



Joint Range of Motion Assessment Techniques

Presentation Created by
Ken Baldwin, M.Ed

Copyright 2001-2006

Objectives

- Understand how joint range of motion & goniometric assessment is an important component of the health/fitness screening process
- Define ROM- both Passive and Active ROM
- Describe Physiological End-Feel
- Review the Reliability and Validity of the assessments
- Understand the measurement procedures and techniques of goniometric assessment
- Review procedures of how to explain test results to a client

What is Goniometry?

- The measurement of angles
- For PFT's, the measurement of angles created by joints of the body
- Also measure the amount of available Active and Passive joint motion

Why Goniometry is a valuable tool for PFT's?

- Assist the PFT in determining an individual's coordination, neural/motor abilities, muscle strength, & Joint ROM
- Identifies painful motions due to contracting or stretching of tissues such as muscles, tendons, ligaments, bursa, the joint capsule, & arcs of motion
- Assess & monitors joint ROM for potential movement flaws & neural inefficiencies

Why Goniometry is a valuable tool for PFT's?

- Assessing the available joint ROM CORRELATES to a individuals current posture, body alignment, muscular imbalances, and ability to perform exercise movements pain free.
- Adds an essential component to a comprehensive Health/fitness evaluation
- If ROM is painful or awkward, PFT can refer to a medical care provider before training begins
- Provides feedback for the PFT & client of how their training program is progressing

Joint Range of Motion (ROM)

- Joint ROM Definition-the amount of motion available at a specific Joint, sometimes called Anatomical ROM. The normal ROM available to a joint within the anatomical limits of joint structure.
- Place body in Anatomic Position: body at rest is at 0° of flexion, extension, abduction and adduction.
- ROM effected by type of motion applied (Active or Passive ROM)

Anatomical ROM

What unique anatomical structures in a specific joint may limit the ROM?

- The Joint capsule
- The Shape of joint surfaces
- Ligamentous structures
- Muscular structures
- Bony Structures

Abnormal (Pathological) ROM

- Joint ROM is considered pathological (abnormal) when ROM at a joint exceeds or fails to reach normal anatomical limits
- Hypermobility-when ROM *is greater than* normal limits
- Hypomobility-when ROM is *less than* normal

Active ROM (AROM)

1. Active Range of Motion (AROM)-movement completed solely by client
 - Information provides muscular strength, neuromuscular control, painful arcs, & functional abilities

Active Assisted ROM (AAROM)

2. Active Assisted Range of Motion (AAROM)-
movement performed by client, guided and assisted by PFT
- PFT makes sure client is moving through the proper Joint ROM & is stabilized correctly

Passive ROM (PROM)

3. Passive Range of Motion (PROM)-
movement determined by examiner without
clients help
 - PROM is slightly greater than AROM
 - Examiner can get a better feel for joint-play
and physiological end-feel of the movement
 - Currently performed by physical & rehab
therapists

Physiologic End-Feel

- PROM is limited by the joint structure being evaluated
- Each joint is unique in its allowable anatomical ROM
- The Definition of End-Feel: that feeling experienced by the examiner as a barrier to further motion at the end of Passive ROM
- It takes practice and sensitivity

Table 1 Normal (Physiological) End-Feels (Pg.9)

End-Feel	Structure	Example
1. Soft	Soft tissue	Elbow Flex
2. Firm	Muscular stretch	Hip flexion
	Capsular stretch	Ext. MP JT.
	Ligamentous stretch	Forearm Sup.
3. Hard	Bone & Bone	Elbow Ext.

Table 2 Abnormal (Pathological) End-Feel (Pg. 9)

End-Feel		Example
1.Soft	Occurs sooner than usual Normally in a firm/hard end feel	Synovitis (boggy feel)
2.Firm	Occurs sooner than usual Normally soft or hard end feel	Mus/Lig short
3.Hard	Occurs sooner than usual Normally soft or firm end feel	Osteoarthritis (Bony Grating)
4.Empty	No end feel, pain prevents reaching end or ROM	(Jt inflammation)

Reliability & Validity of Testing Procedures

Knowledge of Examiner:

- Recommended Testing Position
- Alternative testing positions
- Stabilization techniques required
- Normal joint ROM & joint alignment
- Use of Goniometric instrument
- Anatomic Bony landmarks
- Joint structure and Function

Reliability & Validity of Testing Procedures

Skills of Examiner:

- Movement of the body part through appropriate ROM
- Positioning of Body & stabilizing correctly
- Reading and Recording measurements correctly
- Aligning goniometer correctly
- Knowledge of end-feel ROM

Goniometer Pre-Testing Procedures

- Determine which joints and motions need to be tested
- Organize test sequence by joint being tested
- Gather necessary equipment: goniometer, towel rolls, & recording forms
- Prepare how you will communicate the procedures to the client

Testing Procedures Pg. 30 & 32

1. PFT maintains good body mechanics and posture during tests
2. Explanation of the Goniometric assessment process & purpose to the client
3. PFT verbally explains the joint being tested
4. PFT demonstrates the movement in testing position first, "Very slowly and deliberate"
5. Client confirms understanding
6. Client gets into proper position and performs movement w/ AROM
7. PFT observes accuracy and client's ability to follow directions
8. PFT may now guide client through AAROM movement
9. PFT now performs AAROM

PFT now performs AAROM

1. Place client in stable position, maintaining posture
2. Place goniometer on appropriate landmark
3. Perform AAROM, assist client in maintaining posture, stability & correct path of motion
3. Read goniometer & record measurement
4. Proceed to next test

Using the Goniometer

The Goniometer

- Body- the ARC of measurement
- Axis- Center of goniometer
- Stabilization Arm (SA)- Contains the axis, is the arm that remains fixed
- Movement Arm (MA)- Only moving arm in the goniometer measurement

Recording Measurements

- Recording results can be done on tables, charts, or with written text (See handouts & appendix C)
- Bilateral comparisons
- Determine beginning, ending degrees.
- Determine Total ROM
- Describe any discomfort or pain reported by client
- List objective information observed by PFT, such as normal pain free motion, as normal (NROM) or (DROM) Decreased ROM ; Compare values obtained with average ROM tables or charts of subjects w/ the same age or gender
- List any special comments

Recording Measurements

- **EXAMPLE:** Elbow Flexion, Starting position 0° , ending position 50° ,
- **TOTAL ROM: 50°**
- **EXAMPLE:** Elbow Flexion, Starting position -15° (hyperextended elbow), ending position 50° , Record as
- **-15° - 0° – 50° , Total ROM: 65°**
- **EXAMPLE:** Elbow flexion, Starting position 20° (hyperflexed elbow), ending position 70° , Record as
- **20° - 70° , Total ROM: 50°**

Explaining Test Results To Clients

- With all fitness testing performed, individuals can be fearful, anxious, & excited by the results, try to put client at ease
- Objectively explain the results, summarize how each joint performed and there relation to posture & body alignment outcomes
- Discuss possible exercise options to enhance ROM of joints, muscular balance, posture, alignment, & exercise performance

Explaining Test Results To Clients

- Discuss possible exercise movements & positions that may put client at risk due to test results
- If necessary, outcomes may require PFT to refer client to a medical provider (2 options)
 1. Refer to medical provider until injury stabilizes
 2. If feasible, design program in conjunction with medical provider
- Finally, describe how you would custom design an exercise program based on the results

ROM Assessment Sequence

- Structure-
- Movement-
- The plane of motion-
- The axis of motion-
- Average range:
- Goniometer Position
- 1. Axis Point:
- 2. Stabilization Arm:
- 3. Movement Arm:
- Stabilization:
- Starting/Ending Body Position:

Structure-The Neck

Movement- Cervical Flexion

- The plane of motion- sagittal
- The axis of motion- coronal
- Average range: 0° - 45°
- Goniometer Position
 1. Axis Point: external auditory meatus
 2. Stabilization Arm: perpendicular to the floor
 3. Movement Arm: parallel to the floor and midline of goniometer is level with the inferior bottom of the nose
- Stabilization: Client is in good posture with a stabilized scapula, thoracic, and lumbar spine.
- Starting/Ending Body Position:
- Client is seated with cervical spine in 0° of flexion, extension, rotation, or lateral flexion. Head is in neutral position. Client performs cervical flexion until the first sign of resistance is reached.



Structure-The Neck

Movement- Cervical Extension

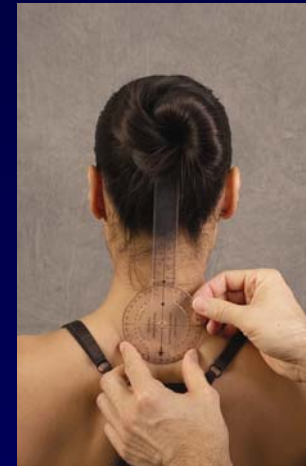
- The plane of motion- Sagittal
- The axis of motion- Coronal
- Average range: 0°-45°
- Goniometer Position
 1. Axis Point: external auditory meatus
 2. Stabilization Arm: perpendicular to the floor
 3. Movement Arm: parallel to the floor and midline of goniometer is level with the inferior bottom of the nose
- Stabilization: Client is in good posture with a stabilized scapula, thoracic, and lumbar spine.
- Starting/Ending Body Position:
- Client is seated with cervical spine in 0° of flexion, extension, rotation, or lateral flexion. Head is in neutral position. Client performs cervical extension until the first sign of resistance is reached.



Structure-The Neck

Movement- Lateral Flexion

- The plane of motion- frontal
- The axis of motion- anterior-posterior
- Average range: 0°-45°
- Goniometer Position
 1. Axis Point: Cervical 7
 2. Stabilization Arm: Perpendicular to the floor
 3. Movement Arm: Midline of the head; occipital protuberance for reference
- Stabilization: Client is in good posture with a stabilized scapula, thoracic, and lumbar spine.
- Starting/Ending Body Position:
 - Client is seated with cervical spine in 0° of flexion, extension, rotation, or lateral flexion. Head is in neutral position. Client performs lateral flexion until the first sign of resistance is reached.



Structure- The Neck

Movement- Cervical Rotation

- The plane of motion-Transverse
- The axis of motion- longitudinal
- Average range: 0° - 60°
- Goniometer Position
 1. Axis Point: Center of subjects head
 2. Stabilization Arm: Perpendicular to the two acromial processes
 3. Movement Arm: Align with the tip of the nose
- Stabilization: Client is in good posture with a stabilized scapula, thoracic, and lumbar spine.
- Starting/Ending Body Position: Client is seated with cervical spine in 0° of flexion, extension, rotation, or lateral flexion. Head is in neutral position. Client performs cervical rotation until the first sign of resistance is reached.



Structure-The Spine

Movement-Lumbar Flexion

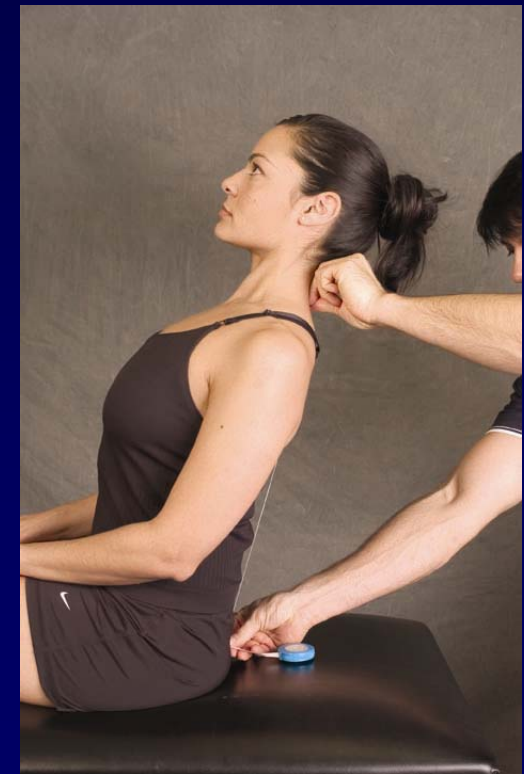
- The plane of motion- Sagittal
- The axis of motion- Coronal
- Average range: 4" Increase
- Tape Measure Position
 1. Top Point: Spinous processes C7
 2. Bottom Point: S1 or level to PSIS-posterior superior iliac spine
- Stabilization: Subject seated on floor or table with pelvis stabilized to prevent anterior/posterior tilting with legs extended.
- Starting/Ending Body Position: Client is in good posture with a stabilized cervical, thoracic, and lumbar spine in 0° of flexion, extension, rotation, or lateral flexion. Head is in neutral position. Client performs lumbar flexion until the first sign of resistance is reached.



Structure-The Spine

Movement-Lumbar Extension

- The plane of motion- Sagittal
- The axis of motion- Coronal
- Average range: 2" difference as spine extends
- Tape Measure Position
 1. Top Point: Spinous processes C7
 2. Bottom Point: S1 or level to PSIS- posterior superior iliac spine
- Stabilization: Subject seated on floor or table with pelvis stabilized to prevent anterior/posterior tilting with legs extended.
- Starting/Ending Body Position: Client is in good posture with a stabilized cervical, thoracic, and lumbar spine in 0° of flexion, extension, rotation, or lateral flexion. Head is in neutral position. Client performs lumbar extension until the first sign of resistance is reached.



Structure-The Shoulder

Movement- Glenohumeral Flexion

- The plane of motion- Sagittal
- The axis of motion- Coronal
- Average range: 0°-90°
- Goniometer Position
 1. Axis Point: Lateral aspect of greater tubercle
 2. Stabilization Arm: perpendicular to the floor
 3. Movement Arm: align with midline of humerus and reference the lateral epicondyle.
- Stabilization: Client is in good posture with a stabilized scapula (retracted), thoracic, and lumbar spine. Stabilize scapula to prevent tilting, rotation, or elevation
- Starting/Ending Body Position:
- Client is seated with glenohumerus in 0° of flexion, extension, abduction, or adduction. Head is in neutral position. Palm of hand should be facing the body. Elbow should be extended completely. Client performs glenohumeral flexion until the first sign of resistance is reached.



Structure-The Shoulder

Movement- Shoulder-Complex Flexion

- The plane of motion- Sagittal
- The axis of motion- Coronal
- Average range: 0°-180°
- Goniometer Position
 1. Axis Point: Lateral aspect of greater tubercle
 2. Stabilization Arm: perpendicular to the floor
 3. Movement Arm: align with midline of humerus and reference the lateral epicondyle.
- Stabilization: Client is in good posture with a stabilized thorax to prevent extension of the spine or rotation.
- Starting/Ending Body Position:
 - Client is seated with glenohumerus in 0° of flexion, extension, abduction, or adduction. Head is in neutral position. Palm of hand should be facing the body. Elbow should be extended completely. Client performs shoulder-complex flexion until the first sign of resistance is reached or if the spine begins to extend or rotate.



Structure-The Shoulder

Movement- Glenohumeral Extension

- The plane of motion- Sagittal
- The axis of motion- Coronal
- Average range: 0°-60°
- Goniometer Position
 1. Axis Point: Lateral aspect of greater tubercle
 2. Stabilization Arm: perpendicular to the floor
 3. Movement Arm: align with midline of the lateral humerus and reference the lateral epicondyle.
- Stabilization: Client is in good posture with a stabilized scapula (retracted), thoracic, and lumbar spine. Stabilize scapula to prevent tilting, rotation, or elevation. Place towel under humerus to stabilize and align with acromion process.
- Starting/Ending Body Position:
- Client is prone on table with glenohumerus in 0° of flexion, extension, abduction, or adduction. Head is in neutral position. Palm of hand should be facing the body. Elbow should be extended completely. Client performs glenohumeral extension until the first sign of resistance is reached.



Structure-The Shoulder

Movement- Glenohumeral Abduction (Palm facing body)

- The plane of motion- Frontal
- The axis of motion- anterior-posterior
- Average range: 0°-90°
- Goniometer Position
 1. Axis Point: 1" distal to the acromion process at the posterior shoulder
 2. Stabilization Arm: perpendicular to the floor
 3. Movement Arm: align with midline of posterior humerus and reference the olecranon process of the elbow.
- Stabilization: Client is in good posture with a stabilized scapula (retracted), thoracic, and lumbar spine. Stabilize scapula to prevent tilting, rotation, or elevation
- Starting/Ending Body Position:
 - Client is seated with glenohumerus in 0° of flexion, extension, abduction, or adduction. Head is in neutral position. Palm of hand should be facing the body. Arm should be extended completely. Client performs glenohumeral abduction until the first sign of resistance is reached.



Structure-The Shoulder

Movement- Glenohumeral Abduction (Palm facing away from body)

- The plane of motion- Frontal
- The axis of motion- anterior-posterior
- Average range: 0°-180°
- Goniometer Position
 1. Axis Point: 1" distal to the acromion process at the posterior shoulder
 2. Stabilization Arm: perpendicular to the floor
 3. Movement Arm: align with midline of posterior humerus and reference the olecranon process of the elbow.
- Stabilization: Client is in good posture with a stabilized scapula (retracted), thoracic, and lumbar spine. Stabilize scapula to prevent tilting, rotation, or elevation
- Starting/Ending Body Position:
 - Client is seated with glenohumerus in 0° of flexion, extension, abduction, or adduction. Head is in neutral position. Palm of hand should be facing away from the body. Arm should be extended completely. Client performs glenohumeral abduction until the first sign of resistance is reached.



Structure-The Shoulder

Movement- Glenohumeral Internal Rotation

- The plane of motion-Transverse
- The axis of motion- Longitudinal
- Average range: 0° - 70°
- Goniometer Position
 1. Axis Point: olecranon process of the elbow.
 2. Stabilization Arm: perpendicular to the floor
 3. Movement Arm: align with lateral midline of ulna and reference the ulnar styloid.
- Stabilization: Client is in good posture with a stabilized scapula (retracted), thoracic, and lumbar spine. Stabilize scapula to prevent tilting, rotation, or elevation. Place towel under humerus to stabilize and align with acromion process.
- Starting/Ending Body Position:
- Client is supine on table with humerus abducted at 90° and elbow is flexed at 90° . Elbow is at 0° of supination and pronation. Client performs glenohumeral internal rotation until the first sign of resistance is reached.



Structure-The Shoulder

Movement- Glenohumeral External Rotation

- The plane of motion-Transverse
- The axis of motion- Longitudinal
- Average range: 0° - 90°
- Goniometer Position
 1. Axis Point: olecranon process of the elbow.
 2. Stabilization Arm: perpendicular to the floor
 3. Movement Arm: align with lateral midline of ulna and reference the ulnar styloid.
- Stabilization: Client is in good posture with a stabilized scapula (retracted), thoracic, and lumbar spine. Stabilize scapula to prevent tilting, rotation, or elevation. Place towel under humerus to stabilize and align with acromion process.
- Starting/Ending Body Position:
 - Client is supine on table with humerus abducted at 90° and elbow is flexed at 90° . Elbow is at 0° of supination and pronation. Client performs glenohumeral external rotation until the first sign of resistance is reached.



Structure-The Hip

Movement- Hip Flexion

(Testing Leg Fully Extended)

- The plane of motion- sagittal
- The axis of motion- coronal
- Average range: 0° - 90°
- Goniometer Position
 1. Axis Point: Greater trochanter of the lateral thigh
 2. Stabilization Arm: lateral midline of the pelvis
 3. Movement Arm: lateral midline of the femur, using the lateral epicondyle as a reference
- Stabilization: Client is in good posture with a stabilized scapula, thoracic, lumbar spine, and pelvic area. Pelvis should not rise off table. Opposite leg not being assessed should have knee flexed and foot flat on table for added stability and protection for the back.
- Starting/Ending Body Position:
 - Client is supine on table with hip in 0° of flexion, extension, abduction, adduction, and rotation. Testing leg has knee fully extended. Client performs hip flexion until the first sign of resistance is reached or until pelvis rotates or knee breaks extension.



Structure-The Hip

Movement- Hip Flexion (Testing Knee Flexed 90° and Hip Flexed 90°)

- The plane of motion- sagittal
- The axis of motion- coronal
- Average range: 0°-120°
- Goniometer Position
 1. Axis Point: Greater trochanter of the lateral thigh
 2. Stabilization Arm: lateral midline of the pelvis
 3. Movement Arm: lateral midline of the femur, using the lateral epicondyle as a reference
- Stabilization: Client is in good posture with a stabilized scapula, thoracic, lumbar spine, and pelvic area. Pelvis should not rise off table. Opposite leg not being assessed should have knee extended on table for added stability and protection for the back.
- Starting/Ending Body Position:
 - Client is supine on table with knee flexed at 90° and hip flexed at 90°; and hip is in 0° of abduction, adduction, and rotation. Knee is flexed to reduce contraction of hamstrings. Client performs hip flexion until the first sign of resistance is reached or until pelvis rotates.



Structure-The Hip

Movement- Hip Extension (Testing Leg Fully Extended)

- The plane of motion- sagittal
- The axis of motion- coronal
- Average range: 0°-30°
- Goniometer Position
 1. Axis Point: Greater trochanter of the lateral thigh
 2. Stabilization Arm: lateral midline of the pelvis
 3. Movement Arm: lateral midline of the femur, using the lateral epicondyle as a reference
- Stabilization: Client is in good posture with a stabilized scapula, thoracic, lumbar spine, and pelvic area. Pelvis should not rise off table. Opposite leg not being assessed should have leg fully extended on table for added stability.
- Starting/Ending Body Position:
- Client is prone on table with hip in 0° of flexion, extension, abduction, adduction, and rotation. Testing leg has knee fully extended. Client performs hip extension until the first sign of resistance is reached or until pelvis rotates.



Structure-The Hip

Movement- Hip Abduction

- The plane of motion- Frontal
- The axis of motion- Anterior-Posterior
- Average range: 0°-45°
- Goniometer Position
 1. Axis Point: Locate at the ASIS (anterior superior iliac spine)
 2. Stabilization Arm: Imaginary horizontal line connecting axis point ASIS to the other ASIS
 3. Movement Arm: anterior midline of the femur, using the midline of the patella as a reference
- Stabilization: Client is in good posture with a stabilized scapula, thoracic, lumbar spine, and pelvic area. Stabilize for lateral trunk flexion on both sides.
- Starting/Ending Body Position:
 - Client is supine on table with hip in 0° of flexion, extension, and rotation. Testing leg has knee fully extended. Client performs hip abduction until the first sign of resistance is reached or lateral trunk flexion occurs on either side.



Structure-The Hip

Movement- Hip Adduction

- The plane of motion- Frontal
- The axis of motion- Anterior-Posterior
- Average range: 0° - 30°
- Goniometer Position
 1. Axis Point: Locate at the ASIS (anterior superior iliac spine)
 2. Stabilization Arm: Imaginary horizontal line connecting axis point ASIS to the other ASIS
 3. Movement Arm: anterior midline of the femur, using the midline of the patella as a reference
- Stabilization: Client is in good posture with a stabilized scapula, thoracic, lumbar spine, and pelvic area. Opposite leg not being tested should be abducted fully to allow for testing hip to be assessed
- Starting/Ending Body Position:
 - Client is supine on table with hip in 0° of flexion, extension, and rotation. Testing leg has knee fully extended. Client performs hip adduction until the first sign of resistance is reached or lateral trunk flexion or pelvic rotation occurs.

