KINESIOLOGY

PRACTICAL

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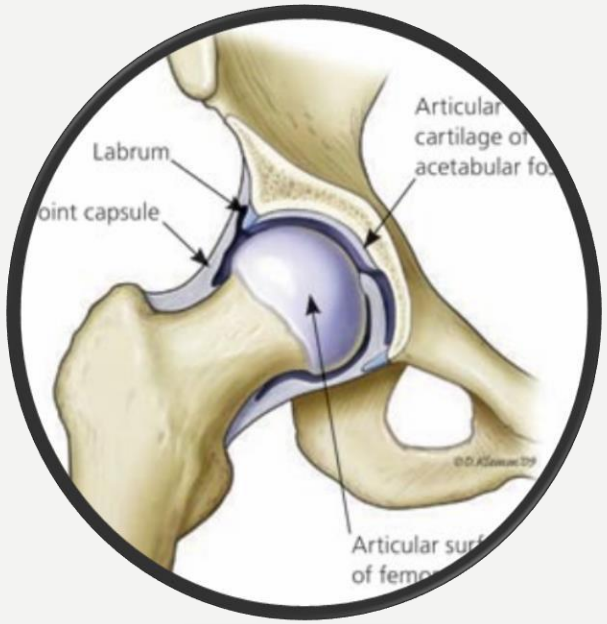
THIS POWERPOINT PERSENTATION IS **NOT** THE REFERENCE FOR THE PRACTICAL LECTURES, THE BOOK "MEASURMENT OF JOINT MOTION (A GUIDE TO GONIOMETRY)" IS

GONIOMETRY

- From the lectures, you should be familiar with:
- - Definition of Goniometry
- - Joint motion
- Arthrokinematics, Osteokinematics, Planes and axis
- - Range of Motion
- Active and passive Range of Motion, End-feel

HIP GONIOMETRY



- **Osteokinematics**

The hip is a synovial ball-and-socket joint with 3 degrees of freedom.

- **Arthrokinematics**

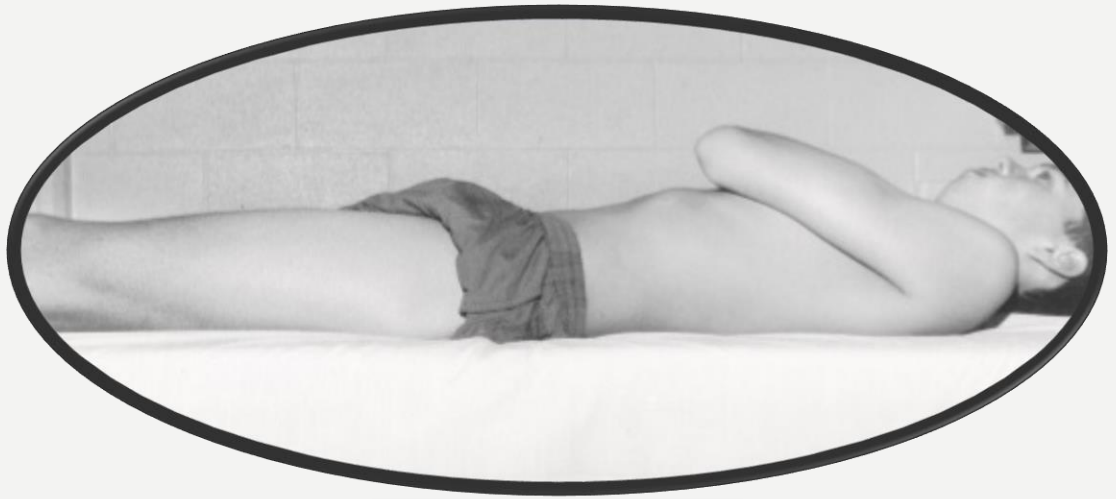
In an open kinematic (non-weight-bearing) chain.

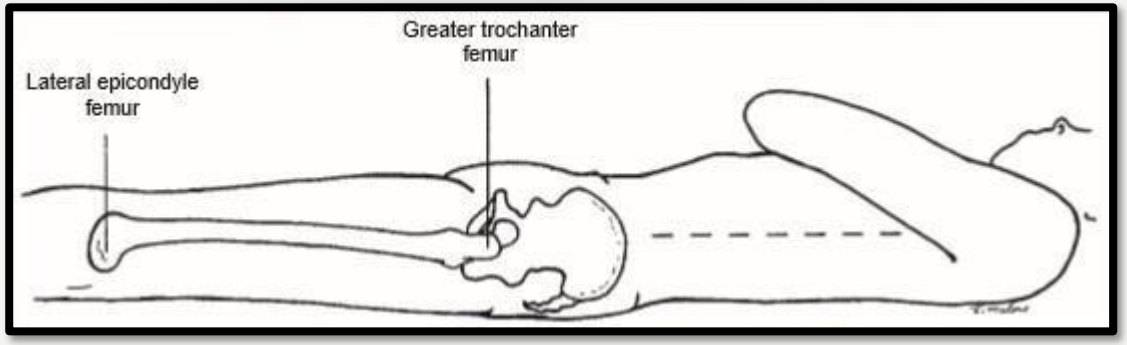
- **Capsular Pattern**

Characterized by a marked restriction of medial rotation accompanied by limitations in flexion and abduction and A slight extension limitations.

BONY LANDMARKS

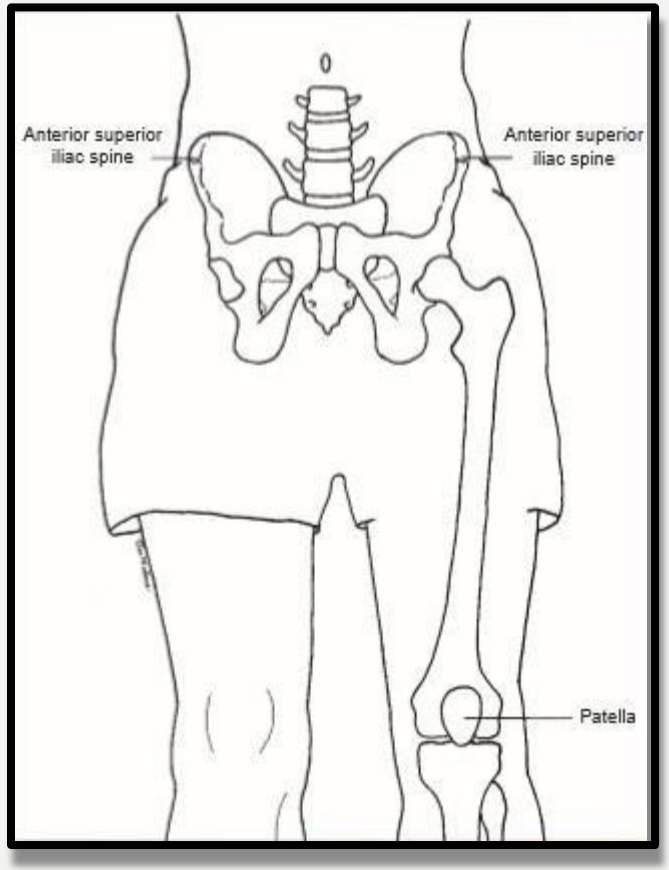
Which movements can I measure using these landmarks?

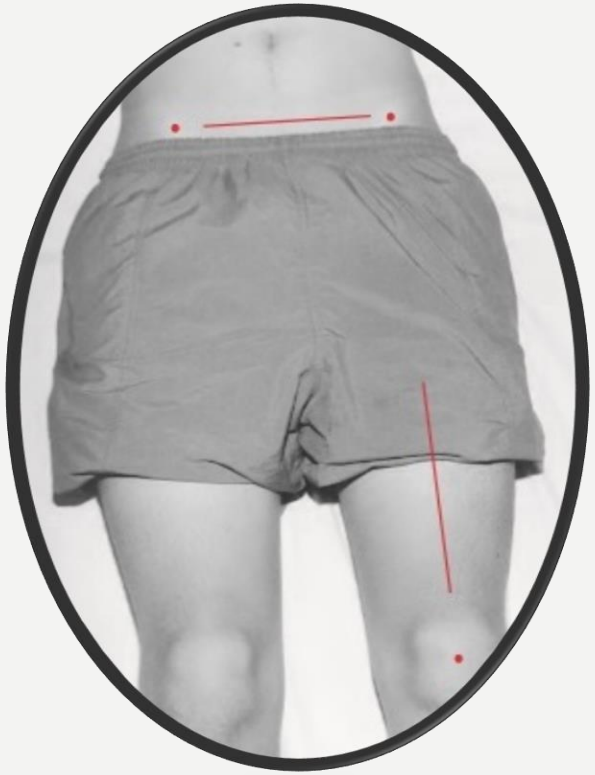




BONY LANDMARKS(CONT)

Which movements can I measure using these landmarks?

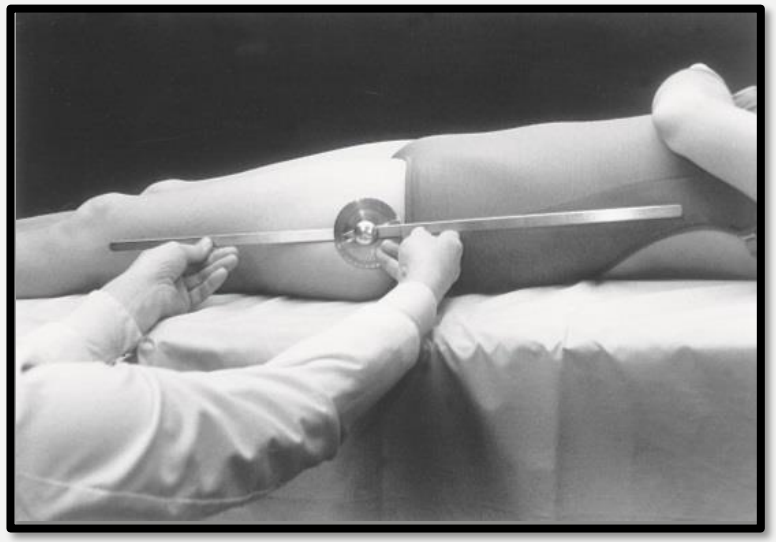




HIP FLEXION

- Normal ROM Value? From 0^0 to 120^0
- End-feel → Soft

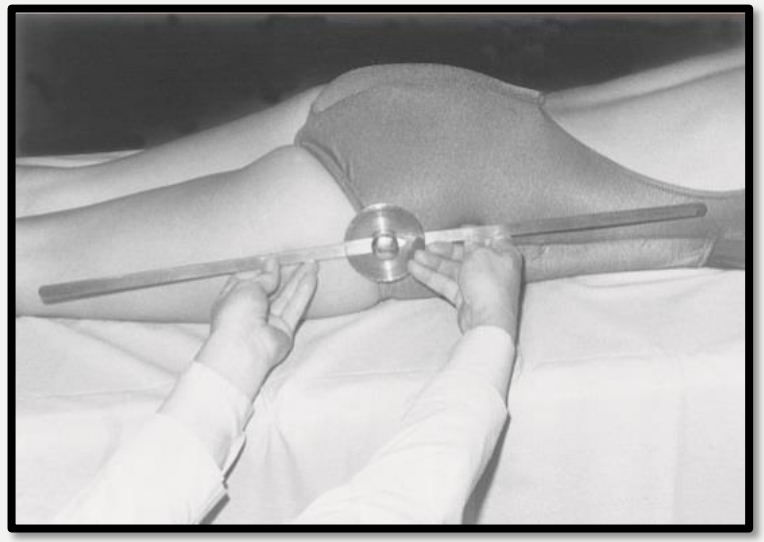
The end-feel is usually soft, However, the end-feel may be firm? How ?

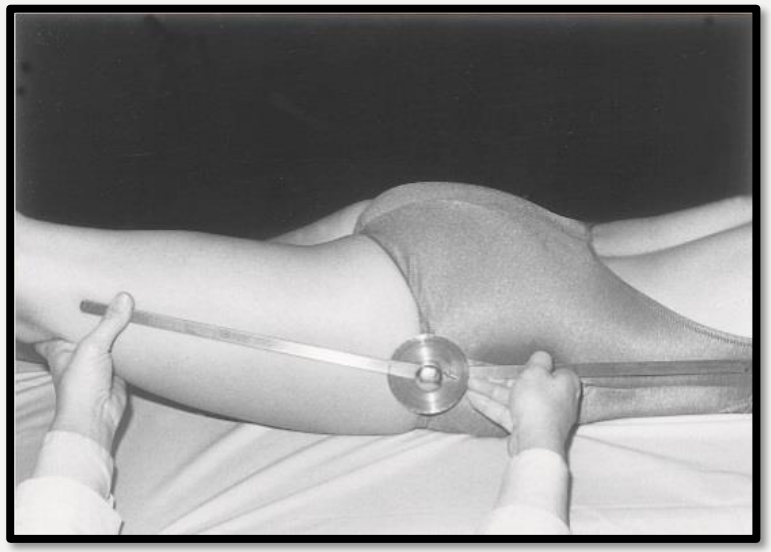


HIP EXTENSION

- Normal ROM Value? 20^0 - 30^0
- End-feel ⟶ **Firm**

Tension in anterior joint capsule and iliofemoral ligament. Tension of hip flexor muscles.





HIP ABDUCTION

- Normal ROM Value? 40^0 - 42^0
- End-feel

Firm → tension in the inferior(medial) joint capsule, pubofemoral ligament, ischiofemoral, and inferior band of iliofemoral ligament. Passive tension in adductor muscles

HIP ADDUCTION

- Normal ROM Value? 20^0
- End-feel

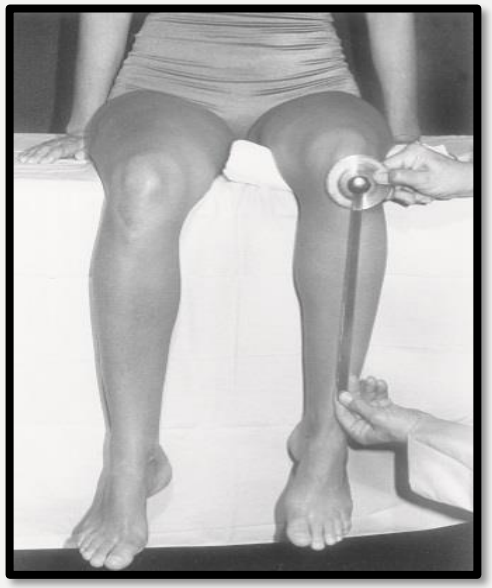
Firm → tension in the superior joint capsule and superior band of the iliofemoral ligament. Tension in gluteus medius and minimus and TFL muscles.

HIP INTERNAL ROTATION

- Normal ROM Value? 40^0 - 45^0
- End-feel

Firm → tension in posterior joint capsule and ischiofemoral ligament. Tension in hip external rotator muscles

Towel roll → to maintain femur in a horizontal plane

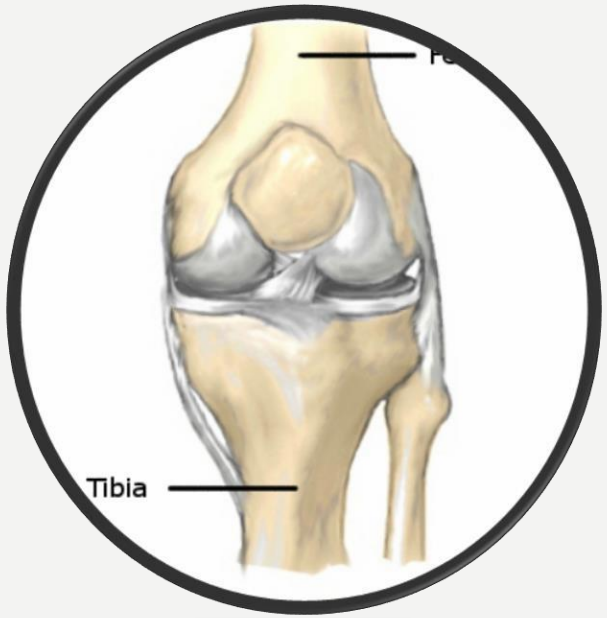


HIP EXTERNAL ROTATION

- Normal ROM Value? $45^0 – 50^0$
- End-feel

Firm → tension in anterior joint capsule and iliofemoral and pubofemoral ligament. Tension in anterior part of gluteus medius and minimus and adductor magnus an longus muscles

KNEE GONIOMETRY



- **Osteokinematics**

The Tibiofemoral joint is a synovial joint with 2 degrees of freedom.

- **Arthrokinematics**

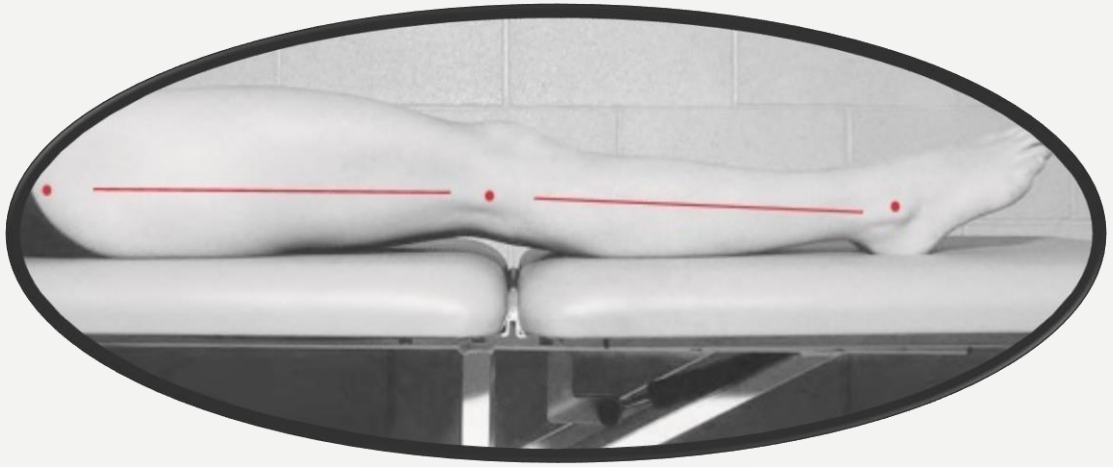
In an open kinematic (non-weight-bearing) chain → the concave tibial surfaces slide on convex femoral condyle.

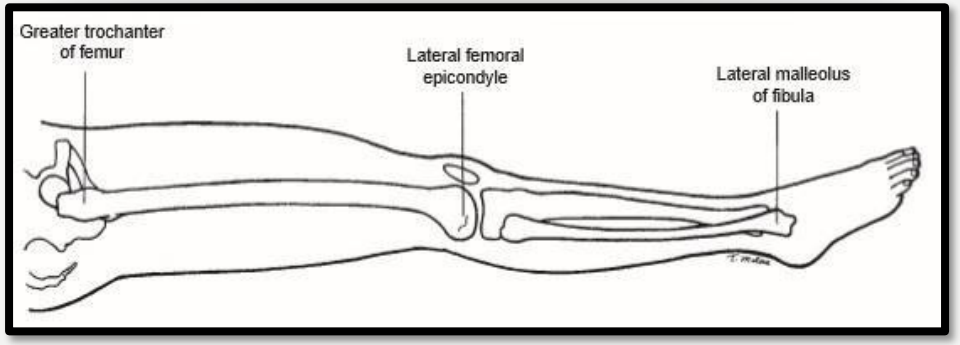
- **Capsular Pattern**

Characterized by a smaller limitation of extension than flexion.

BONY LANDMARKS

Which movements can I measure using these landmarks?

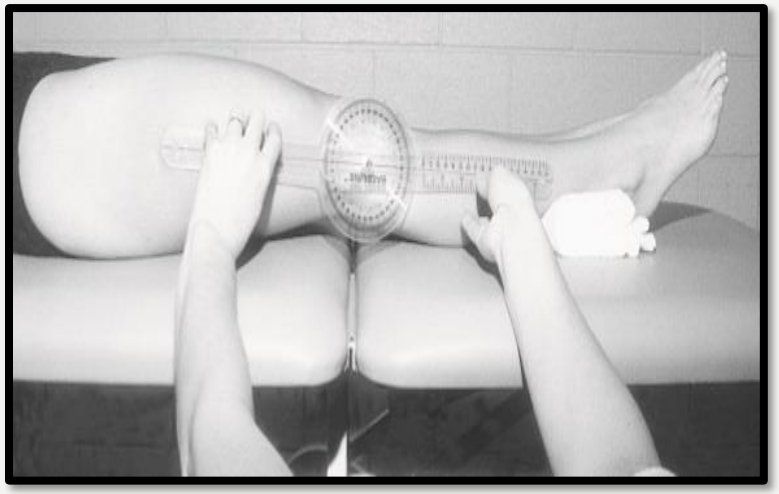




KNEE FLEXION

Goniometer Alignment
See Figures 9.7 and 9.8.

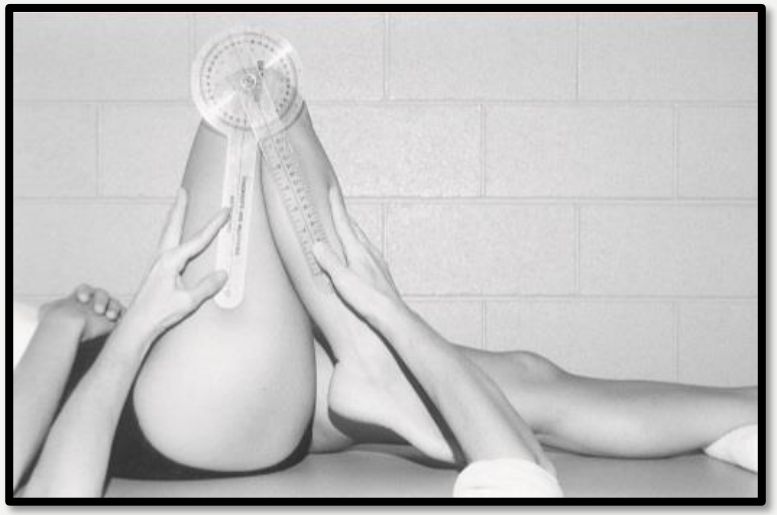
1. Center **fulcrum** of the goniometer over the lateral epicondyle of the femur.
2. Align **proximal arm** with the lateral midline of the femur, using the greater trochanter for reference.
3. Align **distal arm** with the lateral midline of the fibula, using the lateral malleolus and fibular head for reference.



- Normal ROM Value? 0^0 - 150^0
- End-feel

Soft → contact between posterior calf and thigh muscles

May be Firm → tension in vastus medialis, lateralis, and intermedialis muscles



KNEE EXTENSION

KNEE EXTENSION

Extension occurs in the sagittal plane around a medial–lateral axis and may be described as a return to the 0 starting position from the end of the knee flexion ROM. Knee extension is usually recorded as the starting position for flexion. An extension limitation (inability to reach the 0 starting position) is present when the starting position for flexion ROM does not begin at 0 degrees but in some amount of flexion. When extension goes beyond the 0 starting position, it may be within normal limits in children, but when it exceeds 5 or more degrees in the adult, it is called **hyperextension** or **genu recurvatum**. See Table 9.2 in the Research Findings section for normal extension limitations in neonates, and see Table 9.3 for normal extension beyond 0 in children 0 to 12 years of age.

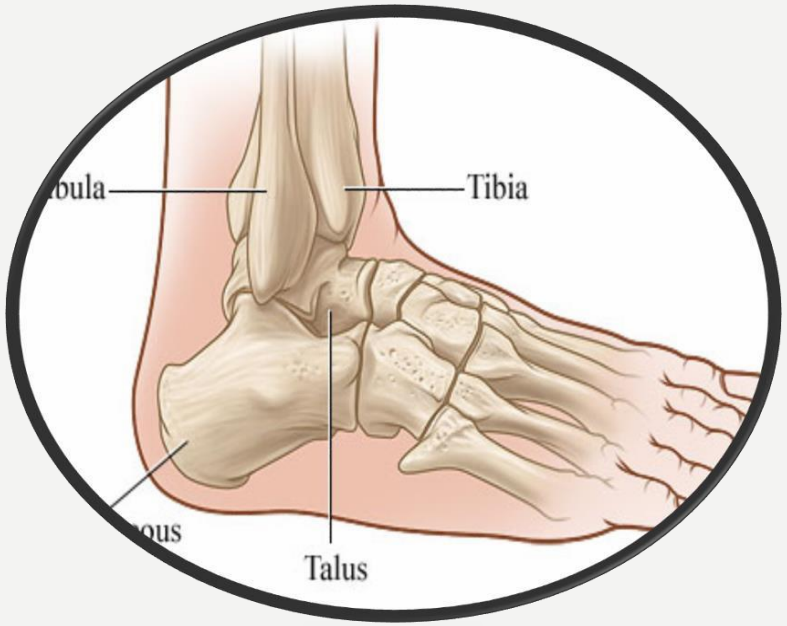
↔ **Hyperextension or genu recurvatum?**

Normal ROM Value? $150^0 - 0^0$

- End-feel

Firm → tension in posterior joint capsule, the collateral ligaments, and the anterior and posterior cruciate ligaments.

ANKLE AND FOOT GONIOMETRY



- **Osteokinematics**

The Talocrural joint is a synovial hinge joint with 1 degree of freedom. (dorsiflexion and plantarflexion)

- **Arthrokinematics**

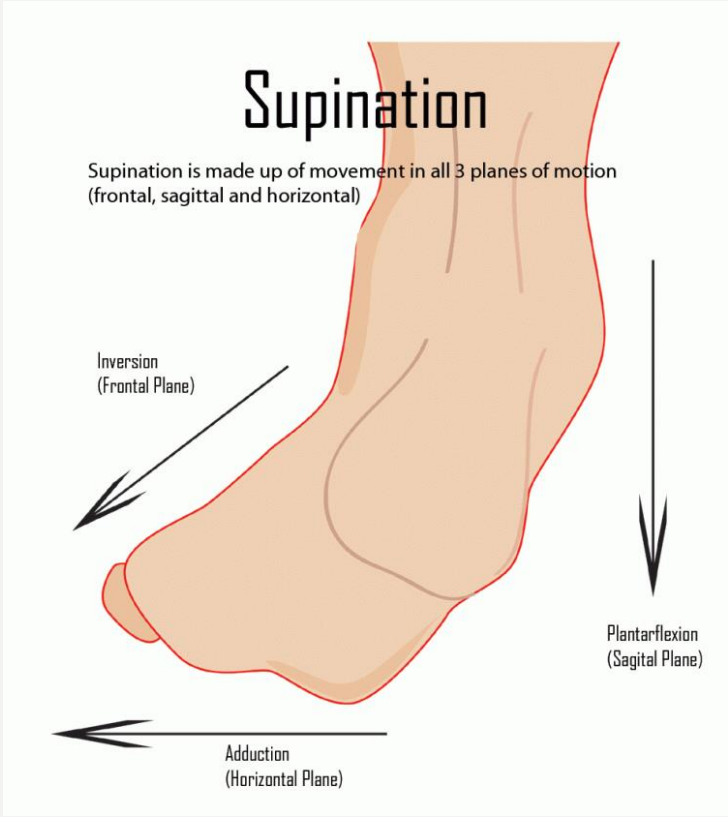
DF In an open kinematic chain(non-weight-bearing) → the talus moves posteriorly. PF the talus moves anteriorly. In the weight-bearing will moves opposite directions.

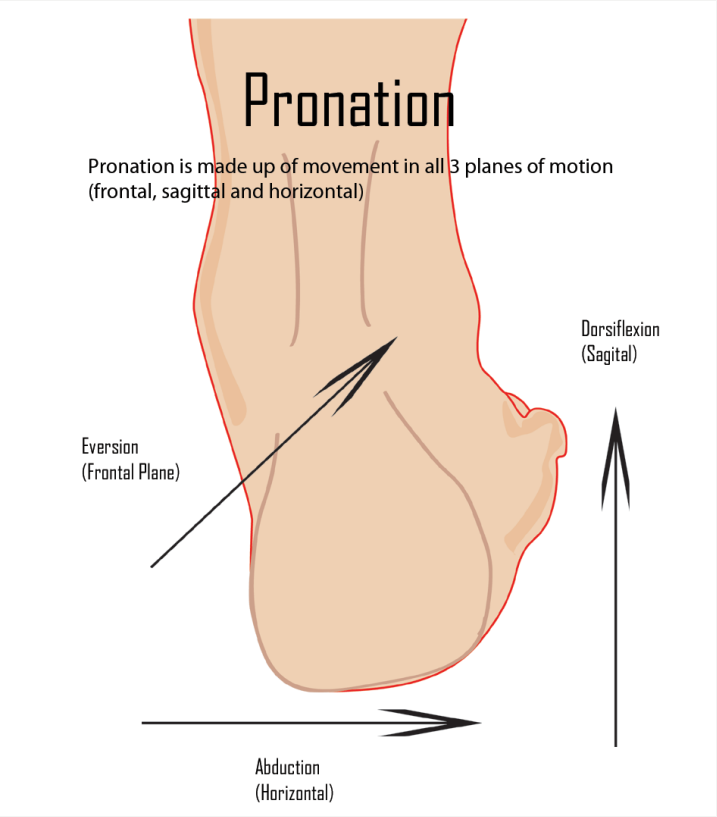
- **Capsular Pattern**

The Talocrural joint characterized by a greater limitation in PF than DF.

The Subtalar joint characterized by a greater limitation in Inversion than Eversion.

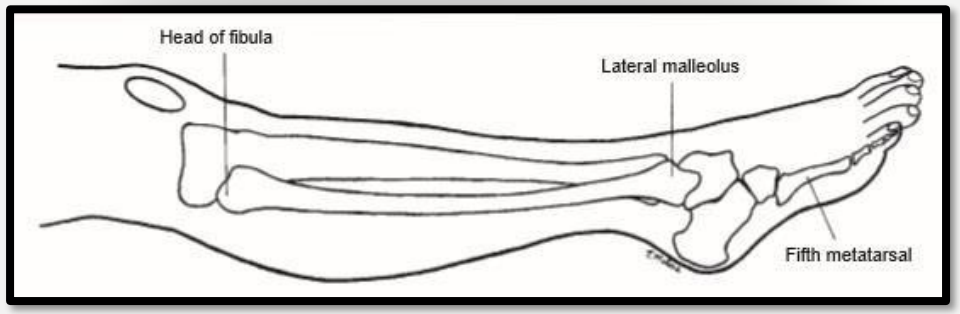
PRONATION AND SUPINATION





BONY LANDMARKS

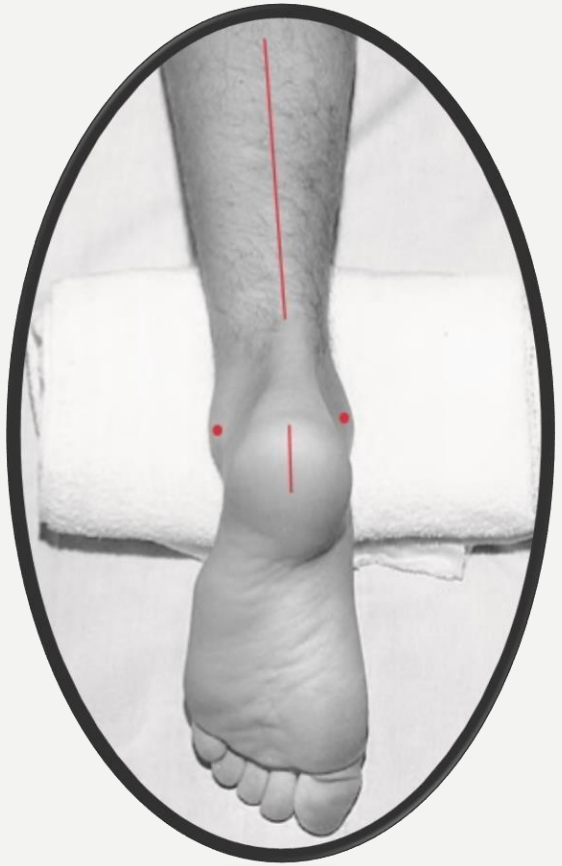
Which movements can I measure using these landmarks?

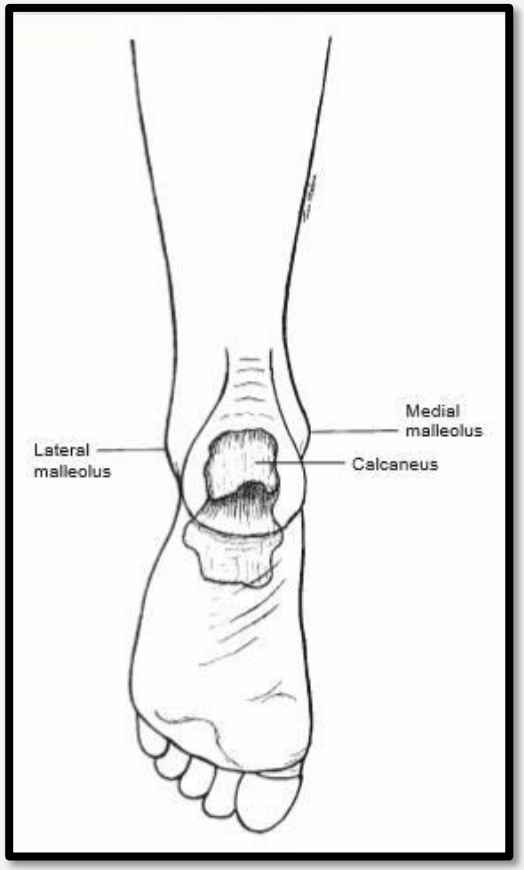


BONY LANDMARKS

Which movements can I measure using these landmarks?

Rear Subtalar joint (Inversion and Eversion)

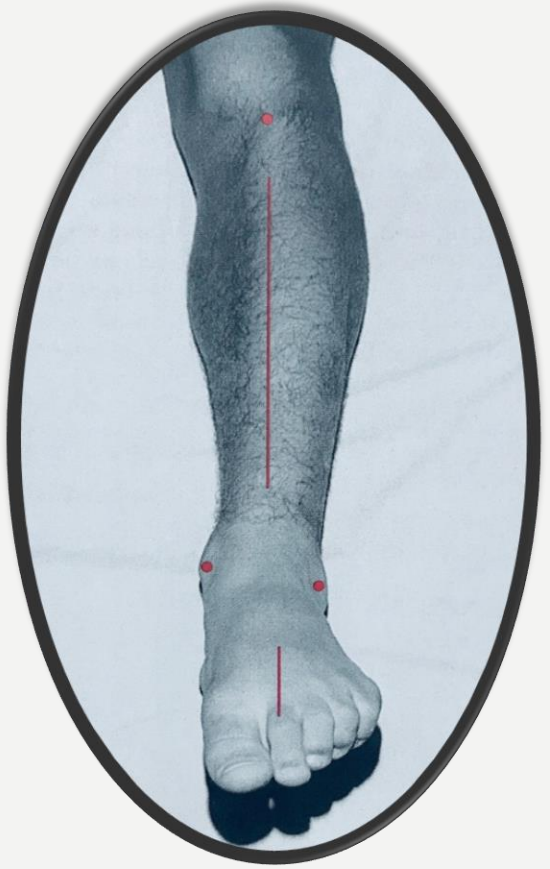


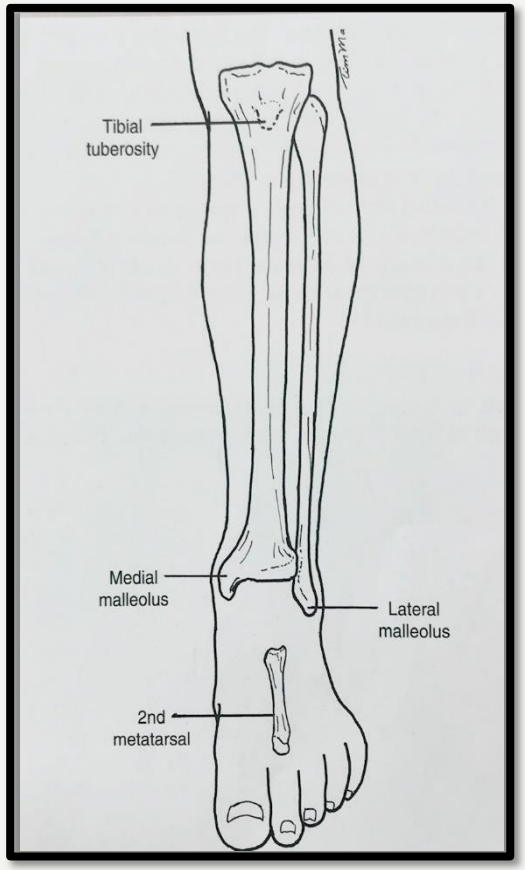


BONY LANDMARKS

Which movements can I measure using these landmarks?

Tarsal joint
(Inversion and Eversion)





DORSIFLEXION COMPONENT

Goniometer Alignment

See Figures 10.12 and 10.13.

1. Center **fulcrum** of the goniometer over the lateral aspect of the lateral malleolus.
2. Align **proximal arm** with the lateral midline of the fibula, using the head of the fibula for reference.
3. Align **distal arm** parallel to the lateral aspect of the fifth metatarsal. Although it is usually easier to palpate and align the distal arm parallel to the fifth metatarsal, an alternative method is to align the distal arm parallel to the inferior aspect of the calcaneus. However, if the latter landmark is used, the full cycle ROM in the sagittal plane (dorsiflexion plus plantarflexion) may be similar to the total ROM of the preferred technique, but the separate ROM values for dorsiflexion and plantarflexion will differ considerably.

- Normal ROM Value? 0^0 - 20^0 ⟶ **Talocrural joint**
- End-feel → Firm

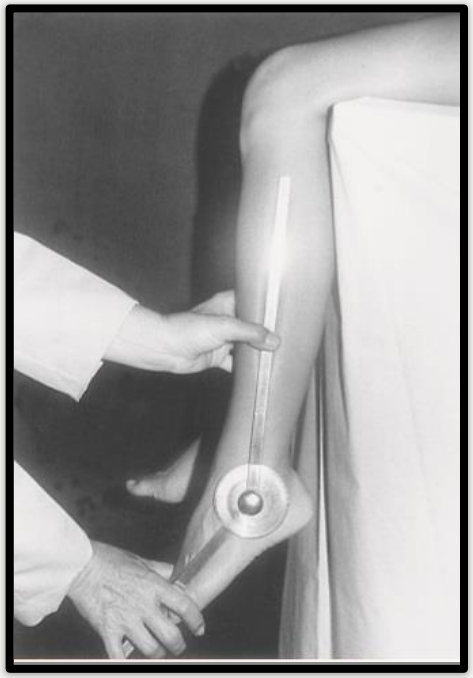
Tension in posterior joint capsule, the soleus muscle, the Achilles tendon and posterior ligaments.

PLANTARFLEXION COMPONENT

Goniometer Alignment

See Figures 10.17 and 10.18.

1. Center **fulcrum** of the goniometer over the lateral aspect of the lateral malleolus.
2. Align **proximal arm** with the lateral midline of the fibula, using the head of the fibula for reference.
3. Align **distal arm** parallel to the lateral aspect of the fifth metatarsal. Although it is usually easier to palpate and align the distal arm parallel to the fifth metatarsal, as an alternative, the distal arm can be aligned parallel to the inferior aspect of the calcaneus. If the alternative landmark is used, full cycle ROM in the sagittal plane (dorsiflexion plus plantarflexion) may be similar to full cycle ROM measurement using the fifth metatarsal as a landmark, but the single cycle ROM values for dorsiflexion and plantarflexion will differ considerably. Measurements taken with the alternative landmark should not be used interchangeably with those taken using the fifth metatarsal landmark.



- Normal ROM Value? 0^0 - 40^0 → **Talocrural joint**
  - End-feel→ Firm →**?**

Tension in anterior joint capsule, the tibialis anterior, extensor hallucis longus and extensor digitorum longus muscle and anterior ligaments.

May be Hard → **?**

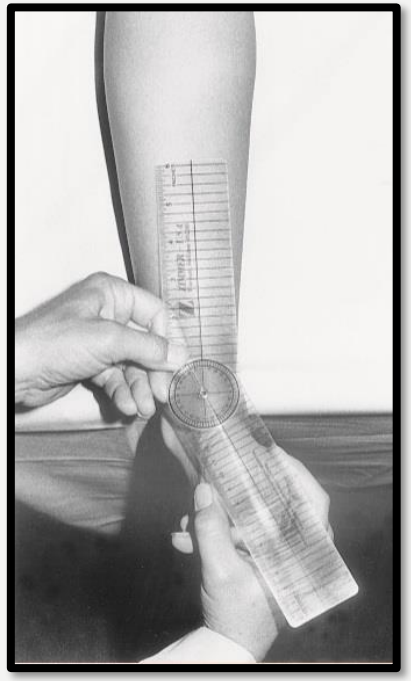
INVERSION COMPONENT

Goniometer Alignment

See Figures 10.33 and 10.34.

1. Center **fulcrum** of the goniometer over the posterior aspect of the ankle midway between the malleoli.
2. Align **proximal arm** with the posterior midline of the lower leg.
3. Align **distal arm** with the posterior midline of the calcaneus.

- Normal ROM Value? 0^0 - 5^0
- End-feel → Firm
  Tension in lateral joint capsule



Rear **Subtalar joint**
(Inversion and Eversion)

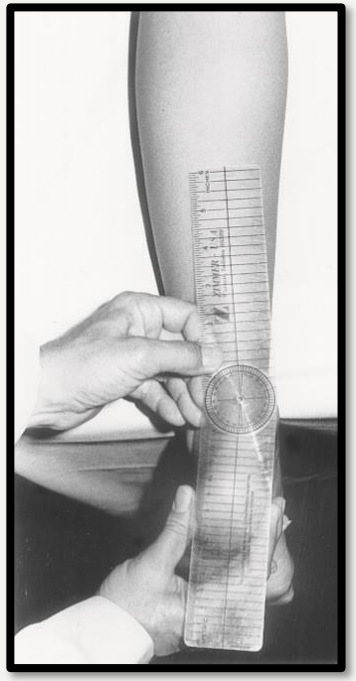
EVERSION COMPONENT

Goniometer Alignment

See Figures 10.33 and 10.34.

1. Center **fulcrum** of the goniometer over the posterior aspect of the ankle midway between the malleoli.
2. Align **proximal arm** with the posterior midline of the lower leg.
3. Align **distal arm** with the posterior midline of the calcaneus.

- Normal ROM Value? 0^0 - 5^0
- End-feel → Hard
  Contact between the calcaneus and floor of tarsi
  → Firm
  Tension in the deltoid ligament.



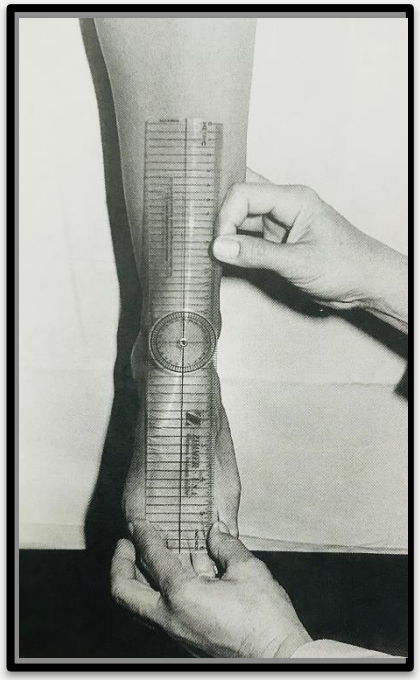
Rear **Subtalar joint**
(Inversion and Eversion)

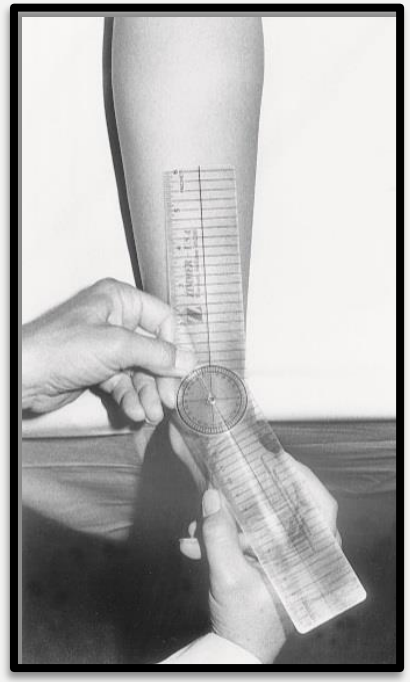
INVERSION AND EVERSION COMPONENT

Goniometer Alignment

See Figures 10.22 and 10.23.

1. Center **fulcrum** of the goniometer over the anterior aspect of the ankle midway between the malleoli. (The flexibility of a plastic goniometer makes this instrument easier to use for measuring inversion than a metal goniometer.)
2. Align **proximal arm** of the goniometer with the anterior midline of the lower leg, using the tibial tuberosity for reference.
3. Align **distal arm** with the anterior midline of the second metatarsal.

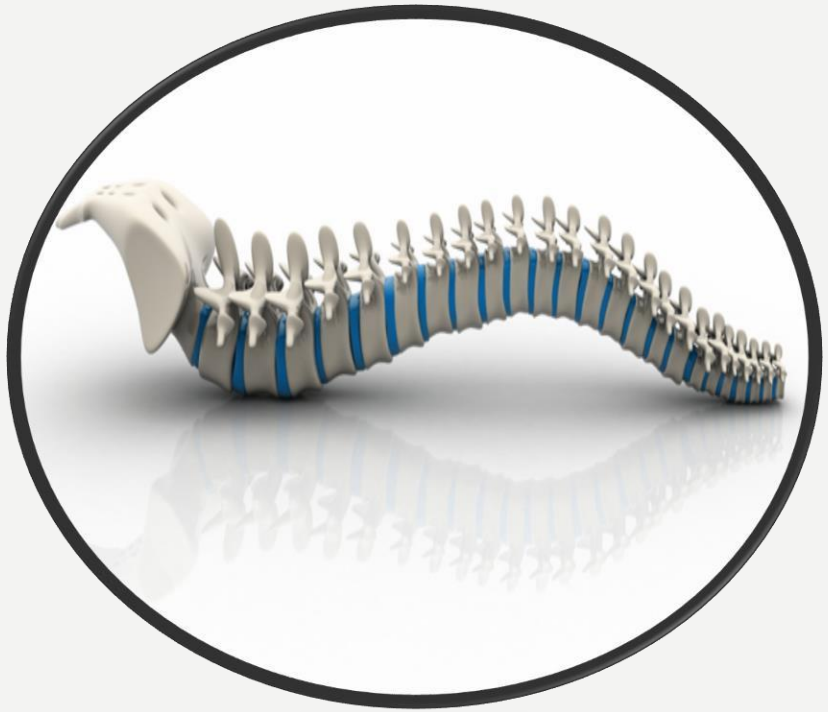




- Normal ROM Value?
  Inversion: 30^0 to 35^0
  Eversion: 11^0 to 12^0
- End-feel → Firm
  Tension in ligament and muscles.

Tarsal joint
(Inversion and Eversion)

SPINE GONIOMETRY



LUMBER FLEXION

Procedure

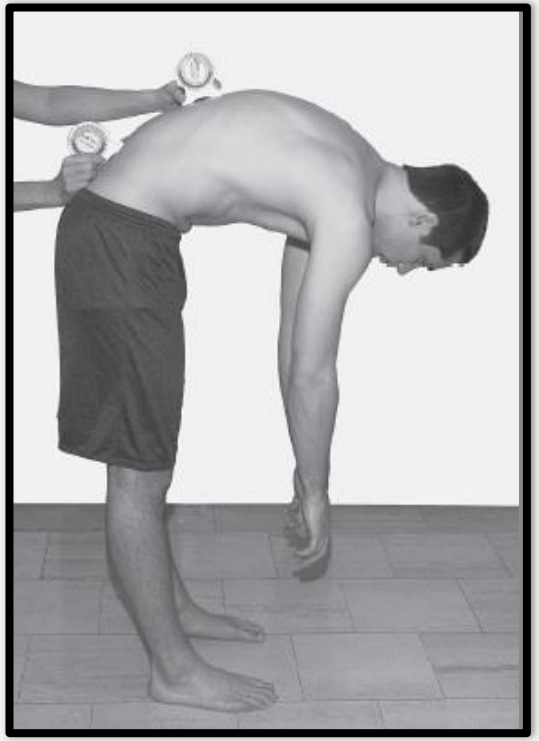
1. Mark the spinous processes of the T12 and S2 vertebrae using a skin marking pencil, with the subject in the standing position.
2. Place **one inclinometer** over the spinous process of T12 and the **second inclinometer** over the sacrum at the level of S2. **Zero** both inclinometers (Fig. 12.33).
3. Ask the subject to bend forward as far as possible while keeping the knees straight. Maintain the inclinometers firmly against the spine during the motion.
4. Note the information on the inclinometers at the end of flexion ROM (Fig. 12.34). Calculate the ROM by subtracting the degrees on the sacral inclinometer from the degrees on T12 inclinometer. The degrees on the sacral inclinometer are supposed to represent hip flexion ROM, and that is why they are subtracted.[21]

- Normal ROM Value? $0^0 - 60^0$ \ 6.3cm
- End-feel → Firm

Tension of the posterior longitudinal ligament, posterior fibers of the annulus fibrosus, tension of the hip extensor muscles.

Double Inclinometer

Fingertip-to-floor



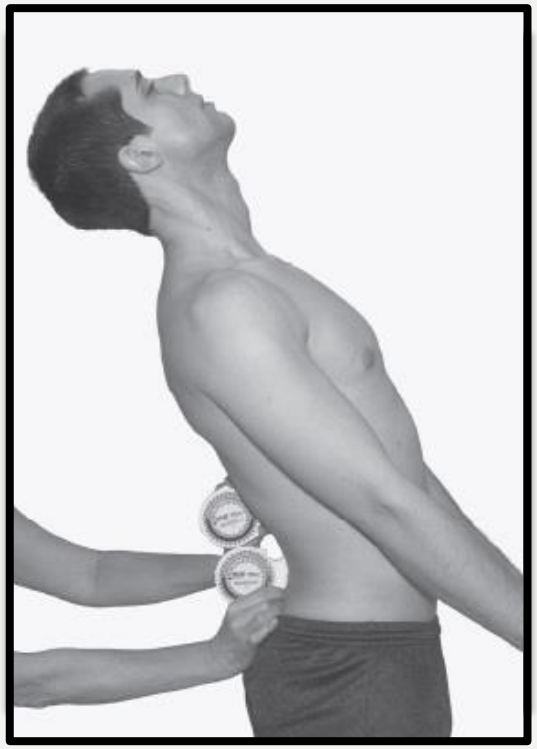
Capsular Pattern

The capsular pattern for the lumbar spine is a marked and equal restriction of lateral flexion followed by restriction of flexion and extension

LUMBER EXTENSION

Procedure

1. Mark the spinous processes of the T12 and S2 vertebrae using a skin marking pencil, with the subject in the standing position.
2. Place **one inclinometer** over the spinous process of T12 and the **second inclinometer** over the midline of the sacrum at S2. Then **zero** both inclinometers (Fig 12.37).
3. Ask the subject to bend backward as far as possible. Maintain the inclinometers firmly against the spine during the motion (Fig. 12.38).
4. Read and record the degrees from both inclinometers at the end of the motion. Subtract the degrees on the sacral inclinometer from the degrees on the T12 inclinometer to obtain the lumbar extension ROM.



- Normal ROM Value? Lumbar spine: $33^0 - 42^0$

- End-feel → Firm

Tension of the anterior longitudinal ligament, anterior fibers of the annulus fibrosus, and tension of the trunk flexor muscles..

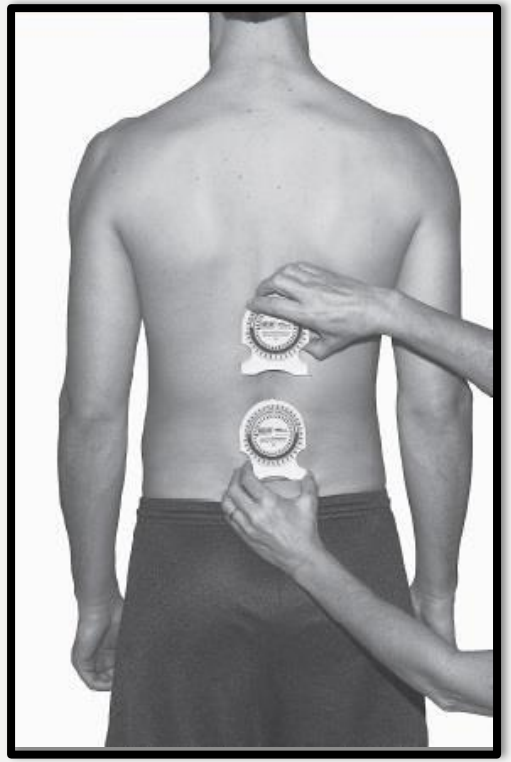
Capsular Pattern

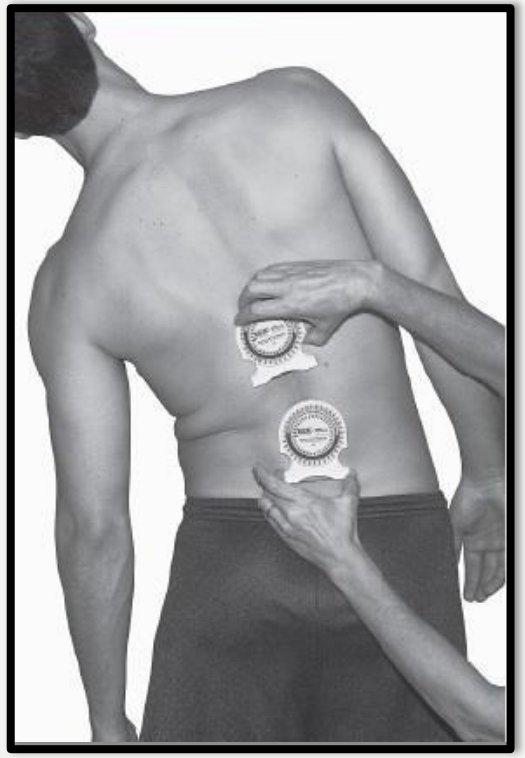
The capsular pattern for the lumbar spine is a marked and equal restriction of lateral flexion followed by restriction of flexion and extension

LUMBER LATERAL FLEXION

Procedure

1. Mark the spinous processes of the T12 and S2 vertebrae using a skin marking pencil, with the subject in the standing position.
2. Position **one inclinometer** over the T12 spinous process and the **second inclinometer** over the sacrum at the level of S2. Then, **zero** both inclinometers (**Fig. 12.39**).
3. Ask the subject to bend the trunk laterally while keeping both feet flat on the ground and the knees straight (Fig. 12.40).
4. Read and record the degrees on both inclinometers. Subtract the degrees on the sacral inclinometer from the degrees on the T12 inclinometer to obtain the lumbar lateral flexion ROM to one side.
5. Repeat the measurement process to measure lumbar lateral flexion ROM on the other side.





- Normal ROM Value? $25^0 - 30^0$
- End-feel → Firm

  Stretching of the contralateral fibers of the annulus fibrosus, external oblique, longissimus thoracis, iliocostalis lumborum and quadratus lumborum

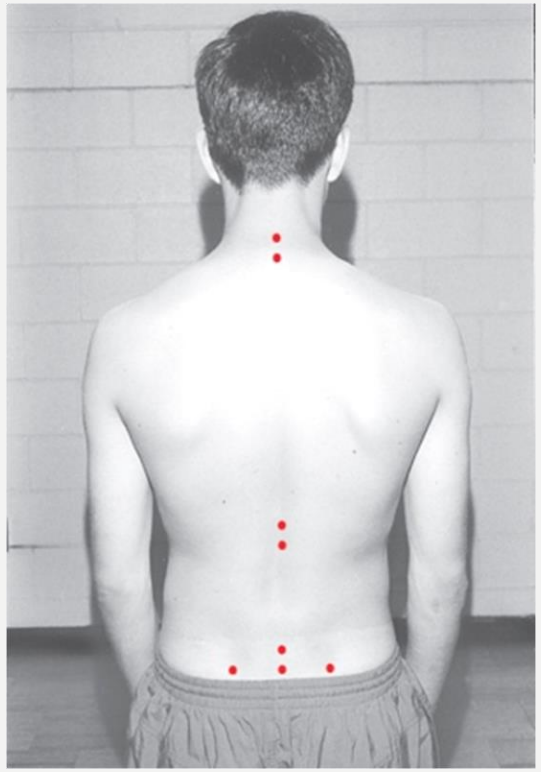
Capsular Pattern

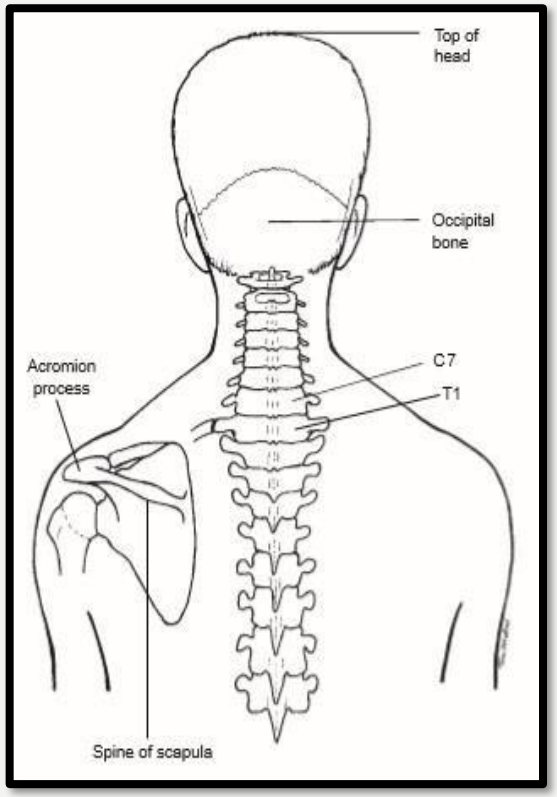
The capsular pattern for the lumbar spine is a marked and equal restriction of lateral flexion followed by restriction of flexion and extension

BONY LANDMARKS

THORACOLUMBAR FLEXION

Which movements can I measure using these landmarks?





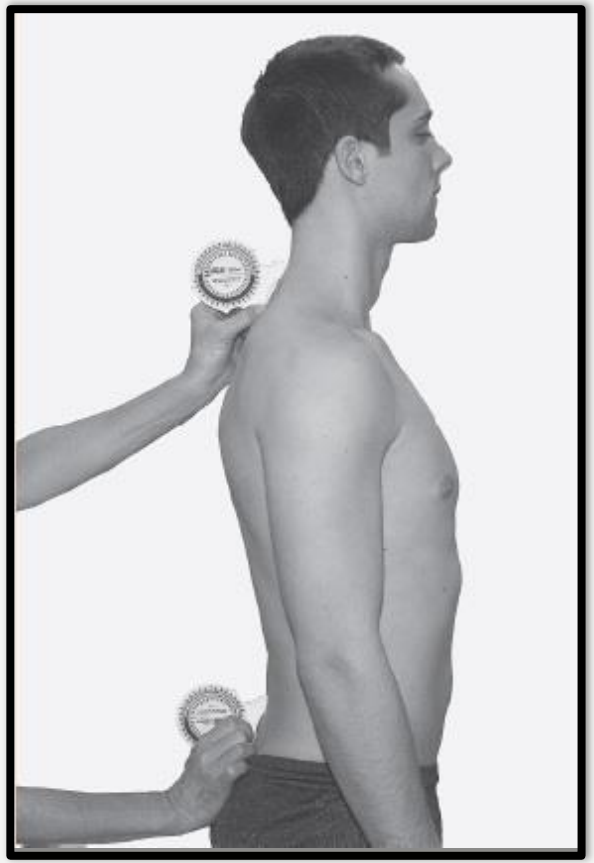
THORACOLUMBAR FLEXION

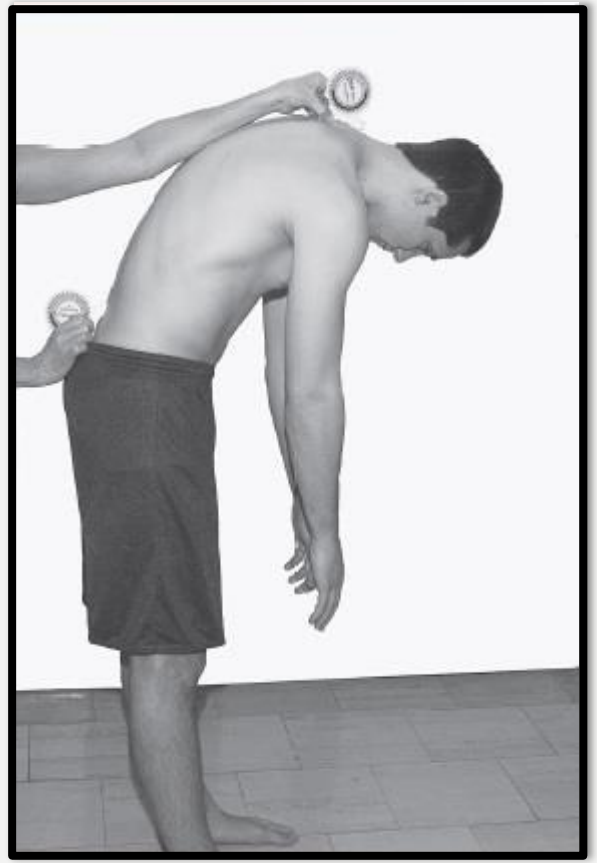
Motion occurs in the sagittal plane around a medial–lateral axis

THORACOLUMBER FLEXION

Procedure

1. Use a skin marking pencil to mark the spinous process of the T1 vertebra and the spinous process of the S2 vertebra (which is on a level with the posterior superior iliac spines [PSIS]), with the subject in the standing position.
2. Position **one inclinometer** over the spinous process of T1 and the **second inclinometer** over the sacrum at the level of S2. Then **zero** both inclinometers (Fig. 12.9).
3. At the end of the motion, read and record the values on both inclinometers (Fig. 12.10). The difference between the two inclinometers indicates the amount of thoracolumbar flexion ROM.





- Normal ROM Value? $0^0 - 60^0$
- End-feel → Firm

  Stretching of the joint capsules, posterior fibers of the annulus fibrosus, posterior longitudinal ligament, and posterior muscles..etc

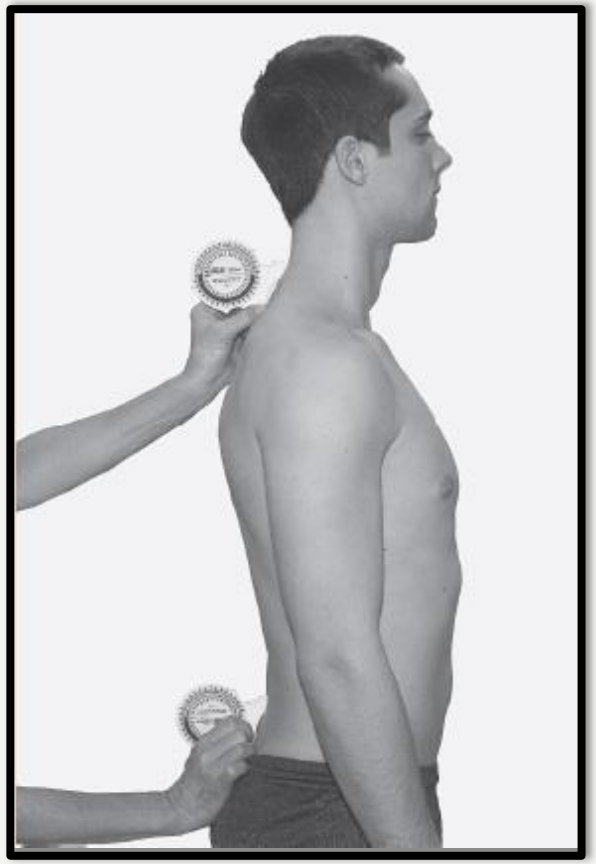
Capsular Pattern

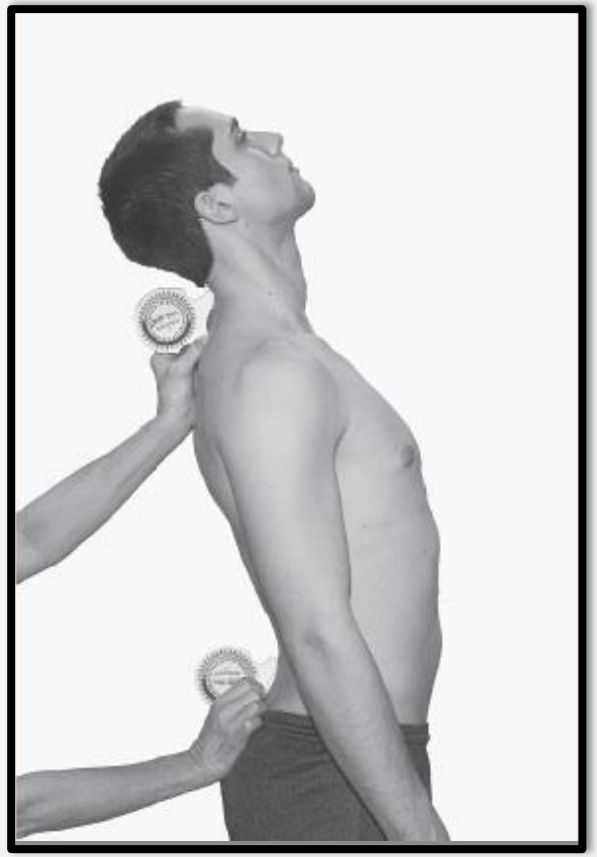
The capsular pattern for the thoracic spine is a greater limitation of extension, lateral flexion, and rotation than of forward flexion.

THORACOLUMBER EXTENSION

Procedure

1. Use a skin marking pencil to mark the spinous process of the T1 vertebra and the spinous process of the S2 vertebra (which is on a level with the posterior superior iliac spines [PSIS]), with the subject in the standing position.
2. Position **one inclinometer** over the spinous process of T1 and the **second inclinometer** over the sacrum at the level of S2. Then **zero** both inclinometers (Fig. 12.9).
3. At the end of the motion, read and record the values on both inclinometers (Fig. 12.10). The difference between the two inclinometers indicates the amount of thoracolumbar flexion ROM.





- Normal ROM Value? $0^0 - 25^0$
- End-feel → Firm
  Stretching of the joint capsules, anterior fibers of the annulus fibrosus, anterior longitudinal ligament, rectus abdominis…etc

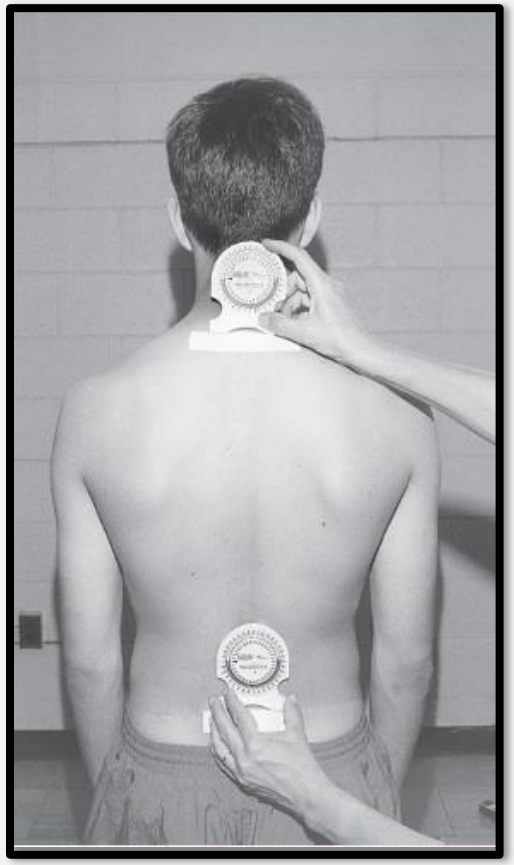
Capsular Pattern

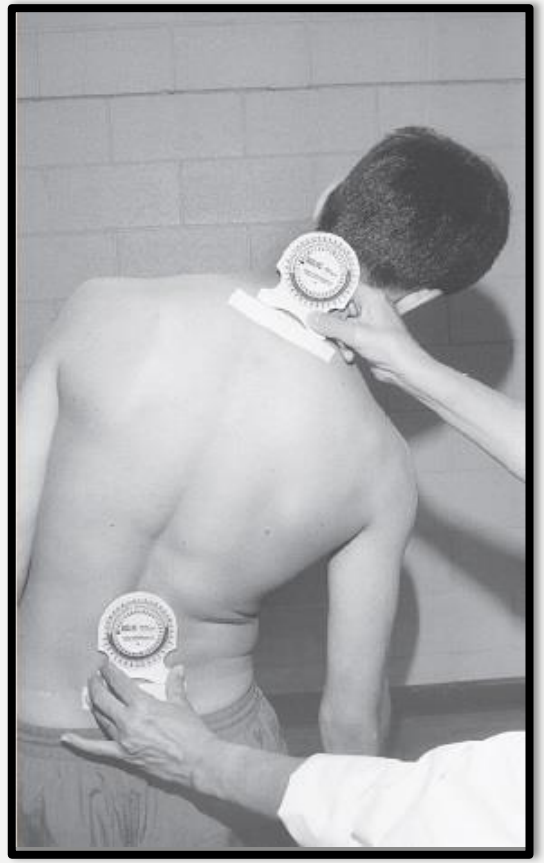
The capsular pattern for the thoracic spine is a greater limitation of extension, lateral flexion, and rotation than of forward flexion.

THORACOLUMBER LATERAL FLEXION (2)

Procedure

1. Mark the spinous processes of the T1 and S2 vertebrae using a skin marking pencil, with the subject in the standing position.
2. Place **one inclinometer** over the T1 spinous process and the **second inclinometer** over the sacrum at the level of S2. Then **zero** both inclinometers (Fig. 12.23).
3. Ask the subject to bend to the side as far as possible while keeping both knees straight and both feet firmly on the ground (Fig. 12.24).
4. At the end of the ROM, read and record the information on both inclinometers. Subtract the degrees on the sacral inclinometer from the degrees on the thoracic inclinometer to obtain the lateral flexion ROM.
5. Repeat the measurement process to measure lateral flexion ROM on the other side.





- Normal ROM Value? 0^0 to 35^0
- End-feel → Firm

  Stretching **the contralateral** fibers of the annulus fibrosus, joint capsule Intertransverse ligaments, and muscles..etc

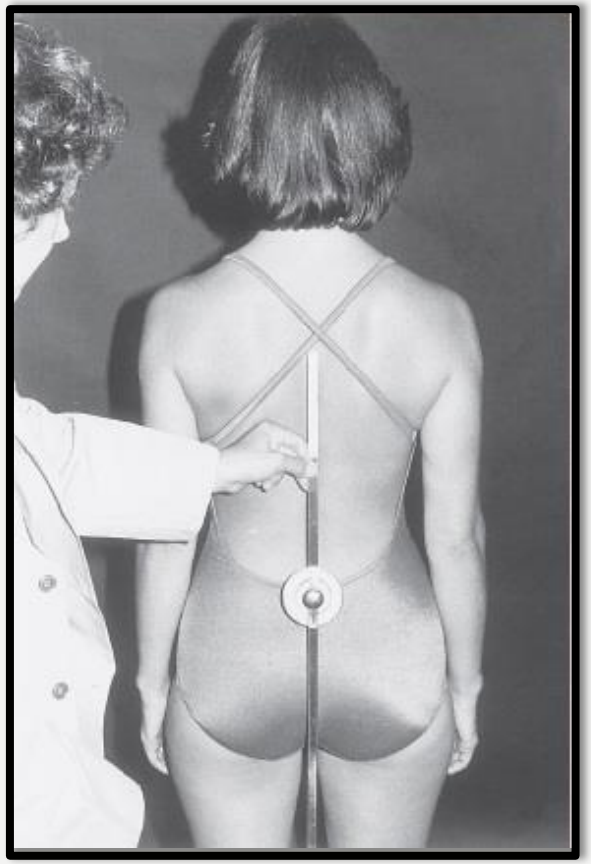
Capsular Pattern

The capsular pattern for the thoracic spine is a greater limitation of extension, lateral flexion, and rotation than of forward flexion.

THORACOLUMBER LATERAL FLEXION

Procedure

1. Mark the spinous processes of C7 and S2 vertebrae using a skin marking pencil.
2. Center **fulcrum** of the goniometer over the posterior aspect of the spinous process of S2 (Fig. 12.17).
3. Align **proximal arm** so that it is perpendicular to the ground.
4. Align **distal arm** with the posterior aspect of the spinous process of C7 (Fig. 12.18).



- Normal ROM Value? 0^0 to 35^0
- End-feel → Firm

  Tension of the posterior longitudinal ligament, posterior fibers of the annulus pulposus, tension of the trunk extensor muscles..

Capsular Pattern

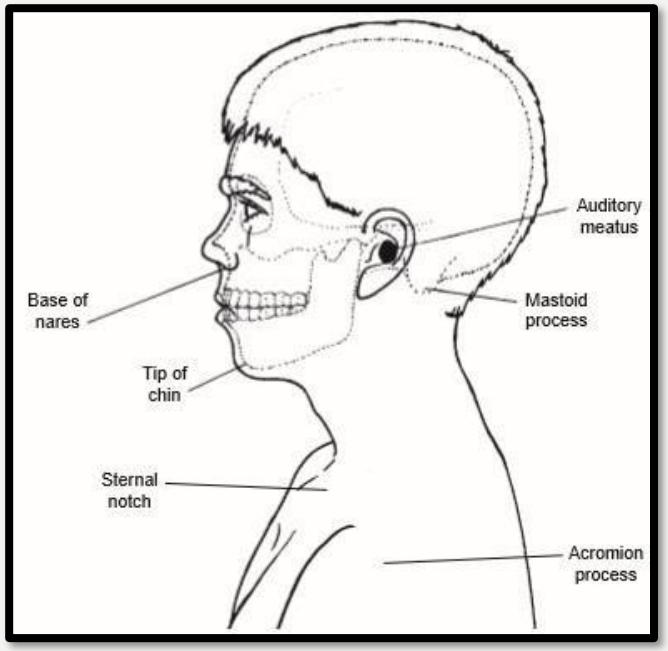
The capsular pattern for the thoracic spine is a greater limitation of extension, lateral flexion, and rotation than of forward flexion.

BONY LANDMARKS

Which movements can I measure using these landmarks?
Flexion and Extension

- **Capsular Pattern**

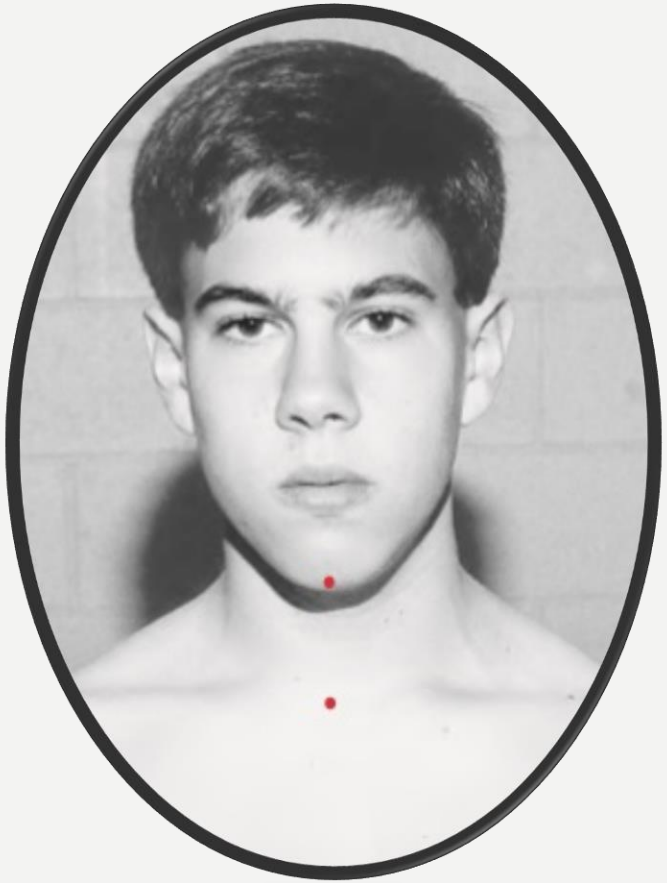
For C2 to C7: Characterized by pain and equal limitation of all motion except flexion.

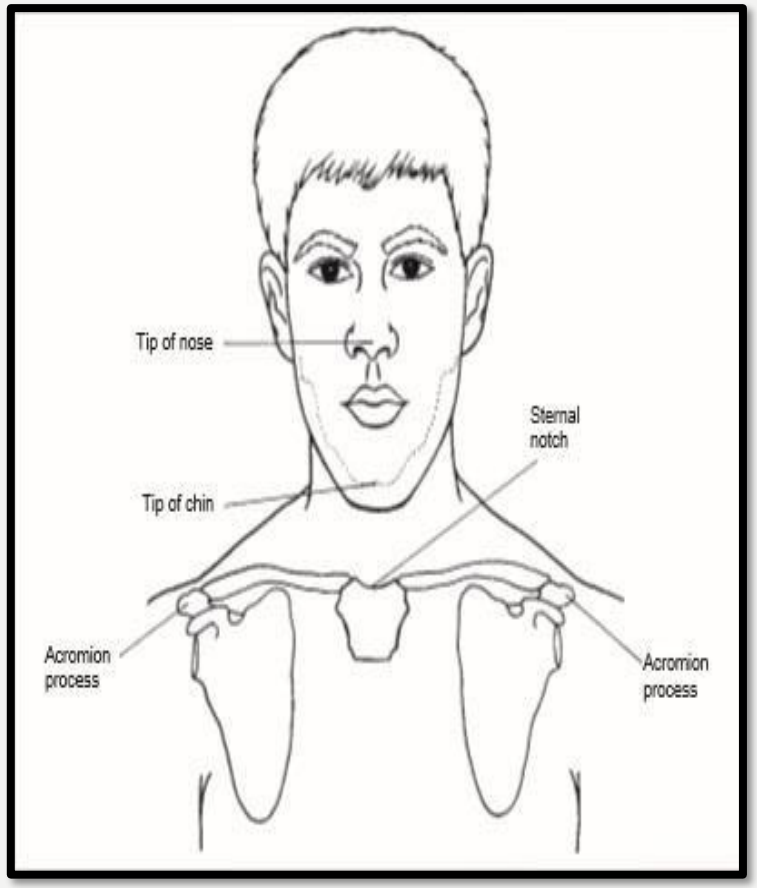


BONY LANDMARKS

Which movements can I measure using these landmarks?

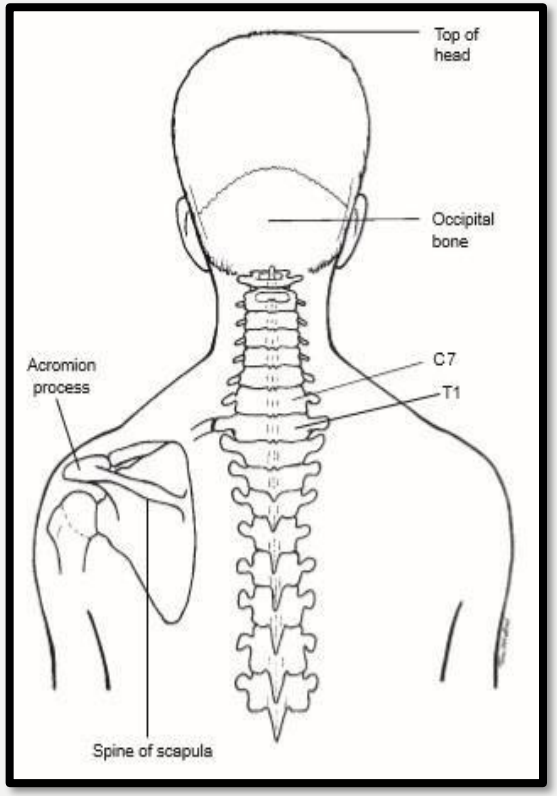
By Tape measure





BONY LANDMARKS

Which movements can I measure using these landmarks?



CERVICAL FLEXION [Universal Goniometer]

Goniometer Alignment

See Figures 11.15 and 11.16.

1. Center **fulcrum** of the goniometer over the external auditory meatus.
2. Align **proximal arm** so that it is either perpendicular or parallel to the ground.
3. Align **distal arm** with the base of the nares. If a tongue depressor is used, align the arm of the goniometer parallel to the longitudinal axis of the tongue depressor.

- Normal ROM Value? $0^0 - 40^0$ \ 1.0 to 4.3 cm

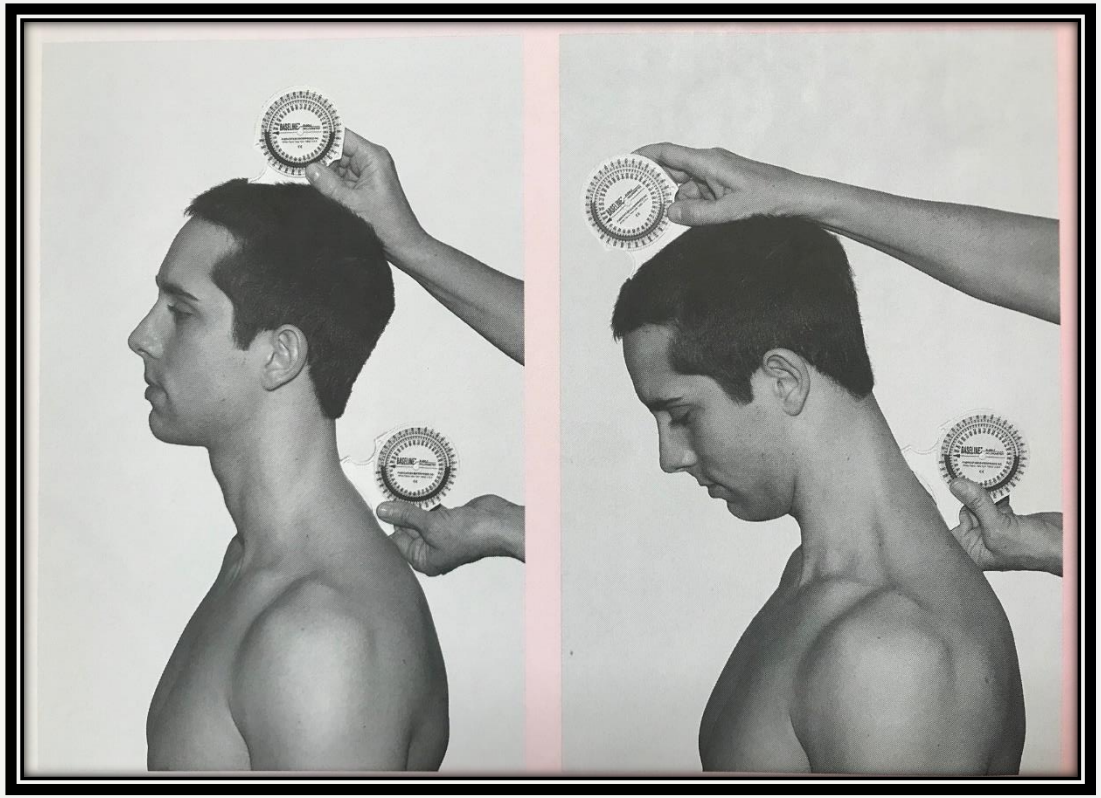
- End-feel → Firm

Tension of the posterior ligament, posterior fibers of the annulus fibrosus, tension of the posterior joint capsules, and tension of cervical extensor muscles..

CERVICAL FLEXION (Double Inclinometer)

Inclinometer Alignment

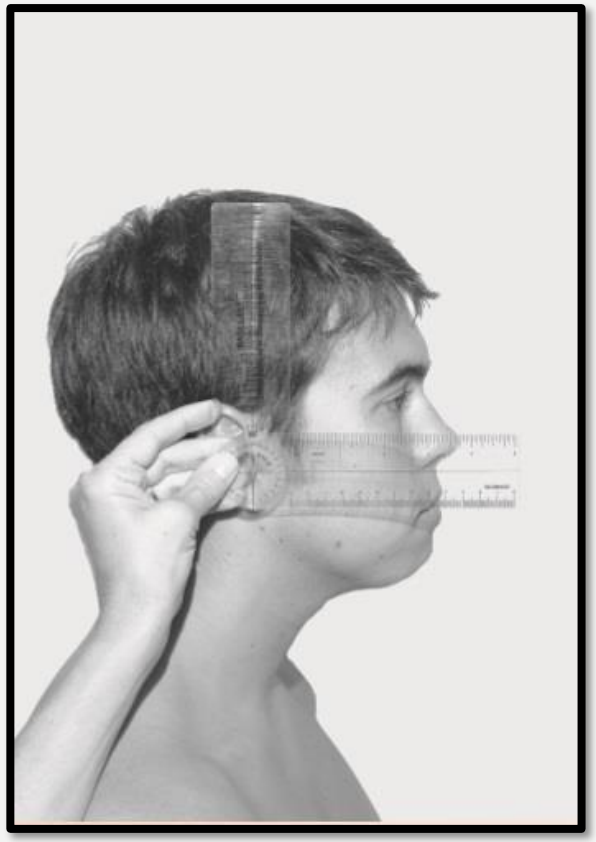
1. Place **one inclinometer** directly over the spinous process of the T-1 vertebra, making sure that the inclinometer is adjusted to 0 degrees.
2. Place the **second inclinometer** firmly on the top of the head, making sure that the inclinometer is adjusted to 0 degrees (Fig. 11.18).

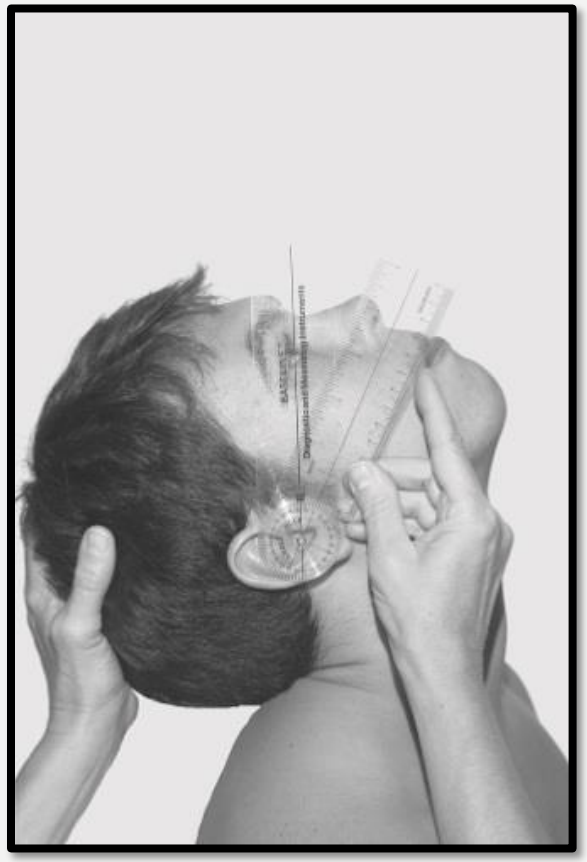


CERVICAL EXTENSION (Universal Goniometer)

Goniometer Alignment
See Figures 11.23 and 11.24.

1. Center **fulcrum** of the goniometer over the external auditory meatus.
2. Align **proximal arm** so that it is either perpendicular or parallel to the ground.
3. Align **distal arm** with the base of the nares. If a tongue depressor is used, align the arm of the goniometer parallel to the longitudinal axis of the tongue depressor.





- Normal ROM Value? $0^0 - 50^0$\ 18.5 to 22.4 cm

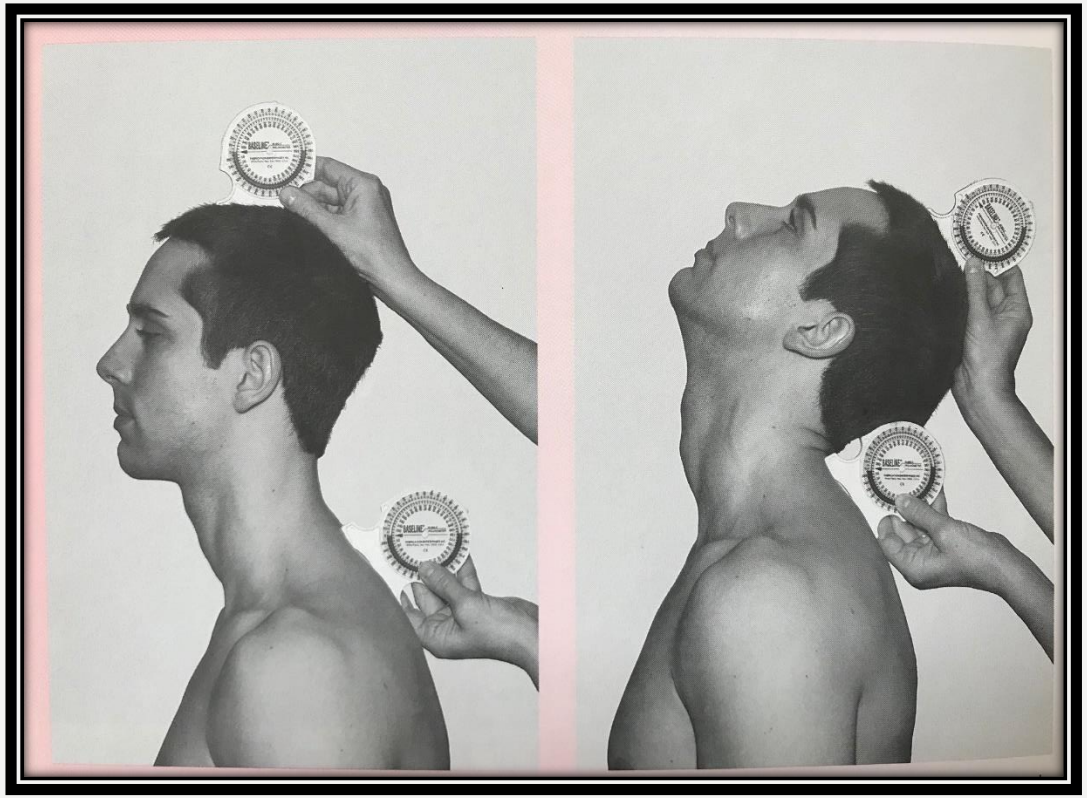
- End-feel→ Firm

Tension of the anterior longitudinal ligament, anterior fibers of the annulus fibrosus, tension of the anterior joint capsules, and tension of cervical flexor muscles.

CERVICAL EXTENSION (Double Inclinometer)

Inclinometer Alignment

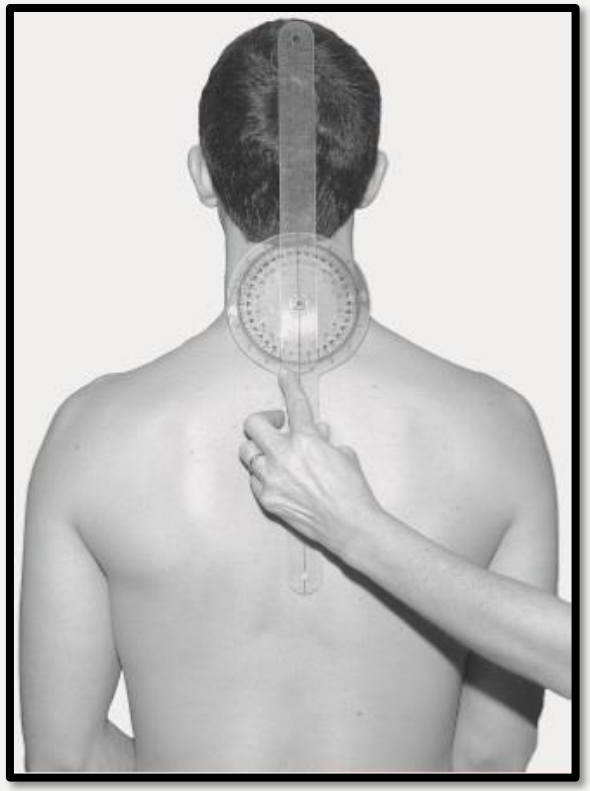
1. Place **one inclinometer** directly over the spinous process of the T-1 vertebra, making sure that the inclinometer is adjusted to 0 degrees.
2. Place the **second inclinometer** firmly on the top of the head, making sure that the inclinometer is adjusted to 0 degrees (Fig. 11.18).



CERVICAL LATERAL FLEXION (GONIOMETER & INCLINOMETER)

Goniometer Alignment
See Figures 11.31 and 11.32.

1. Center **fulcrum** of the goniometer over the spinous process of the C7 vertebra.
2. Align **proximal arm** with the spinous processes of the thoracic vertebrae so that the arm is perpendicular to the ground.
3. Align **distal arm** with the dorsal midline of the head, using the occipital protuberance for reference.



- Normal ROM Value? $0^0 - 22^0$
- End-feel → Firm
  Tension in intertransverse ligament and contralateral muscles

- **Capsular Pattern**

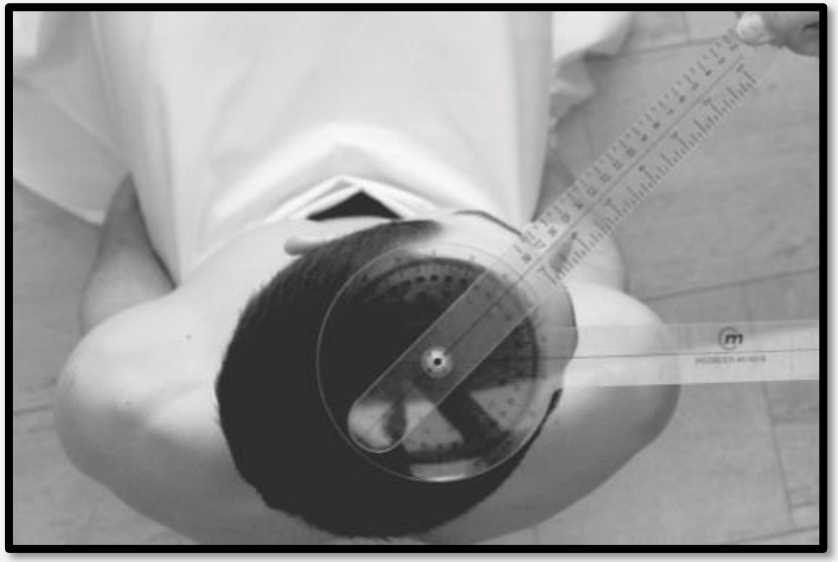
For unilateral facet C2 to C7: Characterized by pain and limitation with a greater restriction of movement in lateral flexion to the opposite side and in rotation to the same side.

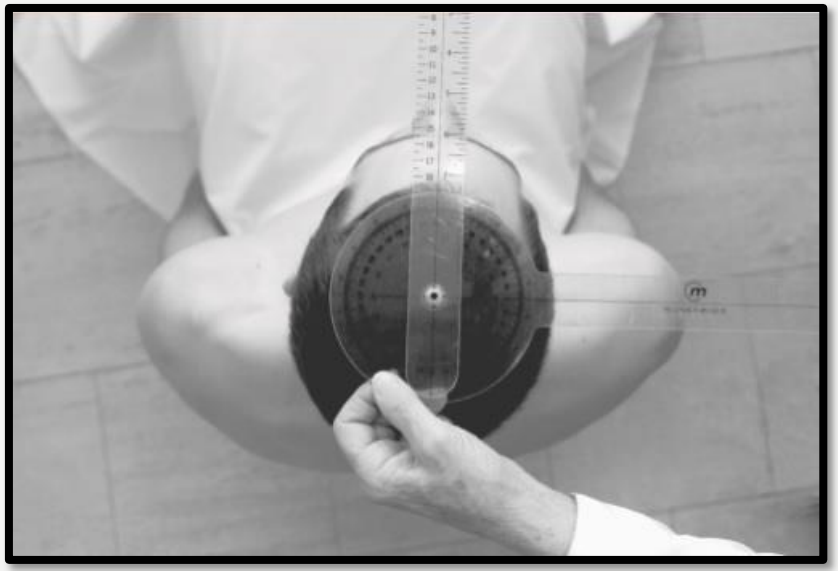
CERVICAL ROTATION (GONIOMETER & INCLINOMETER)

Goniometer Alignment

See Figures 11.39 and 11.40.

1. Center **fulcrum** of the goniometer over the center of the cranial aspect of the head.
2. Align **proximal arm** parallel to an imaginary line between the two acromial processes.
3. Align **distal arm** with the tip of the nose. If a tongue depressor is used, align the arm of the goniometer parallel to the longitudinal axis of the tongue depressor.



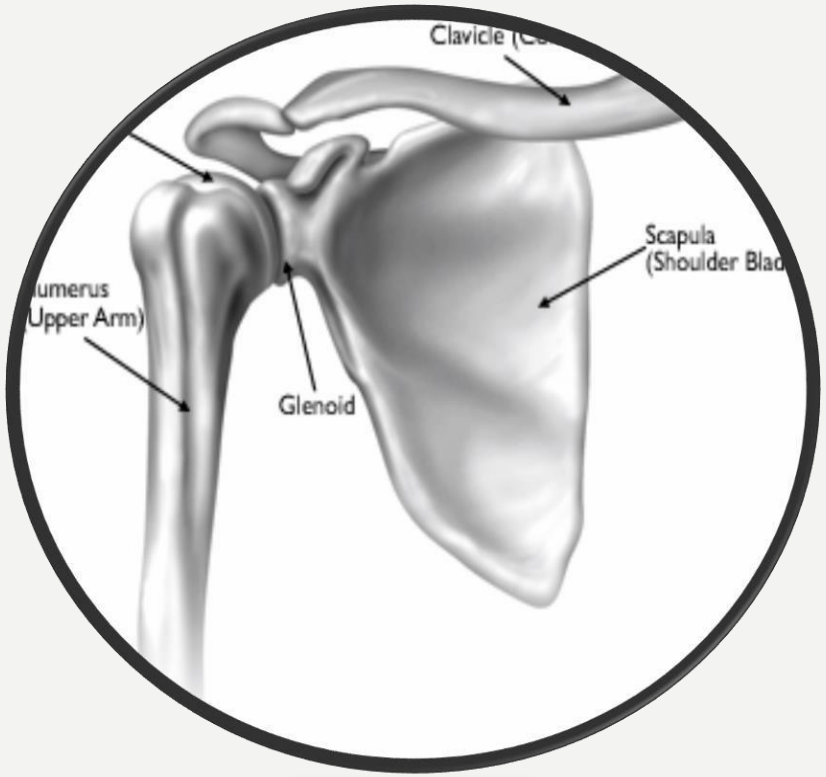


- Normal ROM Value? $70^0 - 90^0$

- End-feel → Firm

Stretching alar ligament and contralateral muscles

SHOULDER GONIOMETRY



- **Osteokinematics**

The GH joint has 3 degrees of freedom. The motions permitted at the joint are flexion–extension, abduction–adduction, and medial–lateral rotation that lie in the sagittal, frontal, and transverse cardinal planes.

- **Arthrokinematics**

In Motion at the GH joint occurs as a rolling and sliding of the head of the humerus on the glenoid fossa. The convex joint surface of the head of the humerus slides in the opposite direction and rolls in the same direction as the osteokinematic movements of the shaft of the humerus.

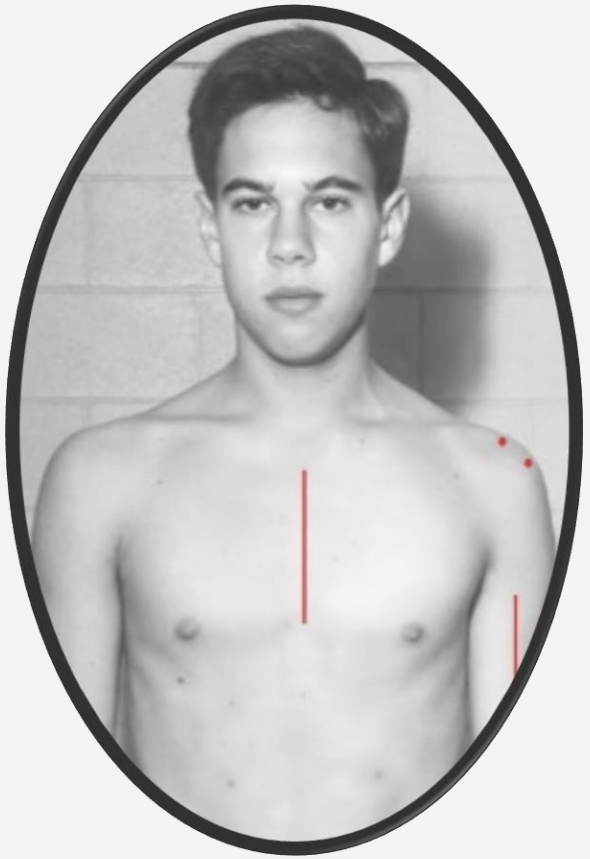
- **Capsular Pattern**

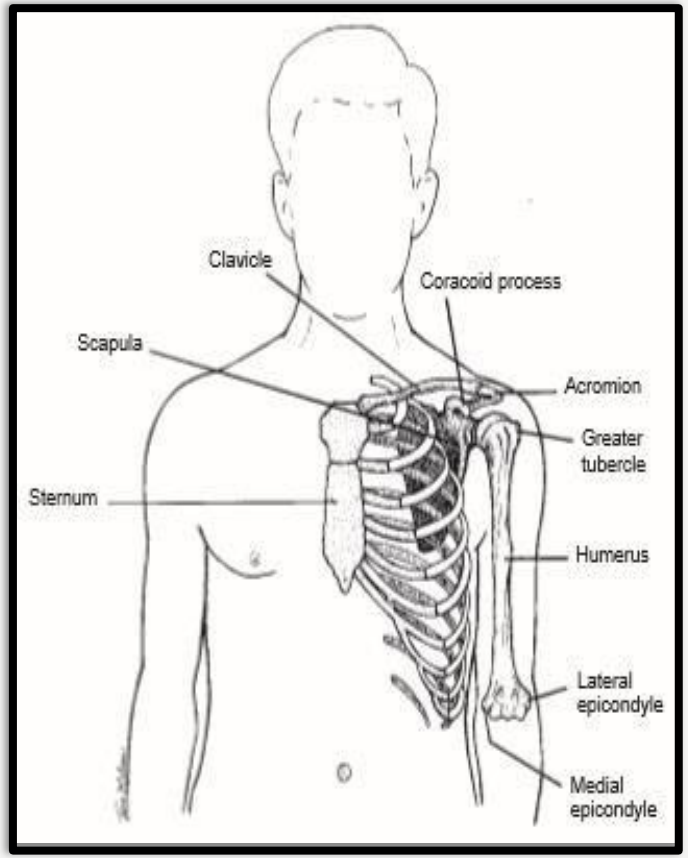
The greatest restriction of passive motion is in lateral rotation, followed by some restriction in abduction and less restriction in medial rotation.

BONY LANDMARKS

The shoulder complex is composed of **four joints**:
the glenohumeral (GH), sternoclavicular (SC), acromioclavicular (AC), and scapulothoracic joints.
Full range of motion (ROM) of the shoulder requires coordinated motion at all four of these joints.

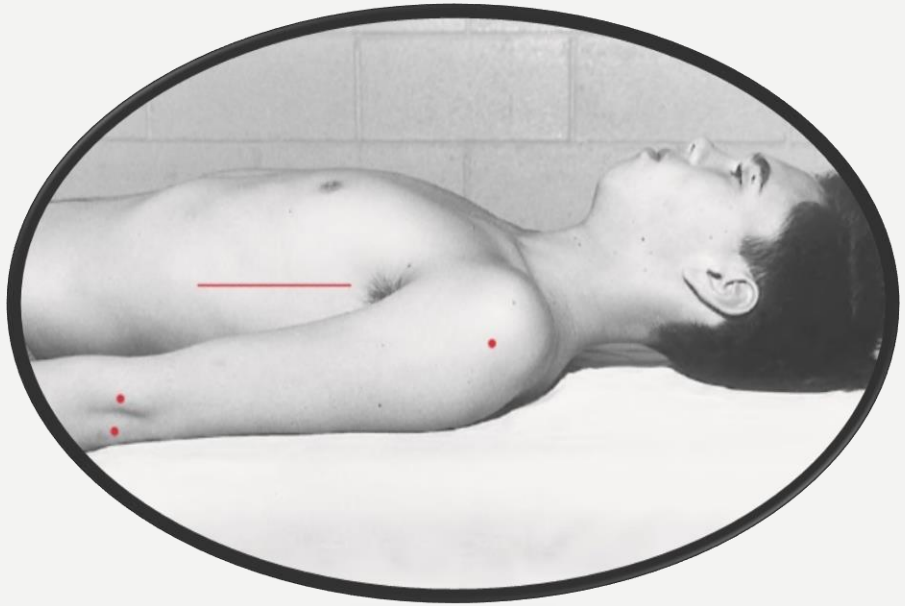
Which movements can I measure using these landmarks?

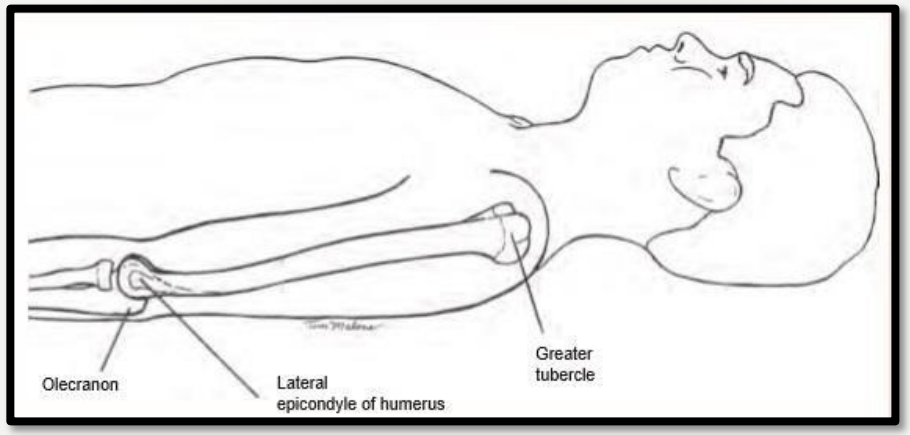




BONY LANDMARKS

Which movements can I measure using these landmarks?



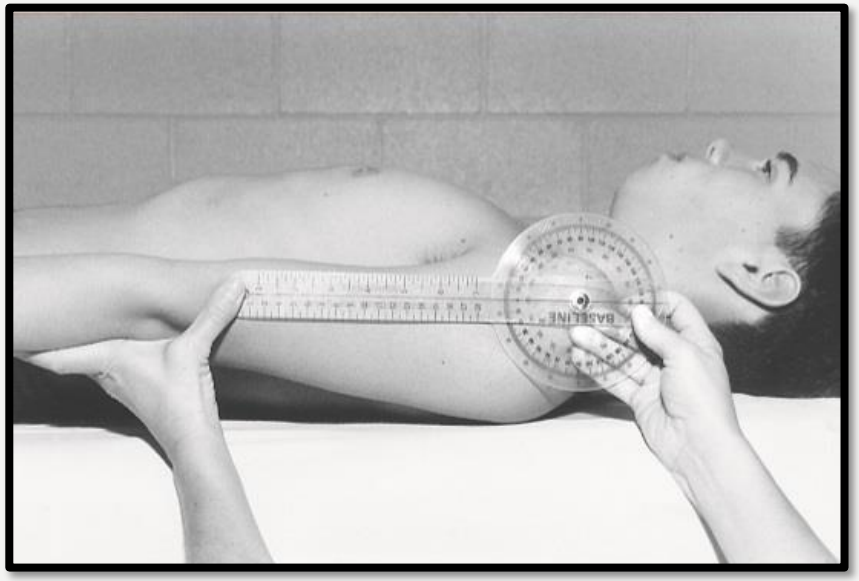


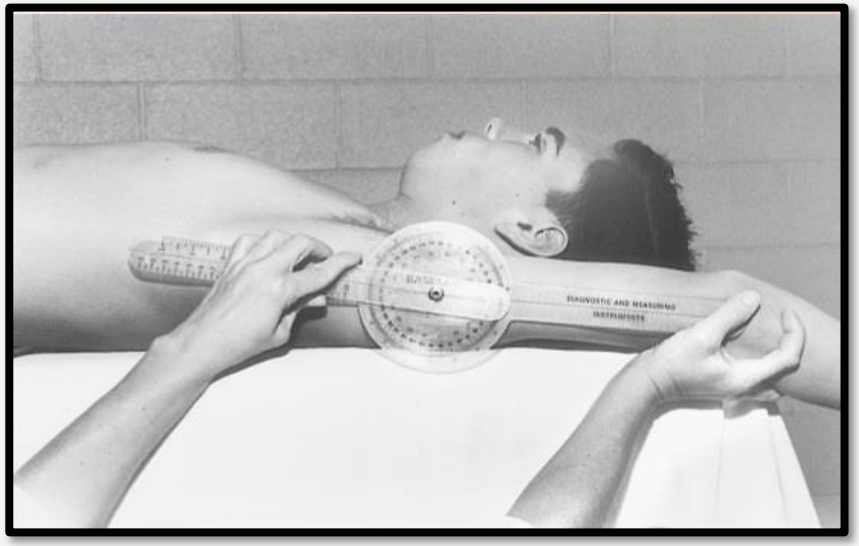
GH & SHOULDER COMPLEX FLEXION

Goniometer Alignment

This goniometer alignment is used for measuring glenohumeral and shoulder complex flexion (Figs. 4.12 through 4.14).

1. Center **fulcrum** of the goniometer over the lateral aspect of the greater tubercle.
2. Align **proximal arm** parallel to the midaxillary line of the thorax.
3. Align **distal arm** with the lateral midline of the humerus. Depending on how much flexion and rotation occur, the lateral epicondyle of the humerus or the olecranon process of the ulnar may be helpful references.





- Normal ROM Value? 0^0 to $165\text{-}180^0$
- End-feel → **Firm**

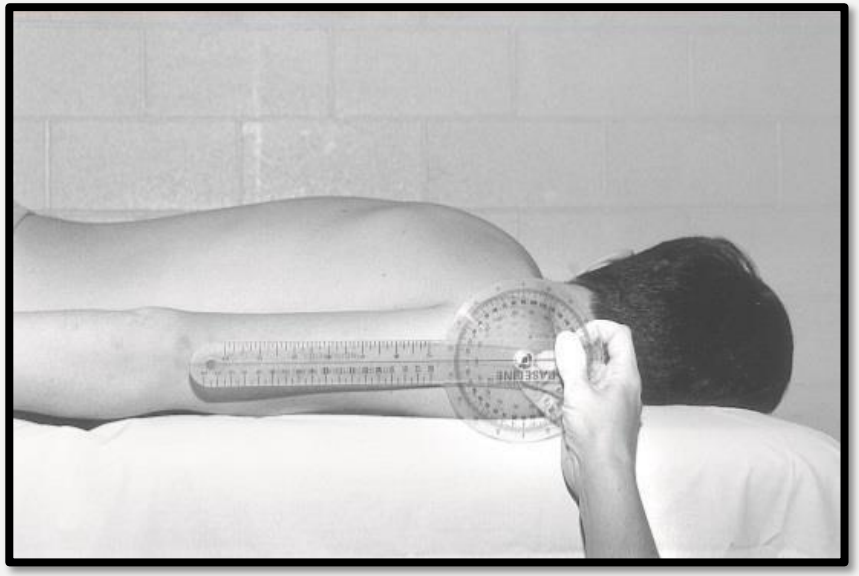
Tension in the posterior band of the coracohumeral ligament; the posterior joint capsule; and the posterior deltoid, teres minor, teres major, and infraspinatus muscles

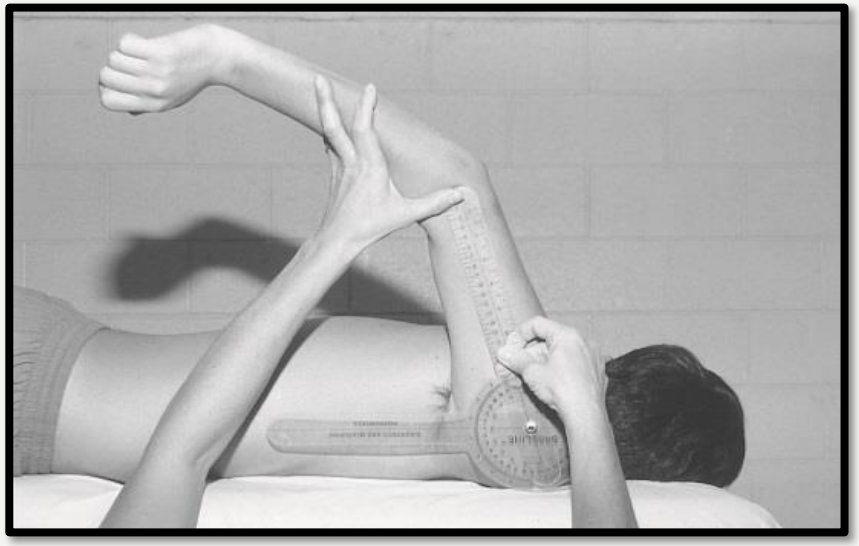
GH & SHOULDER COMPLEX EXTENSION

Goniometer Alignment

This goniometer alignment is used for measuring glenohumeral and shoulder complex extension (Figs. 4.17 to 4.19).

1. Center **fulcrum** of the goniometer over the lateral aspect of the greater tubercle.
2. Align **proximal arm** parallel to the midaxillary line of the thorax.
3. Align **distal arm** with the lateral midline of the humerus, using the lateral epicondyle of the humerus for reference.





- Normal ROM Value? 0^0 to $50\text{-}60^0$
- End-feel → **Firm**

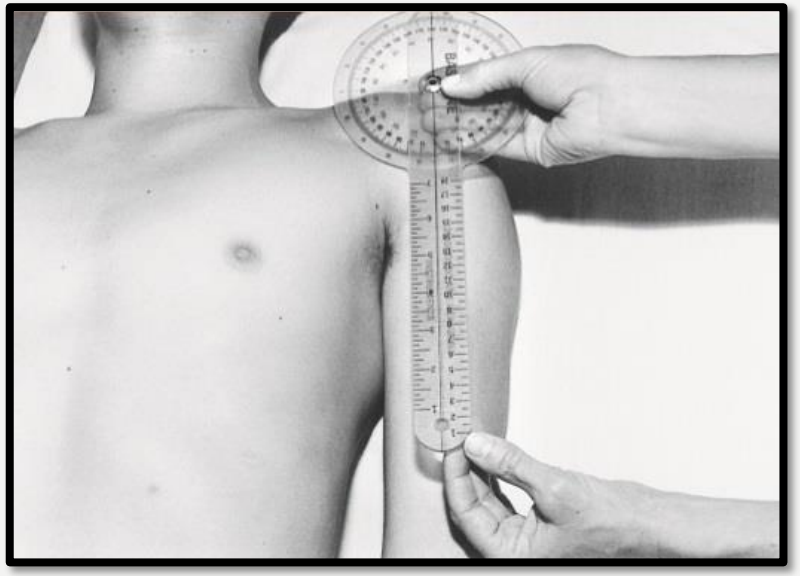
Tension in the anterior band of the coracohumeral ligament; anterior joint capsule; and clavicular fibers of the pectoralis major, and anterior deltoid muscles

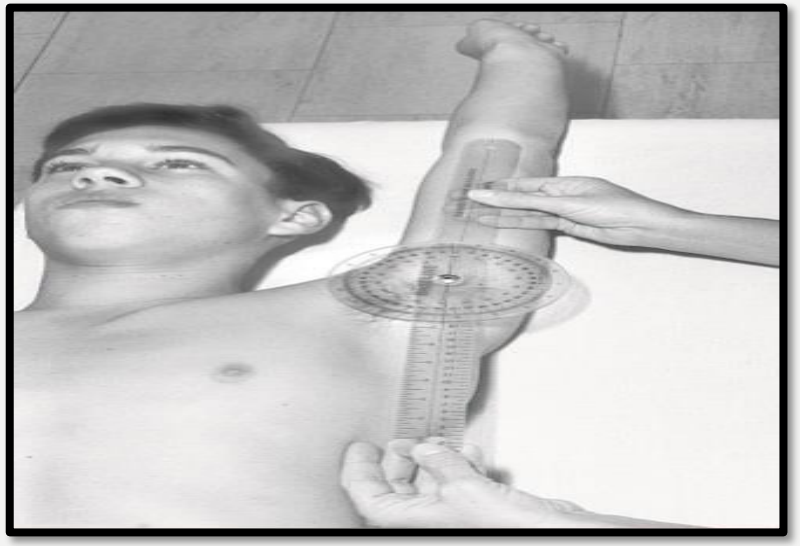
GH & SHOULDER COMPLEX ABDUCTION

Goniometer Alignment

This goniometer alignment is used for measuring glenohumeral and shoulder complex abduction (Figs. 4.22 to 4.24).

1. Center **fulcrum** of the goniometer close to the anterior aspect of the acromial process.
2. Align **proximal arm** so that it is parallel to the mid-line of the anterior aspect of the sternum.
3. Align **distal arm** with the anterior midline of the humerus. Depending on the amount of abduction and lateral rotation that has occurred, the medial epicondyle may be a helpful reference.





- Normal ROM Value? 0^0 to $170\text{-}180^0$
- End-feel ⟶ **Firm**

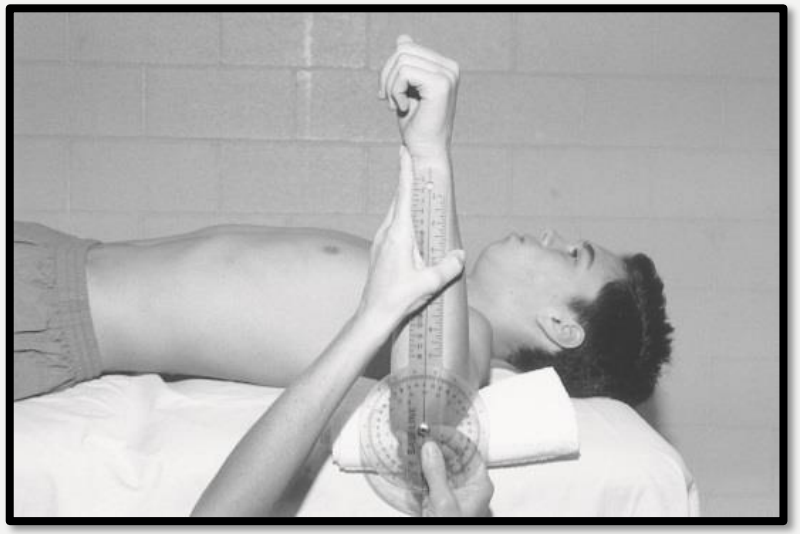
Tension in the costoclavicular ligament; sternoclavicular capsule and ligaments; and latissimus dorsi, sternocostal fibers of the pectoralis major, and major and minor rhomboid muscles.

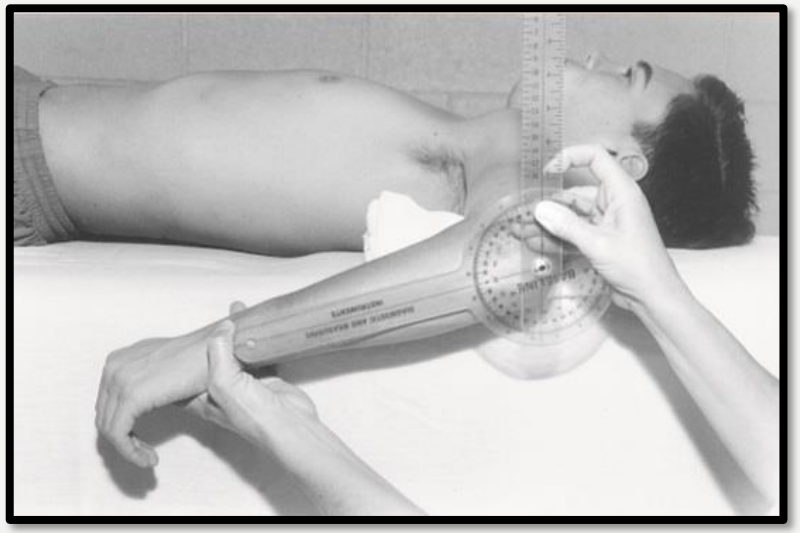
GH & SHOULDER COMPLEX INTERNAL ROTATION

Goniometer Alignment

This goniometer alignment is used for measuring glenohumeral and shoulder complex medial rotation (Figs. 4.27 to 4.29).

1. Center **fulcrum** of the goniometer over the olecranon process.
2. Align **proximal arm** so that it is either perpendicular to or parallel with the floor.
3. Align **distal arm** with the ulna, using the olecranon process and ulnar styloid for reference.





- Normal ROM Value? 0^0 to $70\text{-}90^0$
- End-feel ⟶ **Firm**

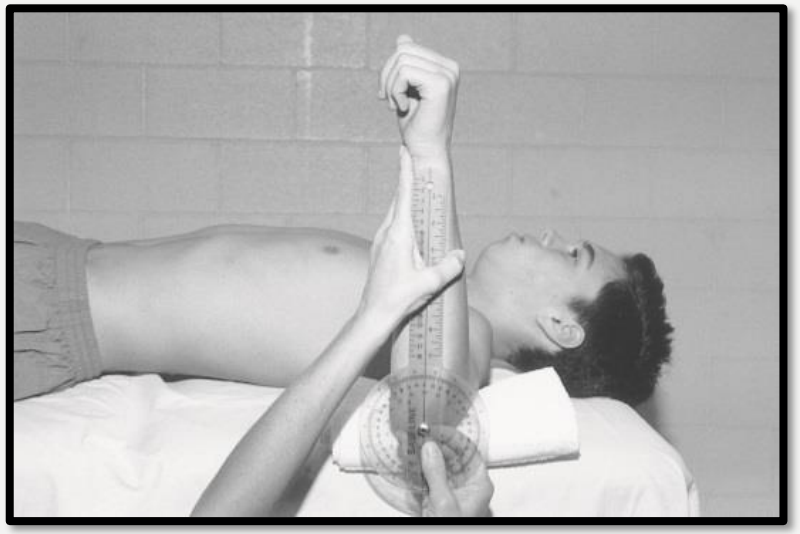
Tension in the posterior joint capsule and the infraspinatus and teres minor muscles.

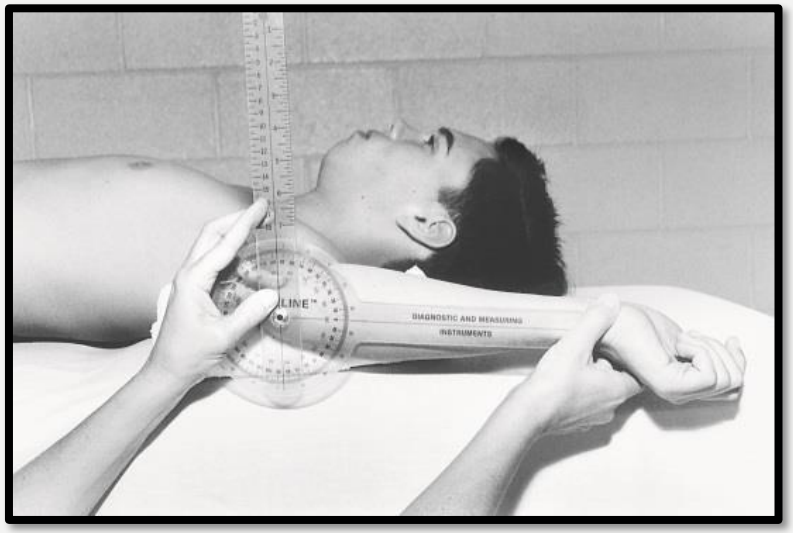
GH & SHOULDER COMPLEX EXTERNAL ROTATION

Goniometer Alignment

This goniometer alignment is used for measuring glenohumeral and shoulder complex lateral rotation (Figs. 4.32 to 4.34).

1. Center **fulcrum** of the goniometer over the olecranon process.
2. Align **proximal arm** so that it is either parallel to or perpendicular to the floor.
3. Align **distal arm** with the ulna, using the olecranon process and ulnar styloid for reference.

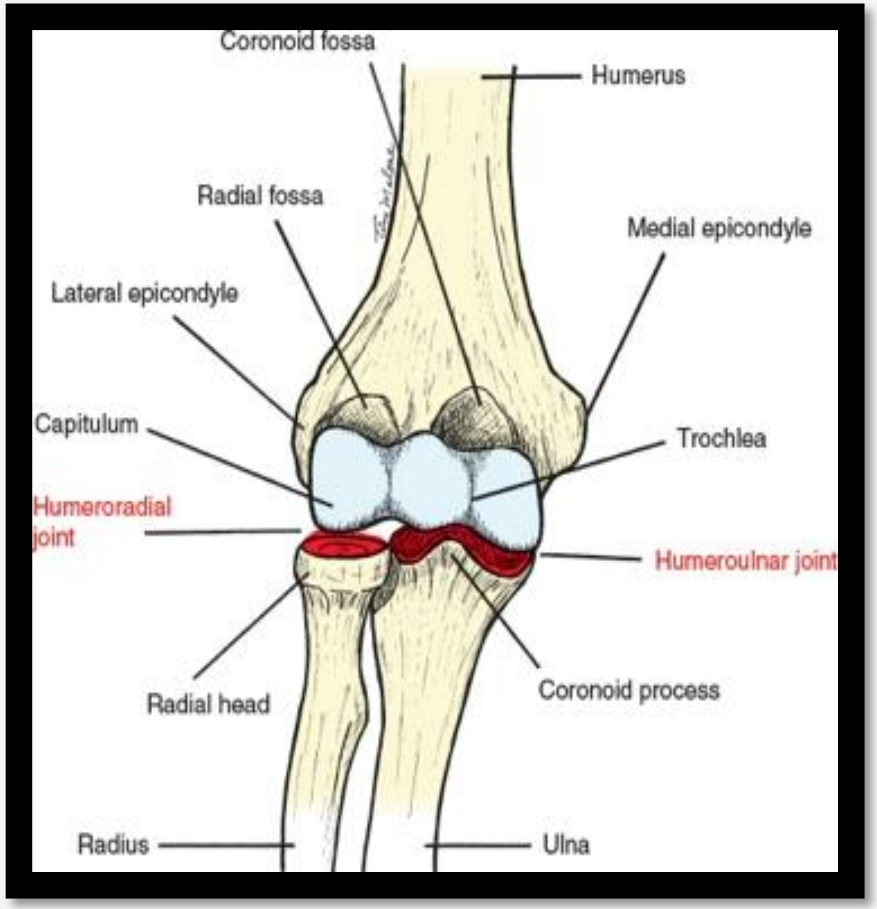


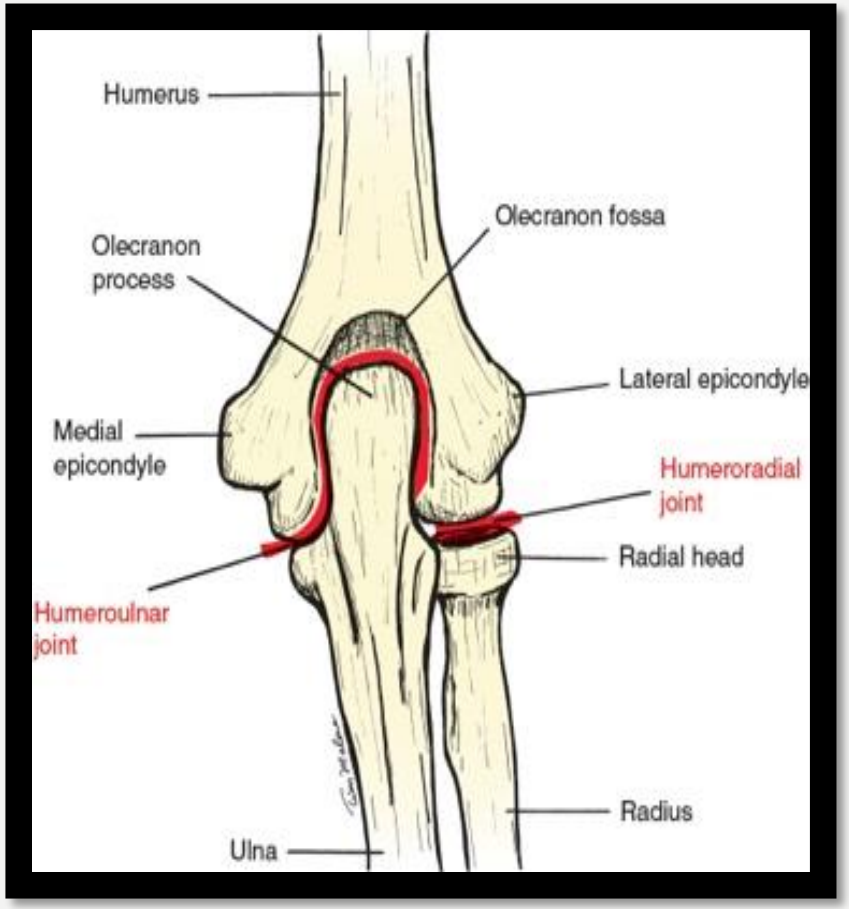


- Normal ROM Value? 0^0 to 90^0
- End-feel → **Firm**

Tension in the anterior joint capsule; the coracohumeral ligament; and the subscapularis, the teres major, and the clavicular fibers of the pectoralis major muscles.

VIEW OF THE RIGHT ELBOW





ELBOW GONIOMETRY

- **Osteokinematics**

The humeroulnar and humeroradial joints have 1 degree of freedom; flexion–extension occurs in the sagittal plane around a medial–lateral (coronal) axis.

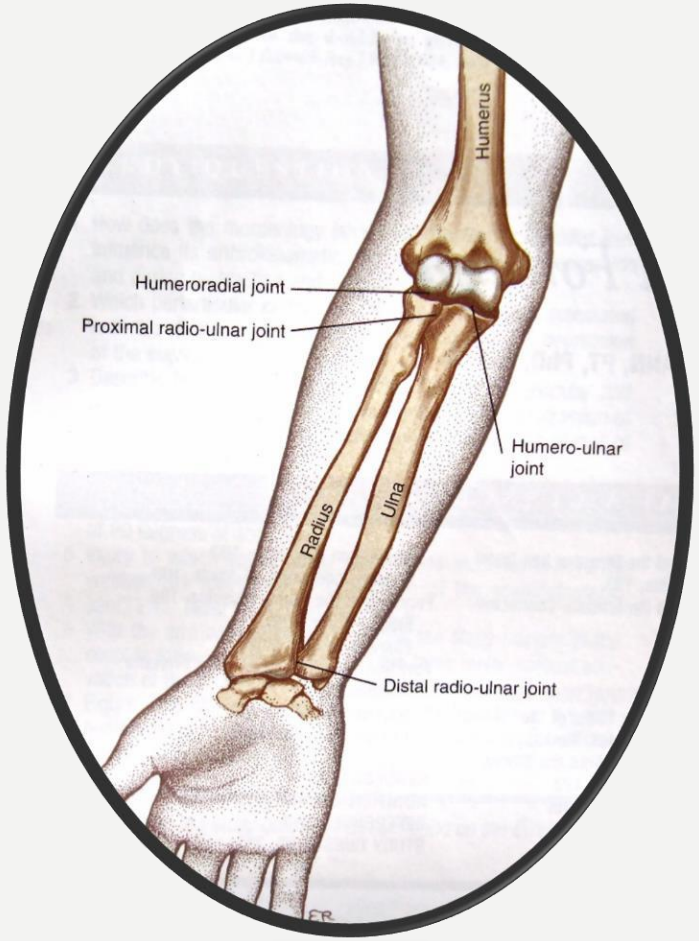
- **Arthrokinematics**

At the humeroulnar joint, posterior sliding of the **concave** trochlear notch of the ulna on the convex trochlea of the humerus continues during extension until the ulnar olecranon process enters the humeral olecranon fossa. In flexion, the ulna slides anteriorly along the humerus.

At the humeroradial joint, the concave radial head slides posteriorly on the convex surface of the capitulum during extension. In flexion, the radial head slides anteriorly

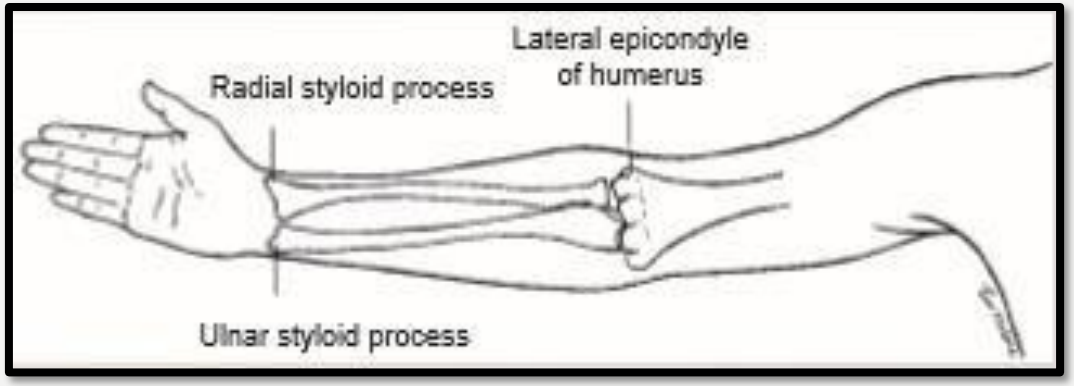
- **Capsular Pattern**

The flexion is more limited than in extension.



BONY LANDMARKS

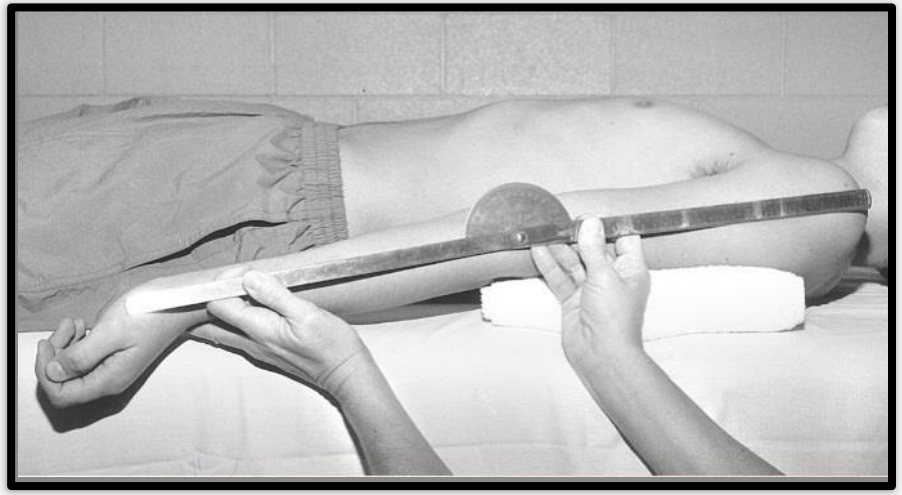
Which movements can I measure using these landmarks?



ELBOW FLEXION AND EXTENSION

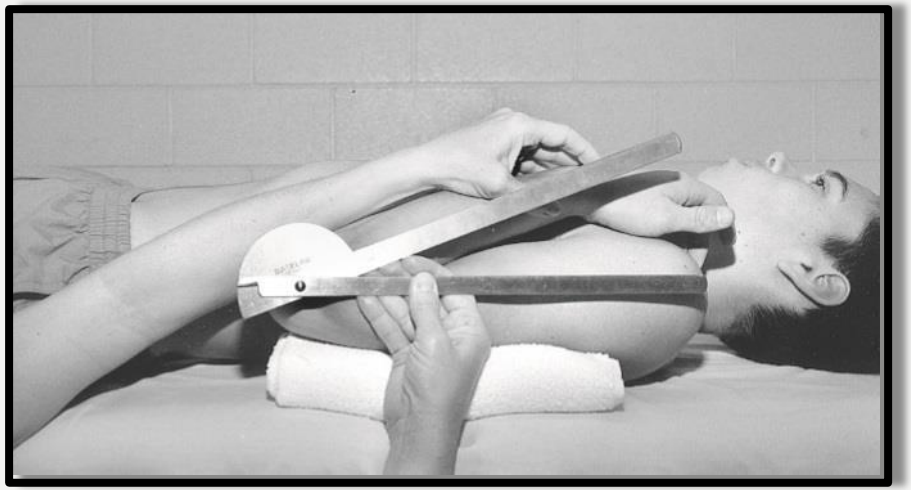
Goniometer Alignment
See Figures 5.14 and 5.15.

1. Center **fulcrum** of the goniometer over the lateral epicondyle of the humerus.
2. Align **proximal arm** with the lateral midline of the humerus, using the center of the acromion process for reference.
3. Align **distal arm** with the lateral midline of the radius, using the radial head and radial styloid process for reference.



- Normal ROM Value? **Flexion ROM:** 0^0 to 140-150^0
- End-feel ⟶ **Soft**

Compression of the muscle bulk of the anterior forearm with that of the anterior upper arm.



Extension ROM: 150 to 0^0 - End-feel ⟶ **Hard**

Contact between the olecranon process of the ulna and the olecranon fossa of the humerus

The testing position, stabilization, and alignment are the same as those used for elbow flexion

FOREARM GONIOMETRY

- **Osteokinematics**

The superior and inferior radioulnar joints have 1 degree of freedom; supination –pronation. In pronation the radius crosses over the ulna, whereas in supination the radius and ulna lie parallel to one another.

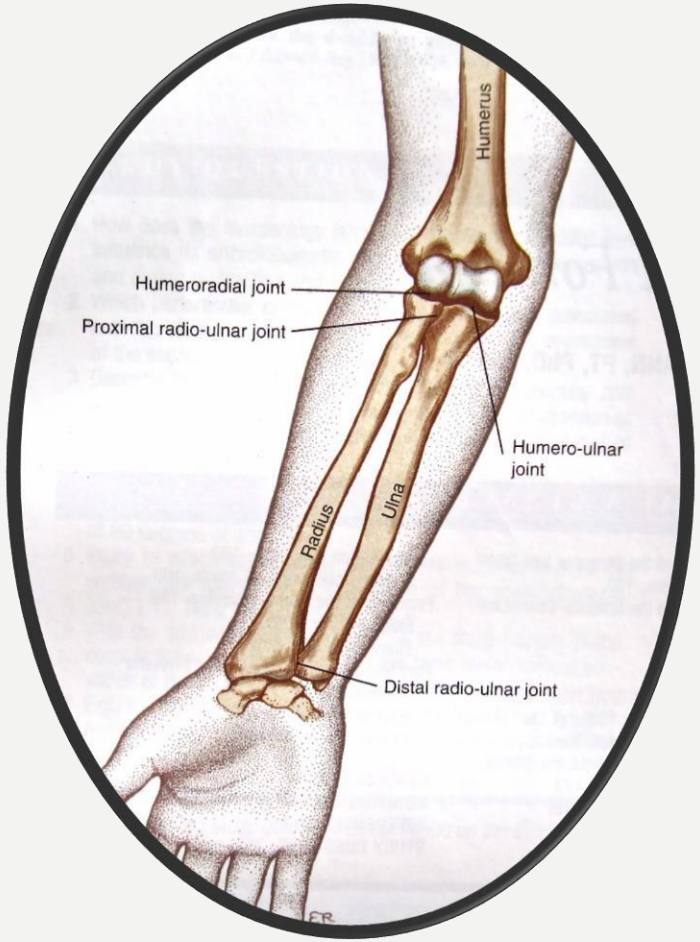
- **Arthrokinematics**

At the superior radioulnar joint, in pronation the radial head(convex) spins posteriorly and radius roll anteriorly. In supination the radial head spins anteriorly and radius roll posteriorly.

At the inferior radioulnar joint, the concave of the ulnar notch on the radius slides over the ulnar head. the concave surface of the radius slides anteriorly during pronation and slides posteriorly during supination.

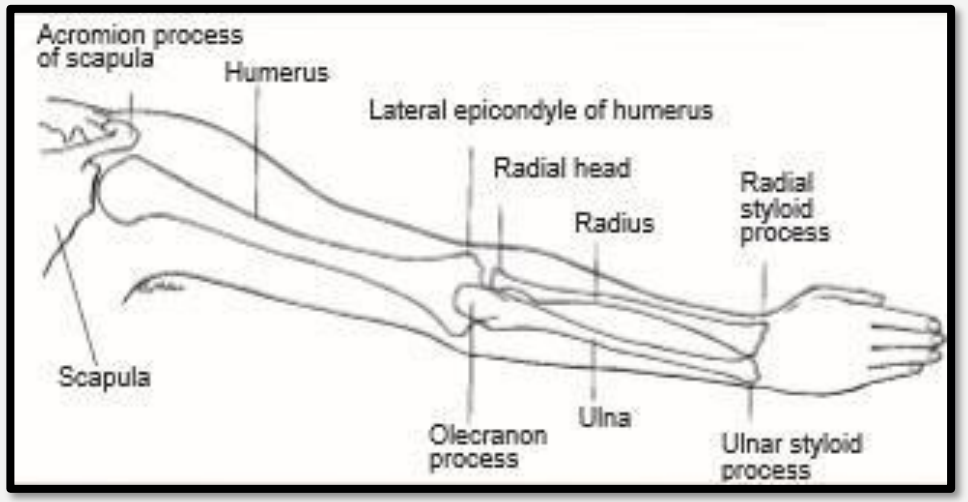
Capsular Pattern

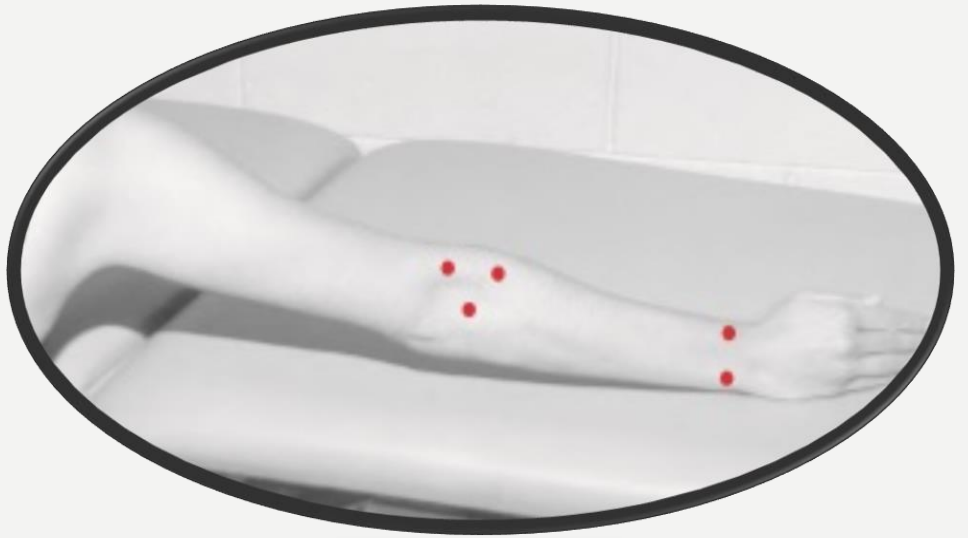
Is equal limitation of supination and pronation.



BONY LANDMARKS

Which movements can I measure using these landmarks?



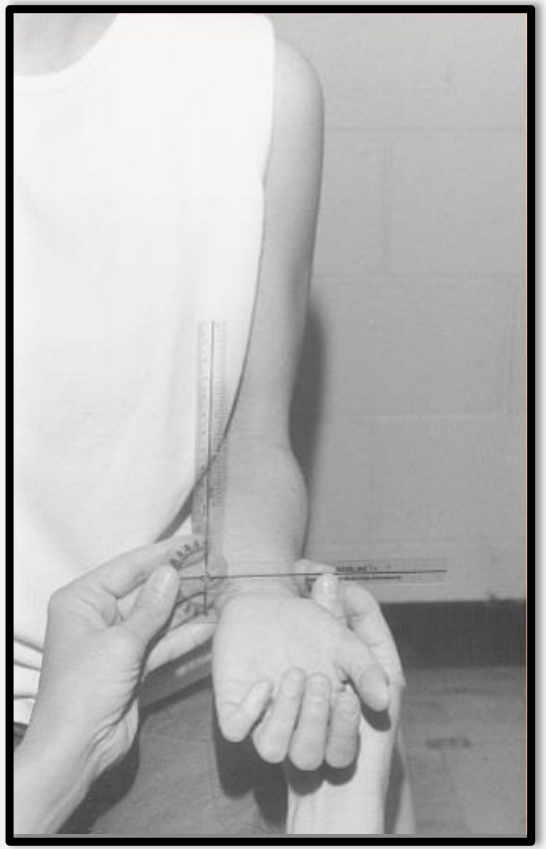


FOREARM SUPINATION

Goniometer Alignment

See Figures 5.20 and 5.21.

1. Place **fulcrum** of the goniometer medially and just proximally to the ulnar styloid process.
2. Align **proximal arm** parallel to the anterior midline of the humerus.
3. Place **distal arm** across the ventral aspect of the forearm, just proximal to the styloid processes, where the forearm is most level and free of muscle bulk. The distal arm of the goniometer should be parallel to the styloid processes of the radius and ulna.



- Normal ROM Value? From 0^0 to 80^0

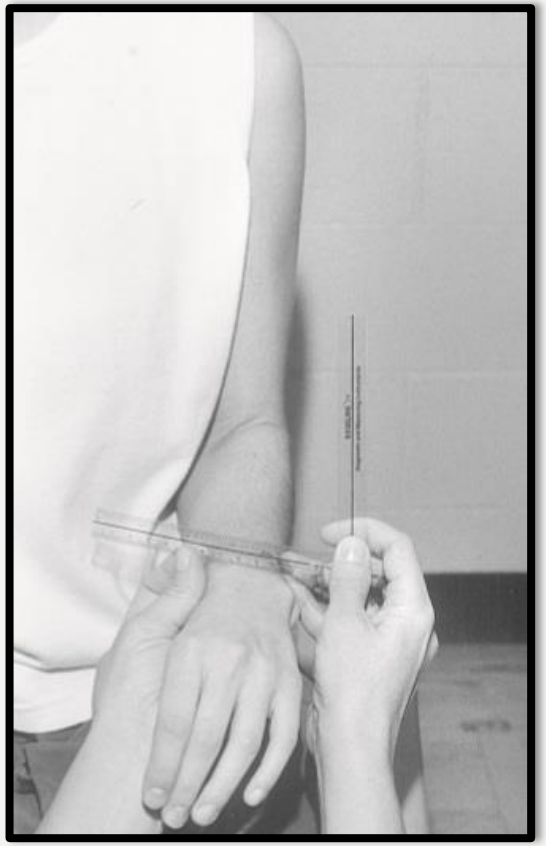
- End-feel → **Firm**

Because of tension in the palmar radioulnar ligament, interosseous membrane, and tension in pronator teres and quadratus muscles.

FOREARM PRONATION

Goniometer Alignment
See Figures 5.17 and 5.18.

1. Center **fulcrum** of the goniometer laterally and proximally to the ulnar styloid process.
2. Align **proximal** arm parallel to the anterior midline of the humerus.
3. Place **distal arm** across the dorsal aspect of the forearm, just proximal to the styloid processes of the radius and ulna, where the forearm is most level and free of muscle bulk. The distal arm of the goniometer should be parallel to the styloid processes of the radius and ulna.



- Normal ROM Value? From 0^0 to 80^0

- End-feel → **Hard**

Because of contact between the ulna and the radius.

It may be → **Firm end feel**

Because of tension in the dorsal radioulnar ligament, interosseous membrane, and tension in the supinator muscle.

WRIST GONIOMETRY

- **Osteokinematics**

The radiocarpal and midcarpal joints have 2 degree of freedom. The wrist complex permits flexion–extension occurs in the sagittal plane around a medial–lateral axis and radial-ulnar deviation in the frontal plane around an anterior-posterior axis.

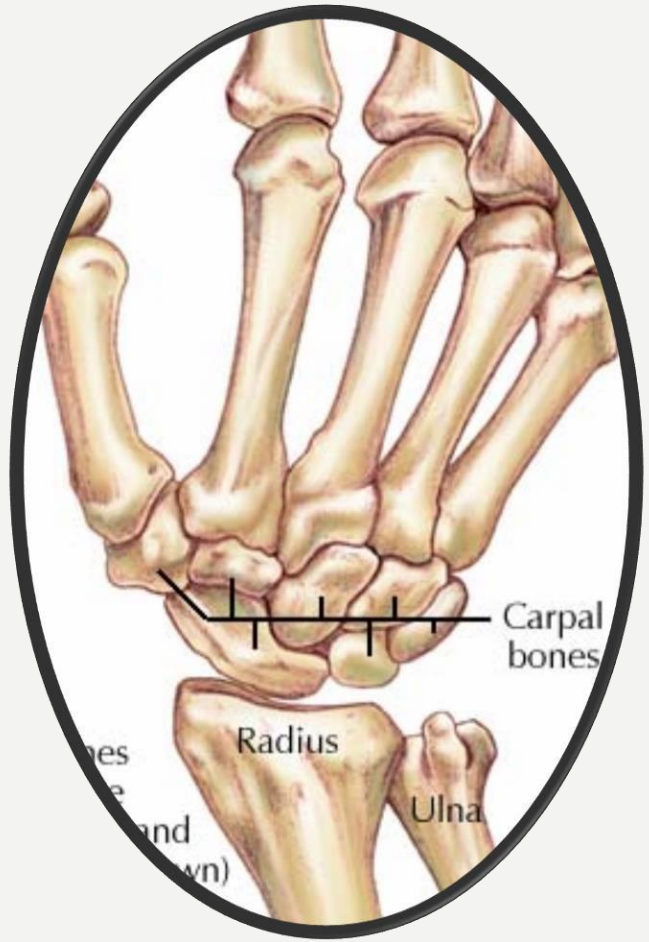
- **Arthrokinematics**

The proximal row of carpals are convex and distal radius and radioulnar surfaces are concave.

Flexion and extension, ulnar and radial deviation → Rolling and Slide?

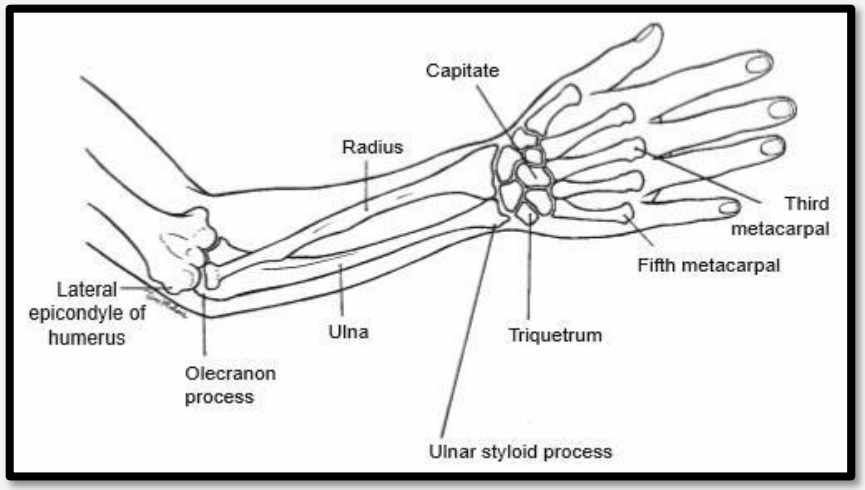
- **Capsular Pattern**

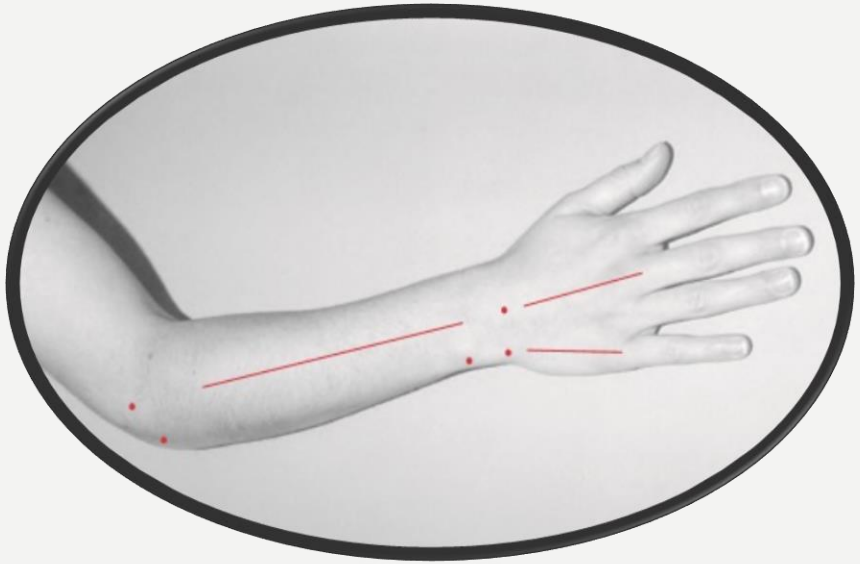
Equal limitation of wrist flexion and extension and a slight limitation of radial and ulnar deviation.



BONY LANDMARKS

Which movements can I measure using these landmarks?



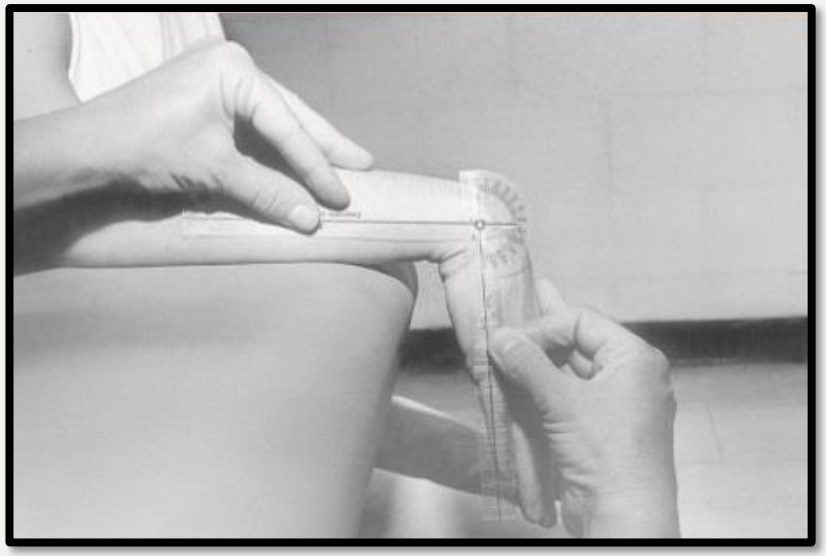


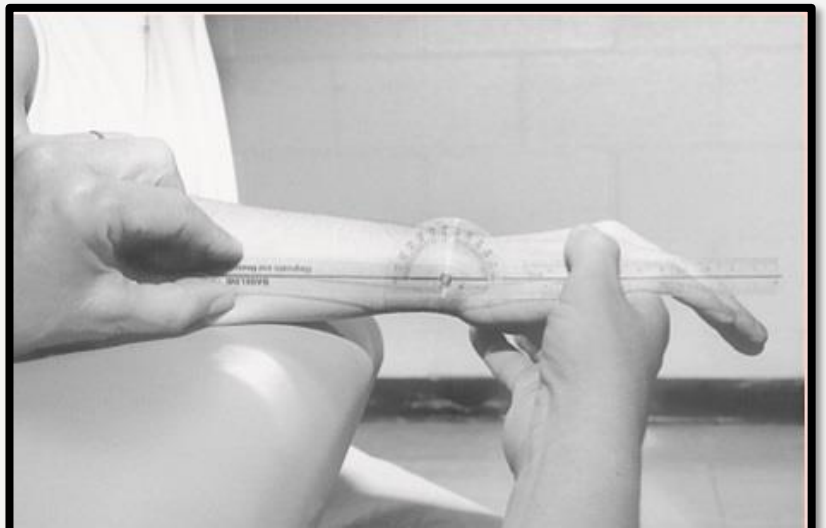
WRIST FLEXION

Goniometer Alignment

See Figures 6.7 and 6.8.

1. Center **fulcrum** on the lateral aspect of the wrist over the triquetrum.
2. Align **proximal arm** with the lateral midline of the ulna, using the olecranon and ulnar styloid processes for reference.
3. Align **distal arm** with the lateral midline of the fifth metacarpal. Do not use the soft tissue of the hypothenar eminence for reference.





- Normal ROM Value? From 0^0 to 80^0

- End-feel → **Firm**

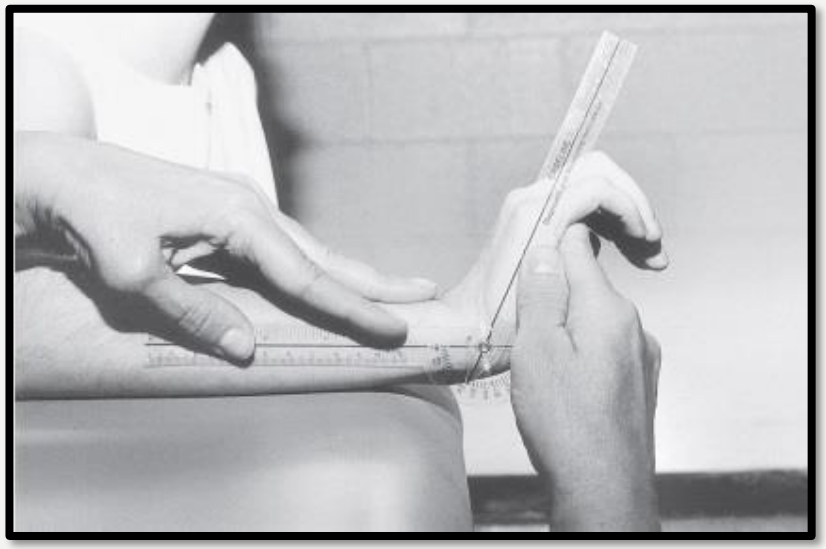
Because of tension in the dorsal radiocarpal ligament, dorsal joint capsule, and tension in the extensor carpi radialis brevis and longus and extensor carpi ulnaris muscles.

WRIST EXTENSION

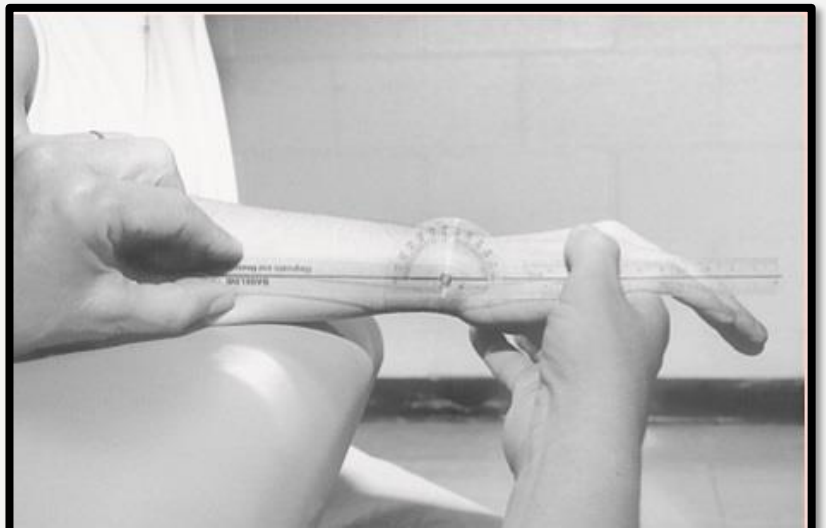
Goniometer Alignment

See Figures 6.10 and 6.11.

1. Center **fulcrum** on the lateral aspect of the wrist over the triquetrum.
2. Align **proximal arm** with the lateral midline of the ulna, using the olecranon and ulnar styloid process for reference.
3. Align **distal arm** with the lateral midline of the fifth metacarpal. Do not use the soft tissue of the hypothenar eminence for reference.



- Normal ROM Value? From 0^0 to 70^0



- End-feel → **Firm**

Because of tension in the palmar radiocarpal ligament, palmar joint capsule, and tension in the flexor carpi radialis and flexor carpi ulnaris muscles.

QUESTIONS???