Manual Muscle Testing

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Evaluation of the function and strength of individual muscles and muscles group based on effective performance of a movement.

Muscle Strength

The maximal amount of tension or force that a muscle can voluntarily exert in one maximal effort.

Factors Affecting Strength

1. **Age:**

   A decrease in strength occurs with increasing age due to deterioration in muscle mass.

2. **Sex:**

   Males are generally stronger than females.

3. **Type of Muscle Contraction :**

   More tension can be developed during an eccentric contraction than during an isometric contraction.

4. **Muscle Size:**

   The larger the cross sectional area of a muscle, the greater the strength of the muscle.

5. **Speed of Muscle Contraction:**

   When a muscle contracts concentrically the force of the contraction decreases as the speed of the contraction increases.

6. **Previous Training Effect:**

   Strength performance depends up on the ability of the nervous system to activate the muscle mass.

7. **Joint Position:**

   Regardless of the type of muscle contraction, a muscle contracts with more force when it is stretched.

8. **Fatigue:**

   As the patient fatigue, muscle strength decrease.

9. **Others:**

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

Types of Muscle Contraction

1. **Isometric (Static) Contraction:**

   This occurs when there is tension developed in the muscle but the muscle length does not change.

2. **Isotonic Contraction:**

   The muscle develops constant tension against a load or resistance with change in length.

i. **Concentric Contraction:**

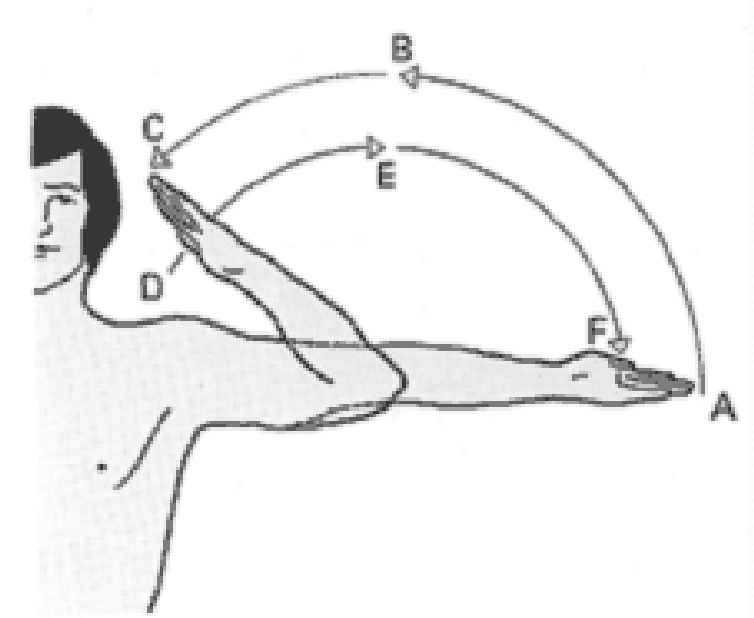
   Tension is developed in the muscle and the origin and insertion of the muscle move closer together. The muscle shortens.

ii. Eccentric Contraction:

Tension is developed in the muscle and the origin and insertion of the muscle move further apart, the muscle lengthens.

A-B-C : Concentric Contraction of Biceps Brachii Muscle.

E-F : Eccentric Contraction of Biceps Brachii Muscle.



Functional Classification of Muscle:

- **Prime Mover or Agonist:**

  A muscle or group of muscles that makes the major contribution to the movement at the joint.

- **Antagonist:**

  A muscle or group of muscles that has an opposite action to the prime mover's. the antagonist relaxes as the agonist moves the part through a ROM.

- **Synergists:**

  A muscle that contracts and works a long with the agonist to produce the desired movement.

Range of Muscle Work:

The full range in which a muscle work is divided into parts, outer, inner and middle ranges.

- **Outer Range:**

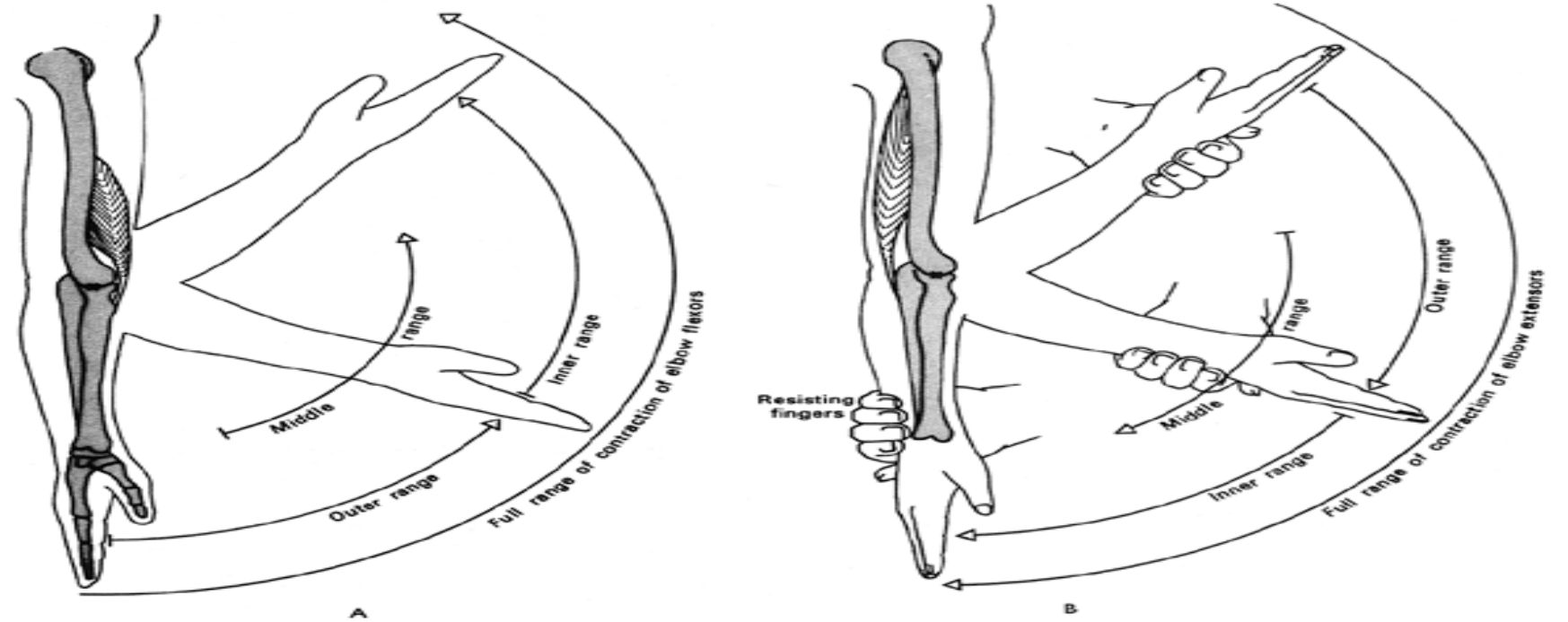
  Is from a position where the muscle is on full stretch to a position half way through the full range of motion.

- **Inner Range:**

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

- **Middle Range:**

  It is the portion of the full range between the midpoint of the outer range and the midpoint of the inner range.



The range of movement produced by contraction of brachialis(A) & Triceps (B)

Individual Versus Group Muscle Test

- Muscles with a common action or actions may be tested as a group or a muscle may be tested individually.

- For ex., flexor Carpi ulnaris and flexor Carpi radialis may be tested together as a group in the action of wrist flexion. Flexor carpi ulnaris may be tested more specifically in the action of wrist flexion with ulnar deviation.

Muscle Testing Assessment Procedures

- **Explanation and Instruction:**

  The therapist demonstrates and /or explains briefly the movement to be performed.

- **Assessment of Normal Muscle Strength:**

  Initially assess and record the strength of the uninvolved limb to determine the patient's normal strength.

- **Patient Position:**

  The patient is positioned to isolate the muscle or muscle group to be tested.

  Ensure the patient is comfortable and well supported.

- **Stabilization:**

Prevent substitutions and trick movements by making use of the following methods:

1. **The patient normal muscles**
2. **The patient's body weight**
3. **The patient position**
4. **External forces**

- **Substitution and Trick Movement:**

When muscles are weak or paralyzed, other muscles may take over or gravity may be used to perform the movement.

Manual Muscle Testing Grades

- **Zero 0/5**

  The subject demonstrates no palpable muscle contraction.

- **Trace 1/5**

  The subject's muscle contraction can be palpated, but there is no joint movement.

- **Poor 2/5**

  The subject completes range of motion with gravity eliminated.

- **Fair 3/5**

  The subject completes ROM against gravity without manual resistance

- **Good 4/5**

  The subject completes ROM against gravity with moderate resistance.

- **Normal 5/5**

  The subject completes ROM against gravity with maximal resistance.

- **Poor Minus 2-/5**

  The subject does not complete ROM in a gravity eliminated position.

- **Poor Plus 2+/5**

  The subject is able to initiate movement against gravity.

- **Fair Minus 3-/5**

  The subject does not complete the range of motion against gravity, but does complete more than half of the range.

- **Fair Plus 3+/5**

  The subject completes ROM against gravity with only minimal resistance.

- **Good Minus 4-/5**

  The subject completes ROM against gravity with minimal-moderate resistance.

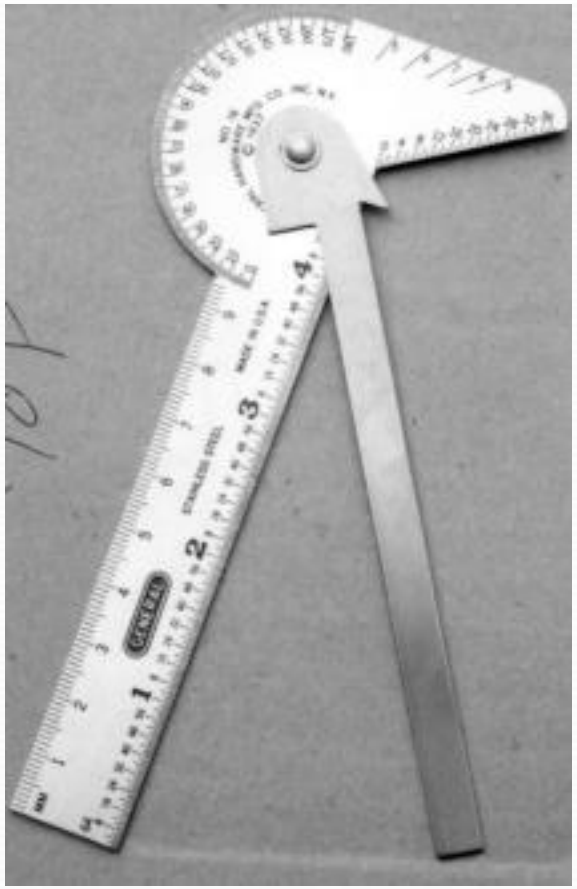
- **Good Plus 4+/5**

The subject completes ROM against gravity with moderate-maximal resistance.

Contraindications and Precautions of MMT

- Inflammation.
- Pain
- Cardiovascular problems.
- Abdominal surgery or herniation.
- Fatigue.
- Extreme debility.

Goniometry



Goniometry

The technique of quantifying human joint active or passive range of motion.

Purpose of Goniometric assessment:

- To establish the existing range of motion available in a joint.
- To aid in diagnosis and determining the patient's joint function.
- To reassess the patient's status after treatment.
- To develop the patient's interest in and motivation for the treatment.

Defining Movement

- Passive (PROM) – no effort by the patient
- Active (AROM) – patient performs the movement themselves
- Assistive (AAROM) – someone else helps the patient through the ROM
- Hypermobility – excessive ROM
- Hypomobility – less than normal ROM

Factors That Influence Range of Motion:

- **Reliability:**

  factors that will improve reliability include removal of tight and restrictive clothing, and measuring at the same time of day.

- **Age:** generally the younger the subject, the greater the range of motion.

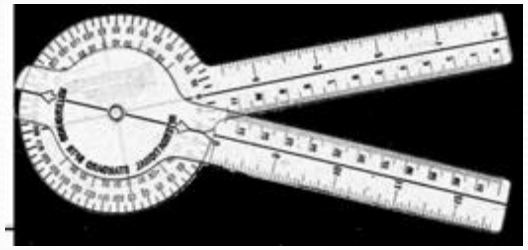
- **Sex:** women tend to have greater ranges than men.

- **Joint structures:** some persons, because of genetics or posture, normally have hypermobile or hypomobile joints.

Types of goniometers

Universal goniometers:

plastic or metal protractor like device with moveable and stationary arms of varying lengths



- **Gravity Dependent Goniometers – Inclinometers:** report position of distal or proximal segment relative to the line of gravity

- **Electrogoniometers:**

  potentiometer detects changes in position of two segments

Parts of the Goniometer

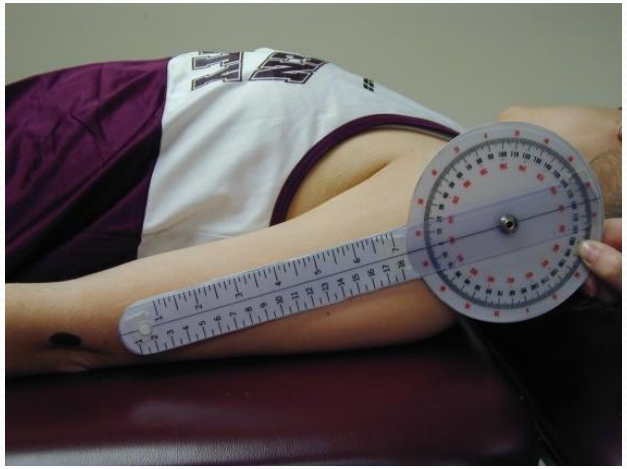
- axis of rotation
- non-moving (Stationary arm)
- moving arm
- reading numbers

Procedures

- Patient position
- Locating joint axis
- Locating stationary arm
- Locating moving arm
- Reading goniometer
- Recording goniometer measures (the mean of 2 or 3 trials is more accurate)

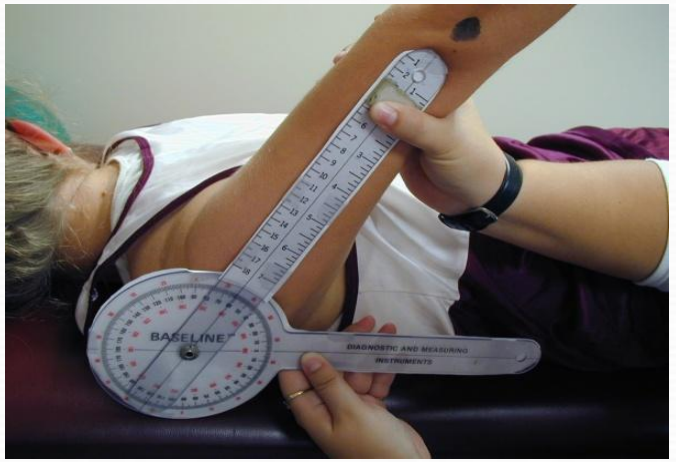
Contraindications and Precautions for ROM Testing:

- Dislocation or unhealed fracture.
- Surgical procedures to tendons, ligaments, muscles, joint capsule or skin.
- Infections or inflammatory process.
- Marked osteoporosis.
- Hyper mobile or sublaxated joint.
- Painful conditions.
- Hematoma.

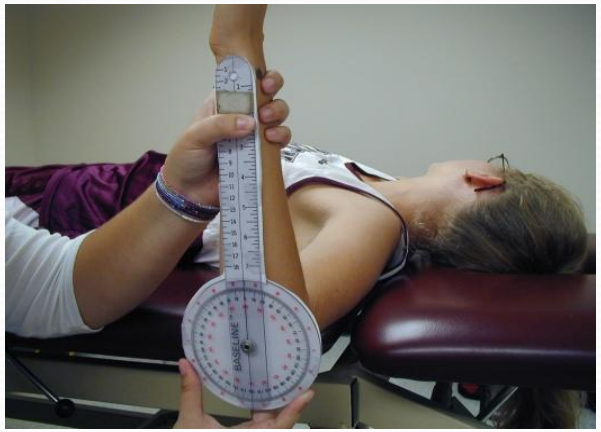


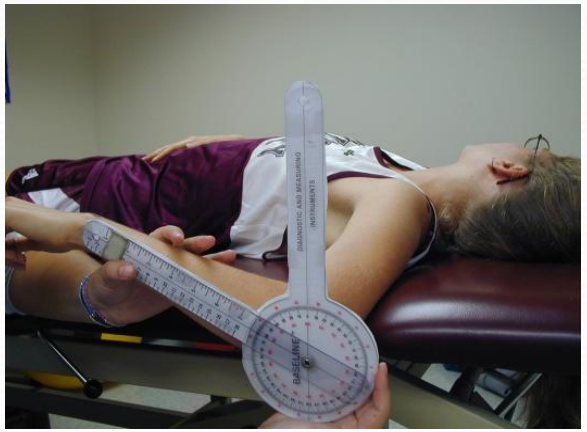
Shoulder flexion

- Shoulder hyperextension



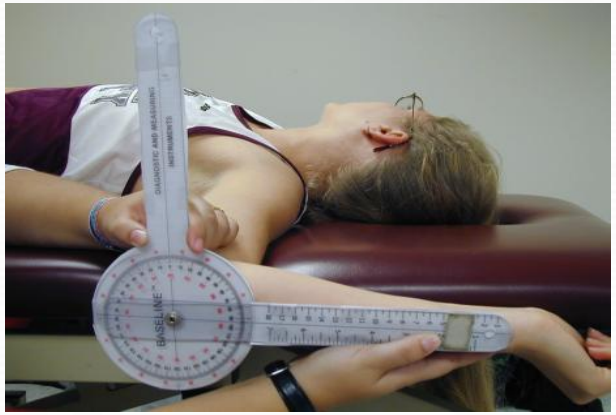
- shoulder abduction

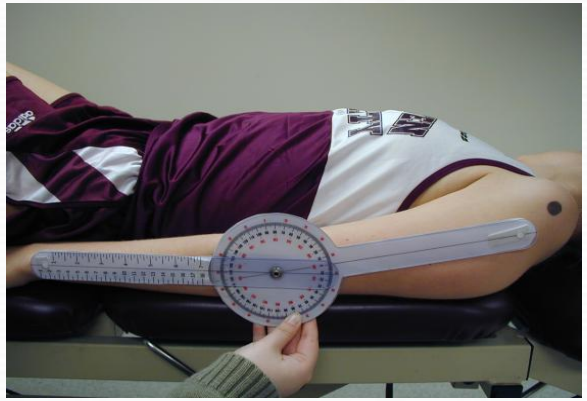


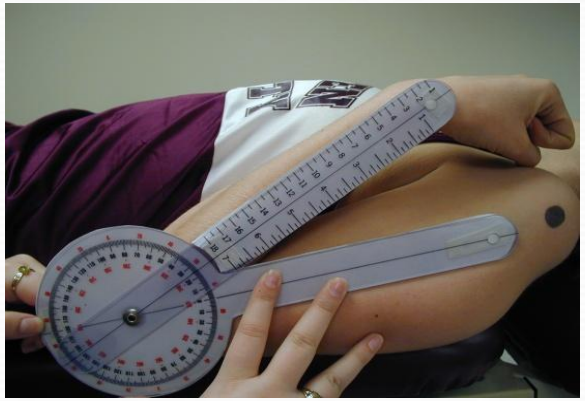


Shoulder internal rotation

Shoulder external rotation







Elbow flexion and extension

END FEEL

Nature of the motion barrier that characterizes the type of tissue limiting range.

Normal or Physiologic END FEEL:

- Hard
- Soft
- Firm
- Capsular stretch

- **Hard (bony):**

  An abrupt, hard stop to movement when bone contacts bone; for ex.: Passive elbow extension. the olecranon process contacts the olecranon fossa.

- **Soft (soft tissue opposition):**

  When two body surfaces come together a soft compression of tissue is felt, for ex.: in passive knee flexion, the posterior aspects of the calf and thigh come together.

- **Firm (soft tissue stretch):**

  Firm or springy sensation that has some give when a muscle is stretched for ex.: passive ankle dorsiflexion performed with the knee in extension is stopped due to tension in the gastrocnemius muscle.

- **Capsular stretch:**

  Hard arrests to movement with some give when the joint capsule or ligaments are stretched. The feel is similar to stretching a piece of leather, for ex.: passive shoulder external rotation.

Long and Round Measurement

- **Long measurement:**

Total: Measure the length of the upper limb from acromion to the radial styloid process.

Segmental: - Measure the length of the humerus from acromion to the lateral epicondyle.

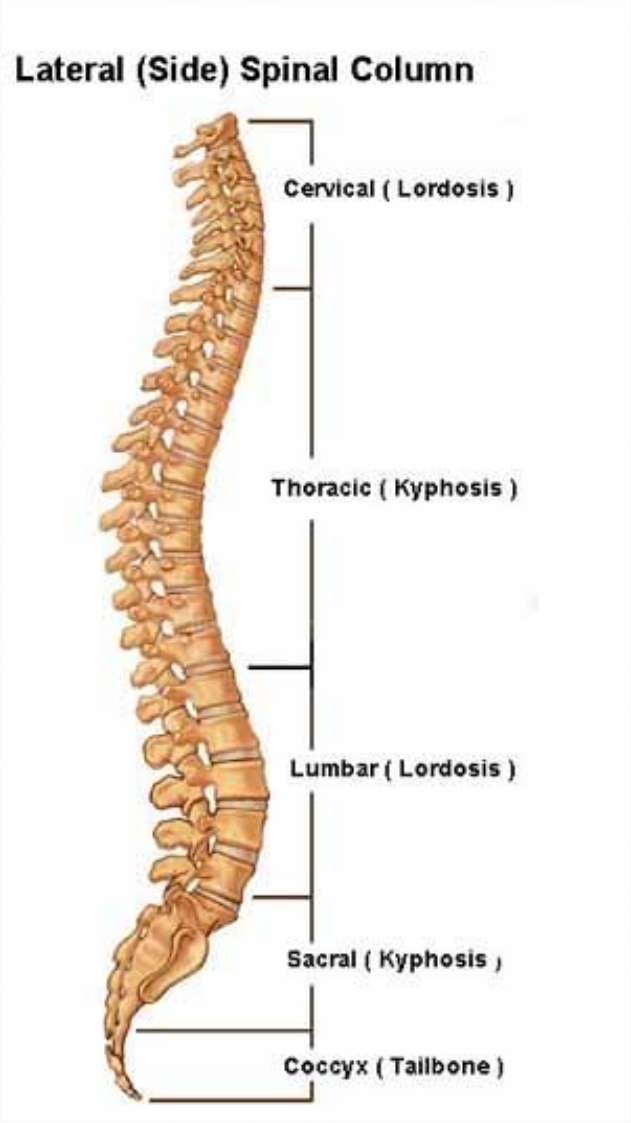
- Measure the length of radius and ulna from lateral epicondyle of humerus to the radial styloid process.

- **Round measurement:**

Muscle atrophy: measure around the midpoint of the arm and around the upper third of the forearm.

Joint edema: measure around the centre of the elbow joint (centre of the capital fossa) and 3cm & 6cm above and below.

Cervical & Lumbar Spine ROM



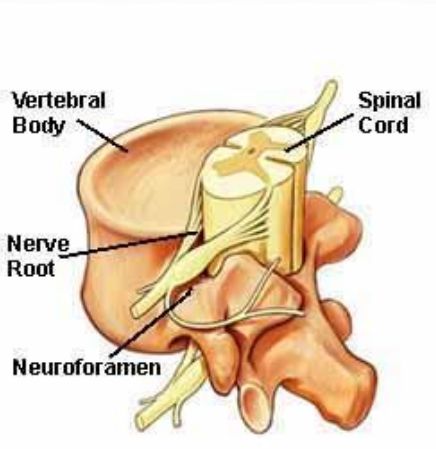
Spinal Column

Cervical Spine ROM

Seven Cervical Vertebrae Forming The Cervical Spine, Including The First& Second Ones (Atlas & Axis)

Construction of the Spinal Vertebra

- **Vertebral bodies:** Weight bearing.
- **Neural arch:** Protect Neural Elements.
- **Bony Processes:** increase the efficiency of muscle action.

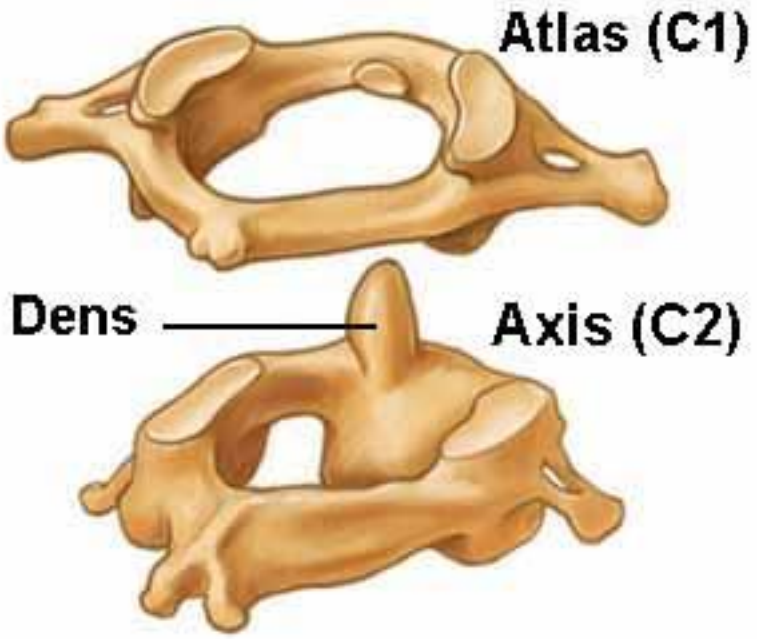


- The atlas (C1) and the axis (C2), have structures unlike those of any other vertebra.

- The atlas has no vertebral body and is shaped like a ring with an anterior and a posterior arch.

- Has no spinous process. Superiorly, it has a fovea, or dishlike depression, that holds the occiput of the skull.

- The articulation of the atlas with the skull is called the atlantooccipital joint. At this joint, the head nods on the spine.



- The atlantooccipital joint allows approximately 10˜° to 15˜° of flexion and extension and no lateral flexion or rotation.
- The weight of the head is transferred to the cervical spine via C2, the axis.
- The articulation with the atlas occurs via a pillar (odontoid process or dens) projecting from the superior surface of the axis that fits into the atlas and locks the atlas into a pivoting joint. (the most mobile of the cervical joints).
- allowing approximately 10˜° of flexion and extension, accounts for 50% of the rotation in the cervical vertebrae and no lateral flexion.

- Because of the short spinous processes, the shape of the discs, and the backward and downward orientation of the articulating facets, movement in the cervical region is greater than in any other region of the vertebral column.

- Forward flexion: 0 to 45 degrees.
- Extension: 0 to 45 degrees.
- Lateral Flexion: 0 to 45 degrees.
- Lateral Rotation: 0 to 80 degrees.

Methods to Measure the Range of Motion of the Cervical Spine

- Radiographs.

- inclinometers.

- Tape measures.

Forward flexion: 0 to 45 degrees.

Extension: 0 to 45 degrees.

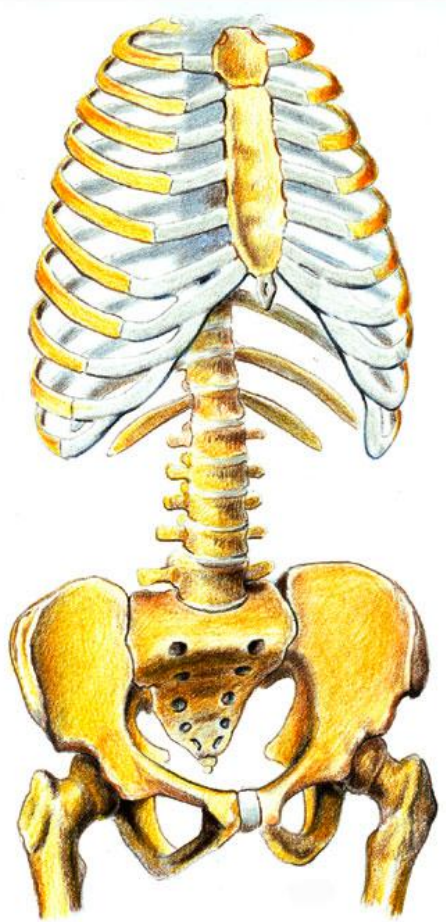
Lateral Flexion: 0 to 45 degrees.

Lateral Rotation: 0 to 80 degrees.

Lumbar Spine ROM

- Five lumbar vertebrae and the sacrum making up the lumbar spine.

- The size of the vertebral body increases from L1 to L5, due to the increasing loads that each lower lumbar vertebral level has to absorb.



- The collective range of motion in the lumbar region is:

- Lumbar flexion (60°)
- Lumbar Extension (30°)
- Lumbar lateral flexion (30- 40°)
- Lumbar rotation (45°)

- The lumbosacral joint is the most mobile of the lumbar joints, accounting for a large proportion of the flexion and extension in the region.
- Of the flexion and extension in the lumbar vertebrae, 75% may occur at this joint, with 20% of the remaining flexion at L4-L5 and 5% at the other lumbar levels.

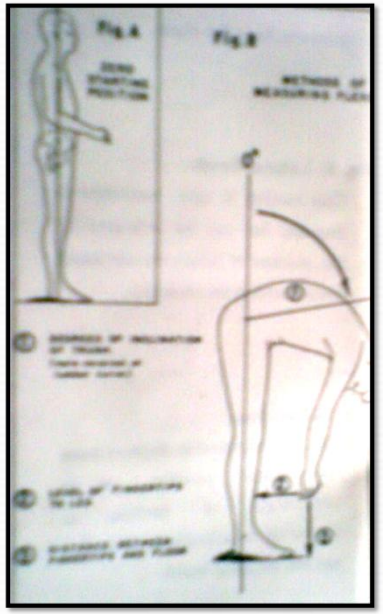
- Lumbar flexion (60°)

- Lumbar rotation (45°)

Clinical Methods to Assess Lumbar ROM

- **Spinal flexion:**

- By measuring the degrees of forward inclination of the trunk in relation to the longitudinal axis of the body. The examiner should fix the pelvis with his hands.



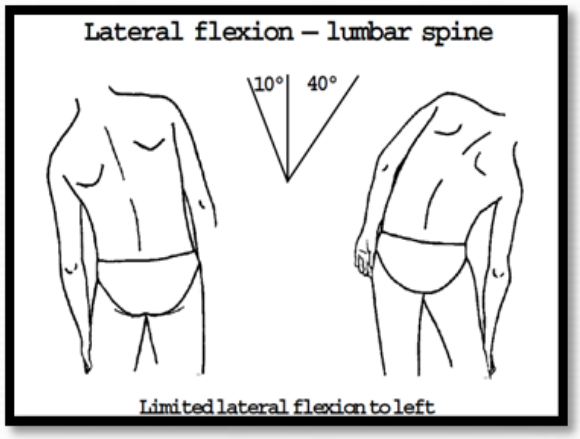
- By indicating the level the fingertips reach along the patient leg. For instance, fingertips to the patella; or fingertips to mid-tibia.
- By measuring the distance in inches or centimeters between the fingertips and the floor.
- By the steel or plastic tape measuring method:

- The most accurate clinical method of measuring true motion of the spine in flexion.
- With the patient standing, the tape is held over the spinous process of C7, and the distal tape held over the spinous process of S1.

- As the patient bends forward, the spinous processes spread, this will be indicated by lengthening of the tape measure.
- In the normal healthy adult, there is, on the average, an increase of 4 inches in forward flexion. If the patient bends forward with his back straight (as in rheumatoid arthritis), the tape will not record motion.
- One is able to record motion of the thoracic spine by taping from the spinous process of C7 to T12.
- Usually if the total spine in flexion is 4 inches the examiner will find that 1inch occurs in the dorsal spine, and 3 inches occurs in the lumbar spine.

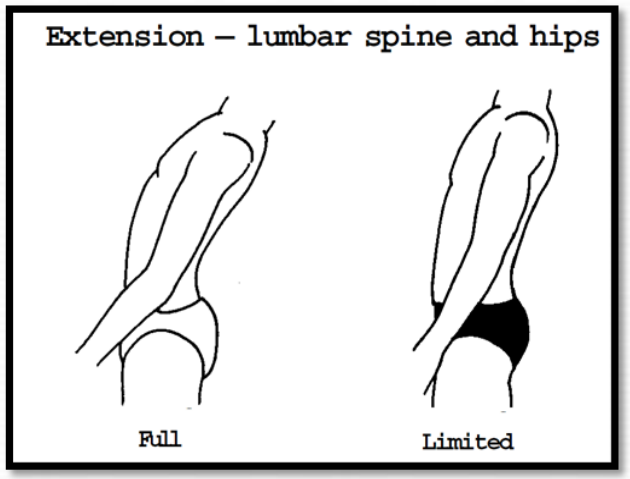
- **Spinal lateral bending:**

While the patient is standing, the knee joint is used as a fixed point .Record distance of finger tips from the knee joint on lateral bending.



- **Spinal extension:**

  while the patient is standing ,measure from C7 to L5 then ask the patient to extend his back and measure again the distance will decrease .



- **Spinal rotation:**

To estimate the degrees of rotation of the spine, the pelvis must be held firmly by the examiner's hands and the patient is instructed to rotate to the left side then to the right side then you have to compare between the degree of rotation on both sides.