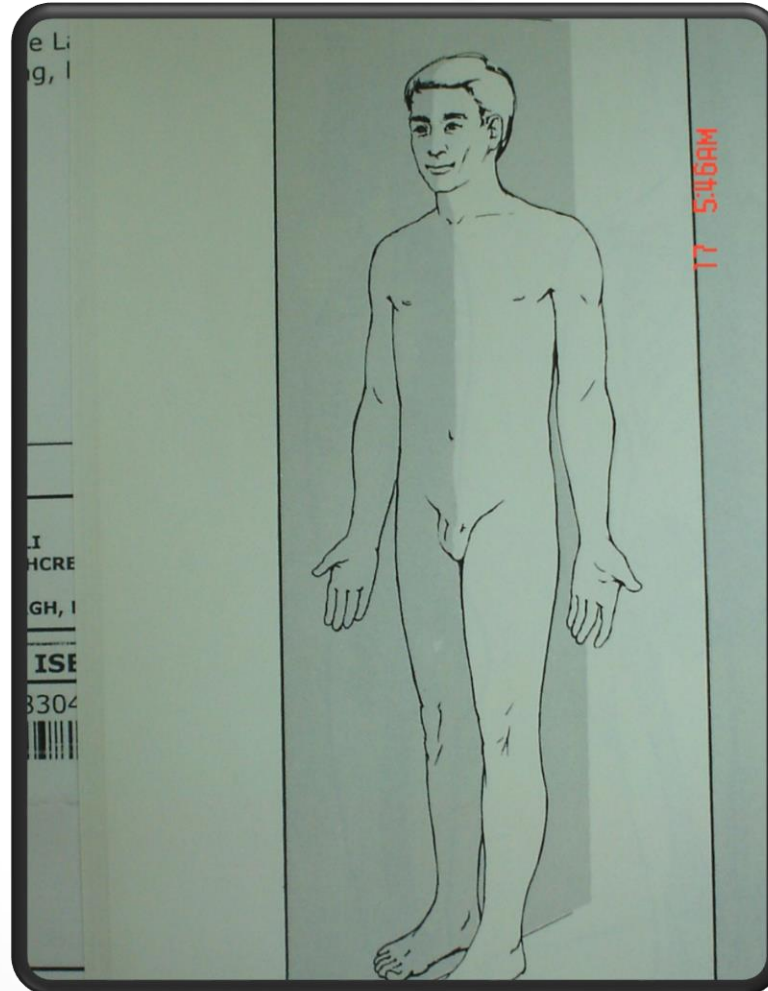
1. **Sagittal plane**: known as the **anterior – posterior** plane, is vertical and extends from front to back (anterior to posterior), divides the body into **right** and **left** halves of equal size..

The motion of **flexion** and **extension** occur in the sagittal plane. All motions take place **around a medial - lateral axis.**

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



# Sagittal plane





# The anatomical position

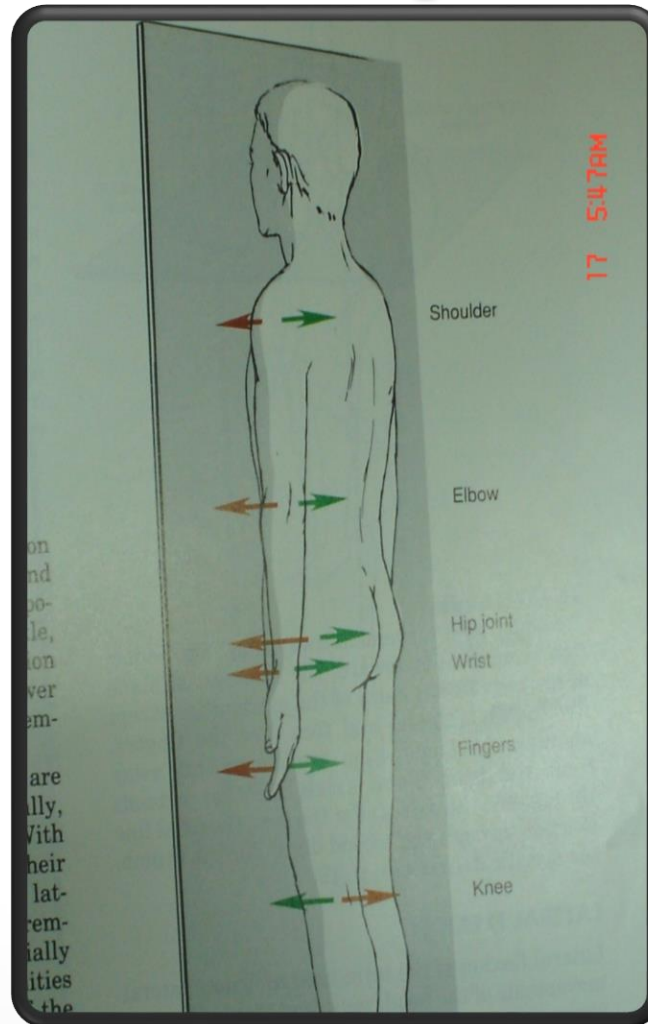
2. **Coronal plane:** known as the **frontal plane**,  
Is vertical and extends from side to side ,divides the body  
into **front** and **back** halves equally...

The movements of **abduction** and adduction take place **around**  
**an anterior-posterior axis.**

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



# Coronal plane







# The anatomical position

## 3. Transverse (Horizontal) plane:

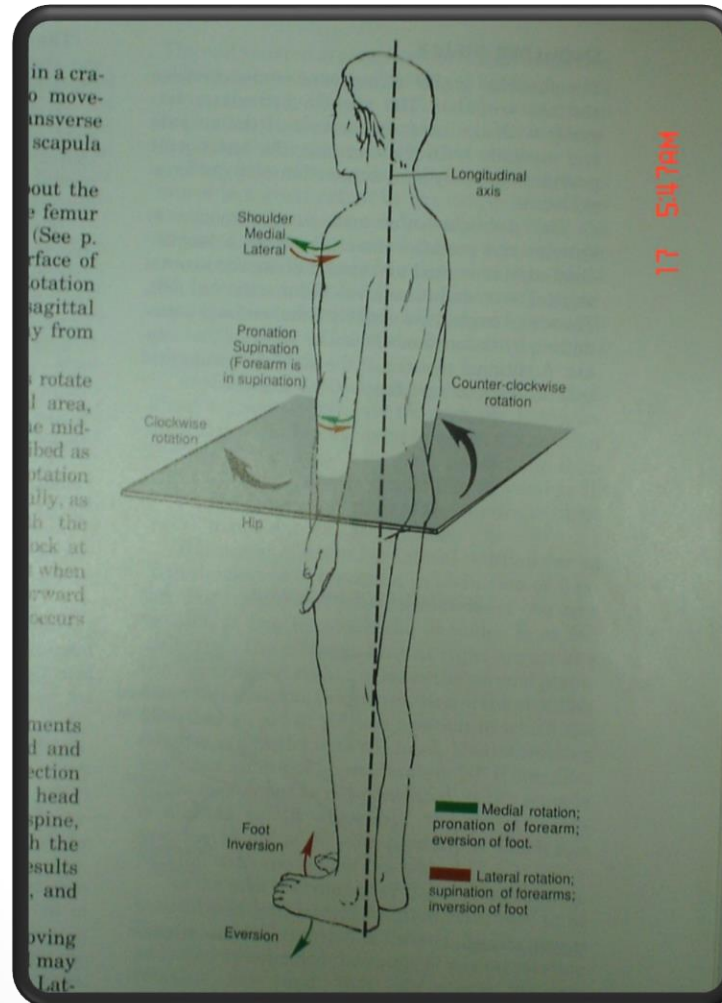
Divides the body into **upper** (cranial) and **lower** (caudal) portion.

The motion of **rotation** occurs around a vertical axis (proceeds in a cranial to caudal direction).

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



# Transverse plane





## How to assess\evaluate any PT cases in generally?

### ❖ **The therapist can do the following:**

- Observe the patient as he or she enters the treatment area to detect gross abnormalities of gait or other aspects of mobility.
- Observe the patient doing other everyday activities such as rising from a chair, completing admission or history forms, or removing street clothing.
- Ask the patient to walk on the toes and then on the heels.
- Ask the patient to grip the therapist's hand.
- Perform gross checks of bilateral muscle groups: reaching toward the floor, overhead, and behind the back.



# How to assess\evaluate any PT cases in generally?

## Physical Examination\Assessment components?

- Medical record. (pt medical file. chart, or sheet)..

### SOAP note

#### 1. Subjective: by History taking:

- A. **Personal** history ( name, sex, age, occupation, address, and marital status.).
- B. **present** history\illness (chief complaint-”c\o” when did it start, cause, behavior of symptoms, visioal analogue scale ”VAS”..).
- C. **past** history (any related disease\illness, surgery, **DM**, **HTN**, or Osteomyelitis)

#### 2. **Objective\physical examination: by**

- A. Inspection
- B. palpation.
- C. Range of Motion
- D. Manual Muscle testing
- E. Special tests



# Physical Examination\Assessment components?

## 3. Assessment:

all present problems( postural deformity, abnormal Gait pattern, redness, swelling, edema\ odema, abnormal skin temperature, tenderness, shorting\ tightness, abnormal muscle tone, atrophy\weakness, limiting ROM...etc)

## 4. Plane of treatment:

- A. Goals (**short** and **long** goals).
- B. Methods (PT managements).



## ➤ INDICATIONS OF MMT:

- 1) Lower Motor Neuron (LMN) Disease (clinically characterised by muscle atrophy, weakness and hyporeflexia without sensory involvement. They may arise from disease processes affecting the anterior horn cell or the motor axon).
- 2) Some other Neurological (Neuromuscular) disease. Such as,
  - Multiple Sclerosis
  - Muscular dystrophy
- 3) Some Musculoskeletal disorders.



## ➤ CONTRAINDICATIONS OF MMT:

- contraindications to muscle testing
  - **Acute phase of injuries**
  - **Inflammation**
  - **Severe \ Significant pain**
  - **Cerebral Palsy**
  - **Parkinson's disease**
  - **Cardio vascular disease / Brain injury**
  - **Recent Fracture or suspected fracture**
  - **Joint instability (dislocation/subluxation joint)**
  - **Bone carcinoma or any fragile bone condition**
  - **Recent surgeries without a doctor note**





## ➤ PRECAUTION:

### EXTRA CARE MUST BE TAKEN:

- Pt with history of cardiopulmonary disease
  - High blood pressure
- Conditions where fatigue may exacerbate condition (e.g., **MS**)
- Chronic Obstructive Pulmonary disease
- Arthritis or abnormal joint conditions.
- ❖ **Multiple Sclerosis**: "a chronic, typically progressive disease involving damage to the sheaths of nerve cells in the brain and spinal cord, whose symptoms may include numbness, impairment of speech and of muscular coordination, blurred vision, and severe fatigue"







## ➤ **LIMITATION OF MMT:**

### **1) UMN LESIONS :**

- Spastic muscle have poor control from higher centers thus its better to go for voluntary control assessment rather than MMT.

### **2) PRESENCE OF PAIN & SWELLING:**

- pain and swelling increases the intra articular tension causing irritation of joint and can affect the MMT result, thus in case always mention about presence of pain along with Grade.



## ➤ LIMITATION OF MMT:

### **3) TYPES OF CONTRACTION :**

MMT gives idea about Quality of concentric contraction only.  
(Not Eccentric which is more functional).

### **4) STRENGTH Vs ENDURANCE:**

MMT give knowledge about only the strength and not endurance.



# ALTERNATE TECHNIQUES OF ASSESSING MUSCLE STRENGTH APART FROM CONVENTIONAL MMT

2. Break test
4. Functional assessment



# BREAK TEST

- Resistance applied at the end of tested range is termed as break test.
- Resistance applied throughout the test is called make test.
- Patient is instructed to complete the test movement and then hold the segment against resistance.
- The isometric hold (break test) shows the muscle to have a higher grade than the make test.
- For one joint muscle resistance is applied at end of ROM and for two joint muscle it is applied at mid range.



# RESULT INTERPRETATION

Findings Possible pathology	Findings Possible pathology
Strong and painless contraction	No neurological deficit
Strong and painful contraction	Minor lesion of tested muscle or tendon
Weak and painless contraction	Disorder of nervous system, complete rupture of muscle or tendon or disuse atrophy
Weak and painful contraction	Fracture, neoplasm, partial rupture of muscle or tendon, inflammation inhibiting contraction.



# FUNCTIONAL TEST

- ❖ Correlating the muscle strength with its functions Such as
  - Standing/ walking on toes
  - Standing/ walking on heels
  - Walking on medial or lateral border of foot
  - One leg standing
  - Squatting and up squatting
  - Sit to stand
  - Backward / forward/ lateral trunk bending / hand to knee..



## ➤ PROCEDURE:

- 1) Explanation & Instruction
- 2) Assessment of normal muscle strength
- 3) Properly positioned the patient
- 4) Stabilization
- 5) Substitution movements & Trick movements



# PREPARATIONS:

- The plinth or mat table for testing must be firm to help stabilize the part being tested. The height of the table should be adjustable to allow the examiner to use proper leverage and body mechanics.
- Materials needed include the following:
  - Muscle test documentation forms
  - Pen, pencil, or computer terminal
  - Pillows, towels, pads, and wedges for positioning
  - Sheets or other draping linen
  - Goniometer
  - Interpreter (if needed)
  - Assistance for turning, moving, or stabilizing the patient
  - Emergency call system (if no assistant is available)





## 1) EXPLANATION & INSTRUCTION:

The therapist demonstrate and or explains briefly the movement to be performed and or passively moves the patient's limb through the test movement. For example, the following statements may be used:

- "I'm going to test the strength of one of the muscles that bends your elbow"
- "This is the movement pattern I want you to do. Do it first on your uninvolved side."

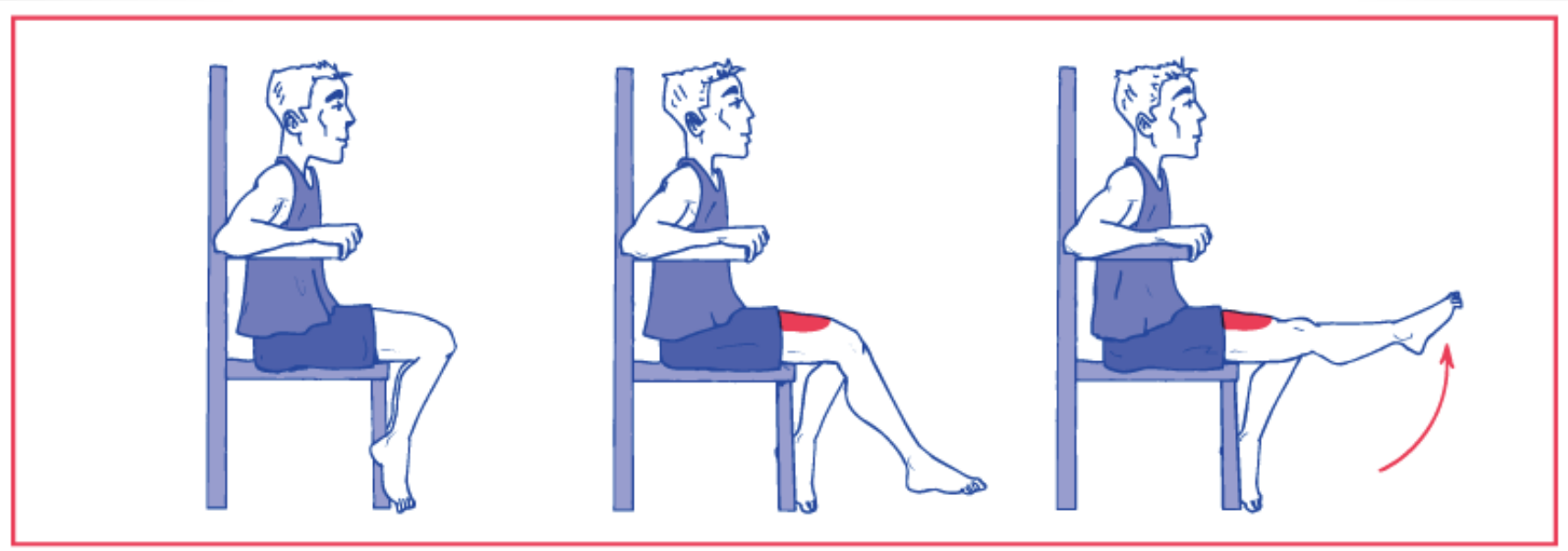
## 2) ASSESSMENT OF NORMAL MUSCLE STRENGTH:

Always assess and record the strength of the **unaffected** side limb to determined the patient's normal strength.



### 3) PROPERLY POSITINED THE PATIENT:

- The patient is positioned to isolate the muscle (or) muscles group to be tested in either gravity eliminated or Against gravity positioned.





#### 4) STABILIZATION:

**I. PROXIMAL HAND** – At Origin of muscle & proximal joint giving stabilization.

**II. DISTAL HAND** – Distally offering resistance or Assistance depend upon performance.



5) Substitutions and trick movements are avoided by making use of the following methods:

- a) **The patient's normal muscles:** For example, the patient holds the edge of the plinth when hip flexion is tested and uses the scapular muscles when glenohumeral flexion is performed.
- b) **The patient's body weight:** It is used to help fix the proximal parts (shoulder or pelvic girdles) during movement of the distal ones.
- c) **The patient's position:** For example, when assessing hip abduction strength in side lying, the patient holds the non-tested limb in hip and knee flexion in order to tilt the pelvis posteriorly and to fix the pelvis and lumbar spine.



**d) External forces:** They may be applied manually by the therapist or mechanically by devices such as belts and sandbags.

**e) Substitution and trick movements:** When muscles are weak or paralyzed, other muscles may take over or gravity may be used to perform movements normally carried out by the weak muscles.



## ➤ FACTORS AFFECTING STRENGTH:

- Age (↓muscle mass and fiber in size and number-- ↑age → ↓strength)
- Sex (male stronger than females- women are more 28 to 30% weaker than men at 40 to 45 years of age)
- Fitness condition (fit or weak physical strength and energy)
- Type of muscle contraction:
- Muscle size:
- Speed of muscle contraction:
- Previous training effect:
- Joint position:
- Fatigue (As the patient fatigues, muscle strength decreases)

The patient's **level of motivation, pain, body type, occupation and dominance** are other factors that may affect strength.



➤ Age:

A decrease in strength occurs with increasing age due to deterioration in muscle mass. Muscle fibers decrease in size and number.

Strength apparently increases for the first 20 years of life, remains at this level for 5 or 10 years and then gradually decreases throughout the rest of life.

The progressive decrease in strength is clearer in the forearm flexors and muscles that raise the body(anti-gravity muscles \ prevent postural collapse) ??



# Steps to do manual muscle testing

- **There are many steps to do manual muscle testing:**

1. **Gravity.** It is important to know the force of a muscle.
2. **Resistance.** Use it when a muscle can perform action against gravity, this include either:
  - ✓ Minimal resistance.
  - ✓ Moderate resistance.
  - ✓ Maximal resistance.
3. **Range of motion.** Is it complete\ full or incomplete\ partial ROM.
4. **Position of patient.** Supine, sideline, prone, sitting, standing.....
5. **Position of therapist\ examiner.** Inner hand\outer hand, stabilization...
6. **Substitutions\** trick movements.
7. **Verbal command\**instruction.





# Types of joints

\*\* we can divide the Types of joints in three categories  
according to:

## 1. Functional:

- ❖ Movable jt.
- ❖ Slight movable jt.
- ❖ Immovable jt.

## 2. Structures:

- Synovial jt.
- Cartilaginous jt.
- Fibrous jt.

- Assignment: List two examples of each?

## 3. Degree freedom:

Six movements

2 Degree freedom:

**Four movements**

1 Degree freedom:

**Two movements**



# 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.



# 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. Thus, a goniometer is an instrument used to measure angles.

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

- Within the field of physical therapy, goniometry is used to measure the total amount of available motion at a specific joint. Goniometry can be used to measure both active and passive range of motion created at human joints by the bones of the body.

“[http://highered.mheducation.com/sites/0071474013/student\\_view0/chapter8/goniometry.html](http://highered.mheducation.com/sites/0071474013/student_view0/chapter8/goniometry.html)”



# Principles of Goniometry

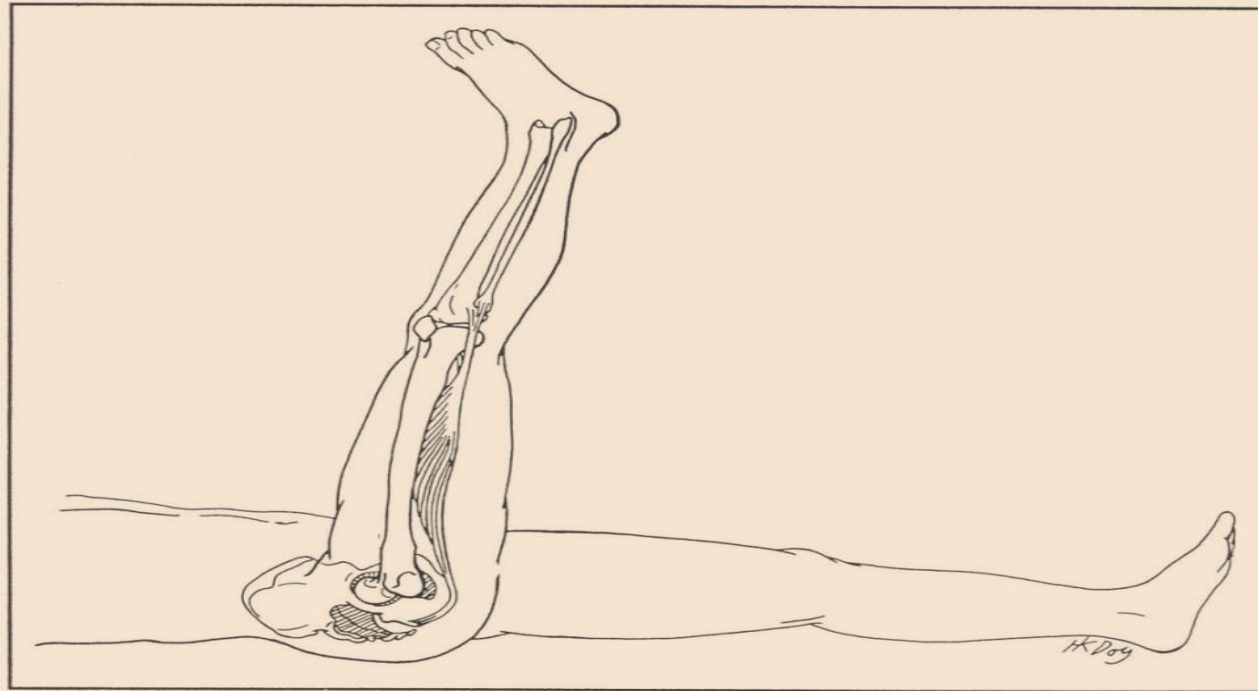
- **General principles for measuring Joint Range of Motion:**
  1. **Passive Range.** (Understanding the starting or ending ROM)
  2. **Starting Position.**(Understanding the anatomical position of 0 degree)
  3. **Alignment.**(the Goniometer is aligned on the lateral side of the test joint)
  4. **Axis.**(the 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)

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



# Passive insufficiency

- ROM is limited by length of muscle  
e.g. Hamstrings.



**Figure 1.18.** Passive insufficiency of the hamstring muscles. Hip flexion range of motion is limited by the length of the hamstring muscles when the knee joint is held in extension.



# 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.



# 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

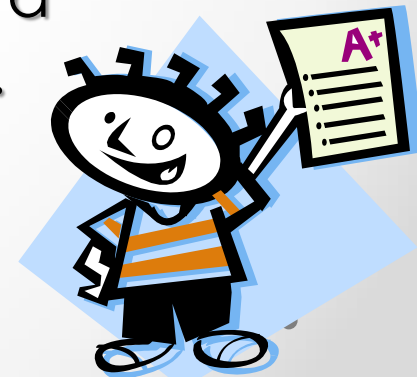
- Patient
- Fixation refers to the stability of the body or body part.
- Test position (the optimal position). Pt and therapist position.
- General position such as **Supine, Side-lying, Prone, Sitting, and Standing**
- Test movement.(a movement of the part in a specified direction and through a specific 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.
- Weakness, shortness, and contracture.
- **Palpation**: to examine (part of the body) by touching it.





## TERMS USED IN MUSCLE TESTING CON'T

- **Grading:** Manual muscle grading is based on 3 factors
  - a. The ability of the muscle or muscle group to move the part through a complete ROM: against gravity, gravity eliminated etc.
  - b. The amount of manual resistance that can be given to a contracted muscle or muscle group.
  - c. Evidence of the presence or absence of a contraction in a muscle or muscle group.





# JOINT POSITIONS



- **Close-Packed Position**

- joint surfaces are fully congruent (maximum contact between articular surfaces ) and cannot be pulled apart-maximal tension in joint capsule and ligaments

For Example: knee extension (tibia and femur maximum contact between both articular surfaces of this joint) most stable position which put ligaments and capsule under tension, so you can't make mobilization for this joint.



# JOINT POSITIONS CONT'D

- **Loose-Packed Position**
  - joint surfaces are least congruent (**surfaces not contact**)
  - greatest laxity of capsule and ligament
  - resting position of joint
  - **Easy to make mobilization**





# 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:

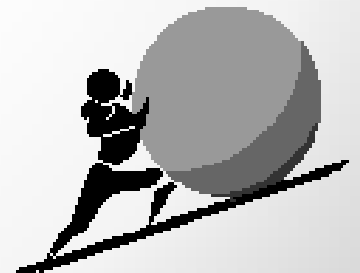
### 1. pt position

### 2. Therapist position:

- a. inner hand
- b. outer hand

### 3. instructions or command

### 4. palpation location.





# REFERENCE :

- ❑ Daniels and Worthingham's -MUSCLE TESTING.
- ❑ MUSCLE TESTING AND FUNCTION – Florence Peterson Kendall, Elizabeth Kendall McCreary, Patricia Geise Provance.
- ❑ MUSCULOSKETAL ASSESSMENT- Hazel M.Clarkson,
- ❑ ESSENTIAL OF EXERCISE PHYSIOLOGY – Victor C.Katch, William D. McArdle, Frank I. Katch.



## Assignment # 2

find and Access to LMS website

- **Due date at 11:00pm on next Wednesday**





Any question ???



*Thank you*