

ROM testing

- ***Range of motion:*** the extent of movement of a joint in a specific direction measured in degrees of a circle
- ***Active ROM:*** the range of movement through which a person can voluntarily move a joint without assistance from another body parts, person or device.
- ***Passive ROM:*** amount of motion at a given joint when the joint is moved by an external force or therapist

Movement Terminology:

- **Angular Movements:**
- Angular motions refer to movements that produce an increase or decrease in the angle between the adjacent bones and include: Flexion, extension, abduction, and adduction.

Rotation Movements:

- These movements generally occurs around a longitudinal or
- vertical axis:
- - Internal (medial, inward) rotation.
- - External (lateral, outward) rotation.
- - Neck or trunk rotation.
- - Scapular rotation.
- - Circumduction.
- - Opposition of the thumb and little finger.
- - Horizontal abduction.
- - Horizontal adduction.
- - Tilt (anterior tilt of the scapula, posterior tilt of the scapula, anterior tilt of pelvis, posterior tilt of pelvis).

Purpose of joint range of motion assessment:

- 1. To establish the existing range of motion available in a joint and to compare it to the normal range for that subject. The information will permit a therapist to establish a database for the patient. This information is used to develop goals and a treatment plan to increase or decrease the range of motion.
- 2. To aid in diagnosing and determining the patient's joint function. Goniometry reveals joint limitations in the arc of motion but does not identify the dysfunction.
- 3. To reassess the patient's status after treatment and compare it to that at the time of the initial evaluation.
- 4. To develop the patient's interest in and motivation and enthusiasm for the treatment program.
- Several factors that influence range of motion must be considered to ensure that goniometry is an objective assessment.

PHYSIOLOGICAL FACTORS AFFECTING RANGE OF MOTION

- - **Age:** Generally the younger the subject, the greater the range of motion. A decline in range of motion occurs in most subjects between age 20 and 30 years, followed by a plateau until the age of 60 years, after which a decline again occurred.
- - **Sex:** Women tend to have greater ranges than men.

- **Joint structures:** Some person, because of genetics or posture, normally have hypermobile or hypo-mobile joints - Body type can influence joint mobility, as can flexibility of the tendon, and ligaments crossing the joint.
- - **Dominance:** Most researchers have found that there is essentially no difference for corresponding joints between the left and right sides of the body.

Factors limiting range of motion

- Joints are structured so that motion is limited by the capsule, ligaments, and tendons, or by the bony configuration.
- Some motions are limited by soft tissue bulk of the segments and not by a limitation associated with the joint. For instance, elbow flexion is usually limited by the muscle bulk of the arm against the forearm.
- Soft tissues such as ligaments, tendons and capsules are dense, regular connective tissue with inherent elastic properties, they may become tight or loose and affect the motion available at joints.
- Muscles associated with the joints may become stretched or/contracted thereby affecting the joint motion.
- The shape of the joint surfaces is designed to allow motion in particular directions. These surfaces may be altered by such factors as postures, disease, or trauma to allow more or less motion than normal at a joint.

End feel

- Normally, each joint has a small amount of motion at the end of the range that is not under voluntary control.
- These accessory motions are not assessed during active range evaluation but are included under the realm of passive measurements. Accessory motions help protect the joint structures by absorbing extrinsic forces.
- Examiners perform RANGE OF MOTION measurements should consider the "end feel" of each joint when determining passive range of motion.

- **Definition** The end feel is the sensation transmitted to the therapist hands at the extreme end of the passive ROM and indicates the structures that limit the joint movement.
- **A normal end feel** exists when there is full ROM at the joint and the normal anatomy of the joint stops movement.
- **An abnormal end feel** exists when there is either a decreased or increased joint ROM or when there is a normal ROM but structures other than the normal anatomy stop joint movement. The end feel may be normal (Physiologic) or abnormal (pathologic).

Normal (Physiologic) End feels:

End feel	Description
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)	A firm or springy sensation that has some give when muscle is stretched for ex.: passive ankle dorsi flexion performed with the knee in extension is stopped due to tension in the gastrocnemius muscle.
(Capsular stretch)	A hard arrest 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.

B. Abnormal Pathologic end feel:

End feel	Description
Hard	An abrupt hard stop to movement, when bone contacts bone, or a bony grating sensation, when rough articular surfaces move past one another, for ex.: in a joint that contains loose bodies, degenerative joint disease, dislocation, or a fracture.
Soft	A boggy sensation that indicates the presence of synovitis or soft tissue edema.
Firm	A springy sensation or a hard arrest to movement with some give, indicating muscular, capsular, or ligamentous shortening.
Springy block	A rebound is seen or felt and indicates the presence of an internal derangement, for Ex. the knee with a torn meniscus.
Empty	If considerable pain is present there is no sensation felt before the extreme of passive ROM as the patient requests the movement be stopped. This indicates pathology such as an extra articular abscess, a neoplasm, acute bursitis, joint inflammation, or a fracture.
Spasm	A hard sudden stop to passive movement that is often accompanied by pain, is indicative of an

Joint mobility testing

- Joint integrity and mobility testing can provide valuable information as to the status and the mobility of each joint and its capsule
- One of three conclusions can be drawn from the passive mobility tests:
 - The joint is determined to be normal
 - The joint motion is determined as being excessive
 - The joint motion is determined as being reduced
- Hypermobility or hypomobility of joints affects a patient's function in activities of daily living.

- **Hypermobility** - laxity in the joint or structures-surrounding the joint allows motion to exceed the normal range.
- **Hypomobility** is joint tightness or a less than normal range of motion.

Type of range of motion tests

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- The range of motion examination should determine the exact directions and types of motion that elicit the symptoms
 - ***Active***
 - ***Passive***
- **Active range of motion testing** gives the clinician information about:
 - The quantity of available physiological motion
 - The presence of muscle substitutions
 - The willingness of the patient to move
 - The integrity of the contractile and inert tissues
 - The quality of motion
 - Symptom reproduction
 - The pattern of motion restriction

- Active range of motion testing provides limited information regarding joint motion.
- Assuming that the subject has complete passive motion, an inability to actively move the segment completely through the motion must be attributed to muscle weakness.
Active range grossly evaluates coordination of movement and functional ability.

Passive range of motion testing

- gives the clinician information about the integrity of the contractile and inert tissues, and the *end-feel*
- Pain that occurs at the end-range of active and passive movement is suggestive of a capsular contraction, or scar tissue that has not been adequately remodeled
- Passive range of motion is usually evaluated in goniometry and is the amount of motion possible when the examiner moves a body part with no assistance from the subject.
- It is usually greater than active range of motion because the integrity of the soft tissue structures do not in themselves dictate the limits of movement.

- Comparison between the passive and active ranges of motion provide information about the amount of motion permitted by the joint structure relative to the person's ability to produce motion at a joint. A comparison may be an advantage in developing a patients treatment plan or aiding in a diagnosis.

Assessment of active range of motion:

- - The patient performs all of the active movements that normally occur at the affected joint(s) and at the joints immediately proximal and distal to the affected joints. The therapist observes as the patient performs each active movement one at a time, and if possible bilaterally and symmetrically.

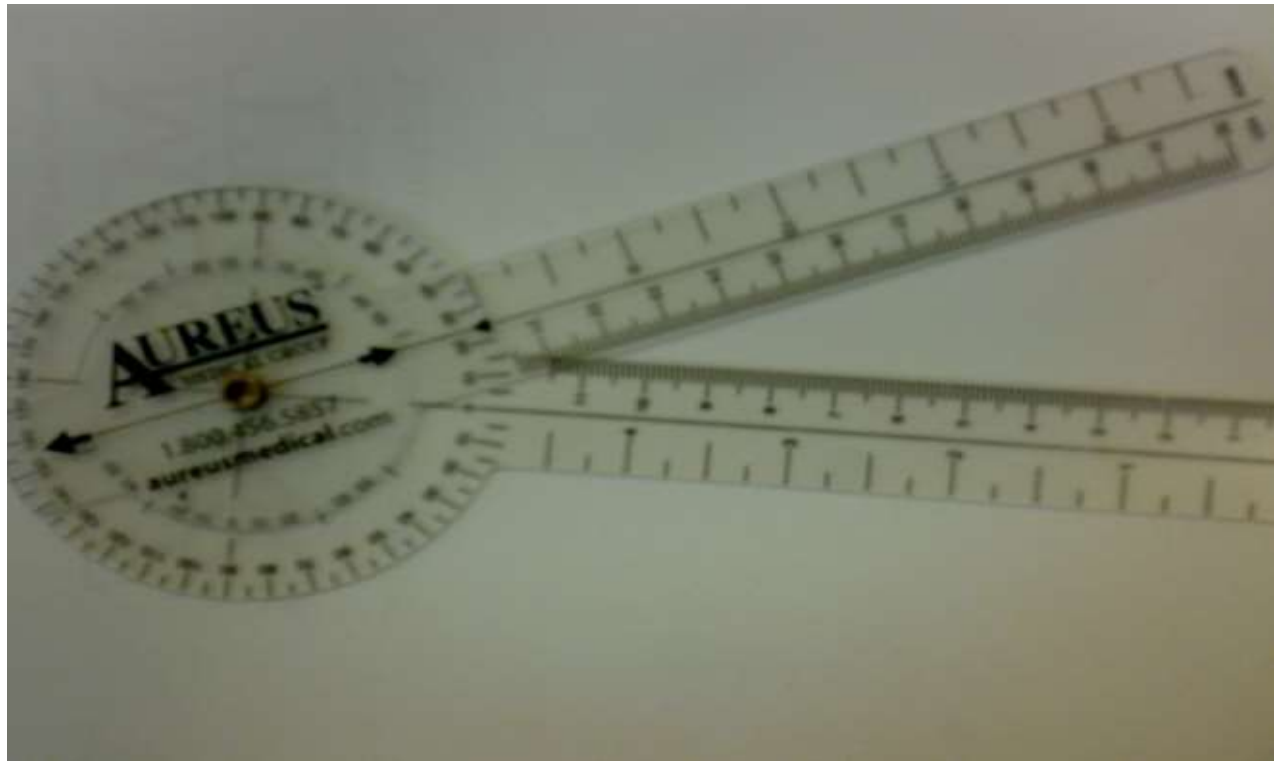
- Level of consciousness, attention span, joint ROM, movements that cause or increase pain, muscle strength, and ability to follow instruction and perform functional activities.
- - Active range of motion may be decreased due to restricted joint mobility, muscle weakness, pain, an inability to follow instructions, and, or an unwillingness to move on the part of the patient. Observation of active ROM is followed by an assessment of passive ROM.

Assessment of Passive Range of Motion:

- Passive range of motion is assessed to determine the amount of movement possible at the joint.
- Passive ROM is usually slightly greater than active ROM due to the slight elastic stretch of tissues and in some instances due to the decreased bulk of relaxed muscles.
- The therapist takes the body segments through a passive ROM to estimate each joint's range of motion, determine the quality of the movement throughout the ROM and the end feel, determine whether a capsular or non-capsular pattern of movement is present, and note the presence of pain.
- The therapist repeats the passive ROM and measures and records the range of motion using a goniometer.

Instruments:

- The instruments practitioners use for measuring joint range of motion are called **goniometers** or arthometers. The tools, although varying in size, shape, and appearance, all possess the capabilities to provide specific information regarding joint motion.
- The widely used **universal goniometer** is durable, washable, and can be applied to almost all joints.
- **The goniometer** is basically a protractor with two long arms. One arm is considered movable and the other stationary, and both are attached to the body of the protractor by a rivet or tension knob.



Reliability

- : Although experienced therapists were reliable in taking goniometric measurements, there is still some concern about the clinical reliability of goniometry.
- - When measuring, the therapist must try to rule out as many of the factors as possible that decrease reliability. Some of these factors that will improve reliability include removal of tight and restrictive clothing, duplications of positions used, and measuring at the same time of day.
- - Comparative goniometry is done when a joint is involved unilaterally, the contralateral limb can then be used as the standard for normal range of motion for that subject.

Electrogoniometer

- **Introduction**
- Determining precise joint angles is extremely important to physiotherapists. The angle data is essential for identifying abnormal patterns and characterizing impairments, disabilities and handicaps. The electrogoniometer is an electronic device that uses angle sensors, such as potentiometers, strain gauges and, more recently, accelerometers to record such measurements.

- **Commonly-used technology**
- The most common electrogoniometers employ one of the following three sensor schemes:
- Potentiometers: A potentiometric element is attached to a joint's rotation point. The potentiometer's electrical resistance can be used to determine the angle between the joints. These types of electrogoniometers are somewhat bulky and restrict patient movement. The instrument's precision can also be compromised due to its inability to follow any changes in the joint's axis of rotation.

Electrogoniometer

Flexible Electrogoniometer

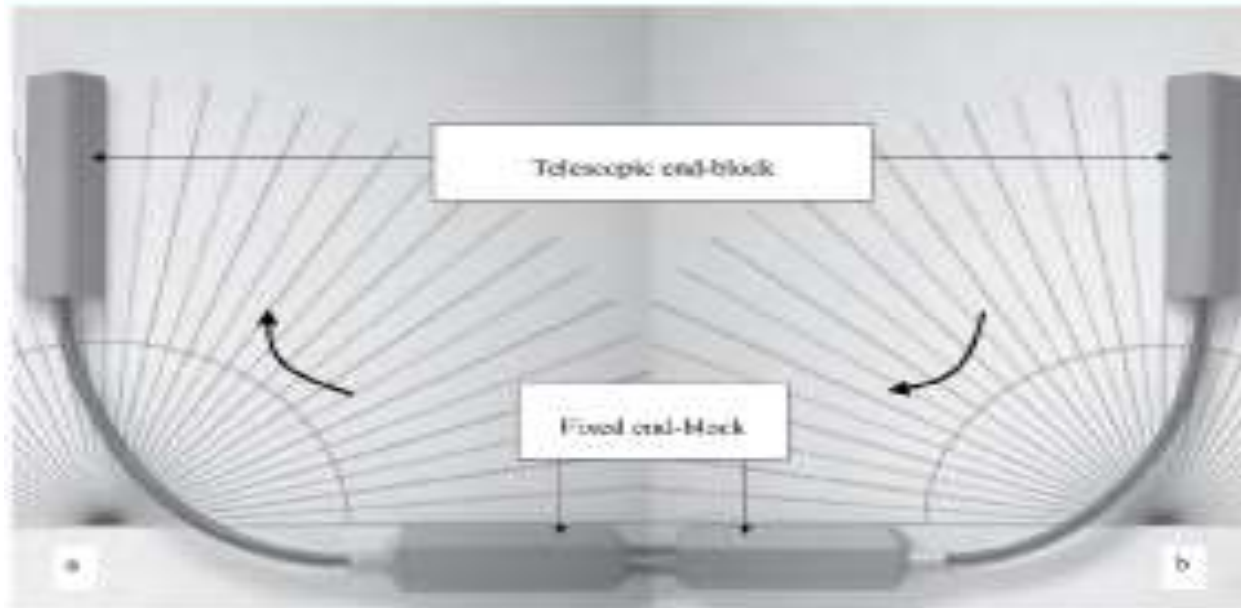


Figure 2

- Strain gauges: Also known as flexible electrogoniometers, a strain gauge is a flexible spring with plastic end blocks on each end. The strain gauge mechanism is housed inside the spring, which changes its electrical resistance proportionally to the change in angle between the plastic end blocks' longitudinal axes. Strain gauges are lightweight, portable, easily applied, do not restrict movements nor interfere in patient activities and adapt well to different body segments. These are currently the most popular electrogoniometers.

Optoelectronic System



Figure 3

- Optoelectronic systems: These are video systems that use one or more video cameras to track bright markers placed at various locations on the patient's body. These markers are either infrared (IR), light emitting diodes (LEDs) or solid shapes of reflective tape. The system keeps track of the vertical and horizontal coordinates of each marker, and computer software processes this information to determine the angle on the body segments of interest. Although optoelectronic systems offer good precision, their calibration procedures and data analysis are time-consuming.

Contraindications and precautions:

- Both active and passive ROM assessment techniques are contra
- indicated:
- 1) In the region of a dislocation or unhealed fracture.
- 2) Immediately following surgical procedures to tendons, ligaments, muscle, joint capsule or skin.
- 3) In the presence of myositis ossificans.

- The therapist must take extra care when performing active and passive ROM assessment where motion to the part might aggravate the condition such as:
 - 1. In the presence of an infections or inflammatory process in a joint or the region around a joint.
 - 2. In patients on medication for pain or muscle relaxants.
 - 3. In the region of marked osteoporosis. (Extreme care or not at all).
 - 4. In assessing a hyper mobile or subluxed joint.

- 5. In painful conditions where the assessment technique might reinforce the severity of symptoms.
- 6. In patient with hemophilia.
- 7. In the region of hematoma, most notably at the elbow, hip or knee.
- 8. In assessing joints if bony ankylosis is suspected.
- 9. Immediately after an injury where there has been a disruption of soft tissue (i.e. tendon, muscle, ligament).