Session Seven

A. Screening Neuro Exam Part II: Motor Exam, Reflexes, Coordination and Gait
B. Screening Musculoskeletal Exam (GALS = Gait, Arms, Legs, and Spine)

1. Learning Objectives

To review the basic neuroanatomy needed to perform the motor exam, reflexes, coordination, and gait exams.
To practice the technique of examining the motor system, reflexes, and coordination.
To identify the surface anatomical landmarks selected bones, joints and muscles.
To practice the techniques of the "GALS" exam of the gait, arms, legs, and spine.
To describe and appreciate the defining features of normal locomotor function.
To develop a flow for the head to toe exam.

2. Student Prep

Read Neuroanatomy handout (see below)
(or pp. 650-658 in Chapter 21 The Nervous System)
Read and view videos at: http://www.neuroexam.com/
Read pp. 593-605, 611-634, Chapter 20 The Musculoskeletal Exam

View online videos at: http://www.neuroexam.com/ especially those listed below

Go to neuroexam.com and use the "Video menu" on the home page to view the following:

MOTOR EXAM	Video 49: Upper Extremity Tone
	Video 50: Lower Extremity Tone
	Video 51: Drift
	Video 52: Rapid Hand Movements
	Video 53: Rapid Foot Tapping
	Video 54: Upper Extremity Strength
	Video 56: Lower Extremity Strength
REFLEXES	Video 58: Deep Tendon Reflexes
	Video 59: Plantar Response
COORDINATION	Video 64: Finger-Nose-Finger

AND GAIT	Video 65: Heel-Shin Video 68: Ordinary Gait, Tandem
CONCLUSION	Video 78: Conclusion

Practice Exercises

On a partner practice the following:

Reflexes: See neuroexam.com Videos 58 and 59. Be sure partner is sitting in relaxed position with the limbs symmetrical, since posture will affect reflexes. Practice adjusting partner's limbs (flexing and extending them slightly) to find optimal positions to help bring out reflexes. Always test each reflex one one side then the other for immediate comparison—e.g. left biceps followed by right biceps followed by left brachioradialis followed by right brachioradialis, etc.

3. Relevant Anatomy for Session Seven:

REVIEW:

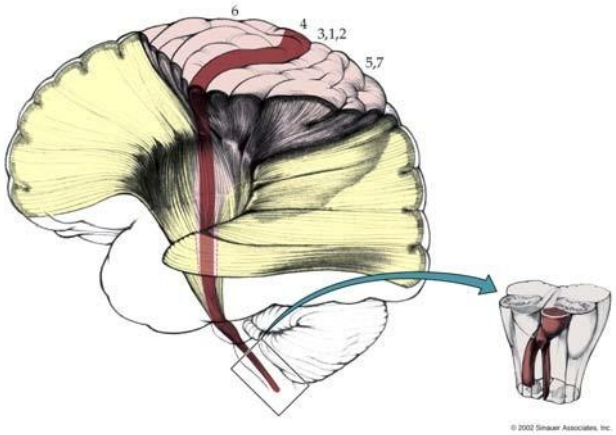
MAIN PARTS OF THE NEURO EXAM

1. **MENTAL STATUS** (last week)
2. **CRANIAL NERVES** (last week)
3. **MOTOR EXAM**
4. **REFLEXES**
5. **COORDINATION AND GAIT**
6. **SENSORY EXAM** (last week)

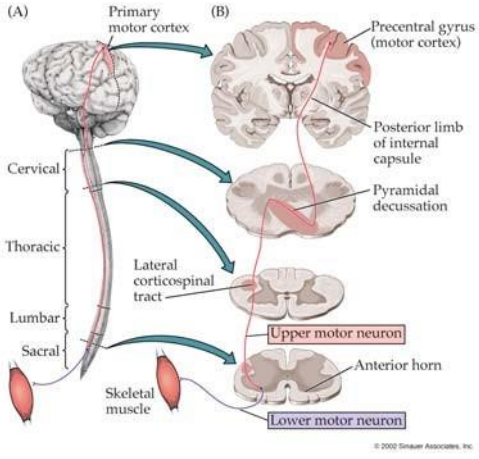
TABLE 7.1 Main Long Tracts of the Nervous System

PATHWAY(S)	FUNCTION	NAME (AND LEVEL) OF DECUSSATION
Lateral corticospinal tract	Motor	Pyramidal decussation (cervicomedullary junction)
Posterior column–medial lemniscal pathway	Sensory (vibration, joint position, fine touch)	Internal arcuate fibers (lower medulla)
Anterolateral pathways	Sensory (pain, temperature, crude touch)	Anterior commissure (spinal cord)

3. Motor Exam: corticospinal tract



3. Motor Exam



3. Motor Exam: Upper vs. Lower Motor Neuron

TABLE 6.4 Signs of Upper Motor Neuron and Lower Motor Neuron Lesions

SIGN	UPPER MOTOR NEURON LESIONS	LOWER MOTOR NEURON LESIONS
Weakness	Yes	Yes
Atrophy	No[a]	Yes
Fasciculations	No	Yes
Reflexes	Increased[b]	Decreased
Tone	Increased[b]	Decreased

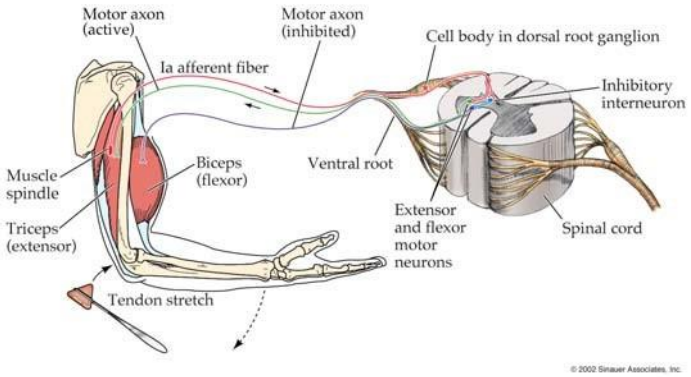
[a] Mild atrophy may develop due to disuse.
[b] With acute upper motor lesions, and tone may be decreased.

4. Reflexes

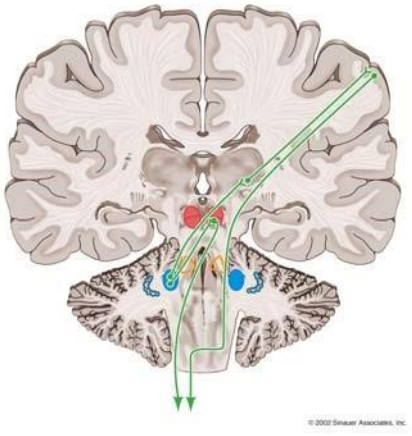
TABLE 3.6 Deep Tendon Reflexes

REFLEX	MAIN SPINAL NERVE ROOTS INVOLVED
Biceps	C5, C6
Brachioradialis	C6
Triceps	C7
Patellar	L4
Achilles tendon	S1

4. Reflexes



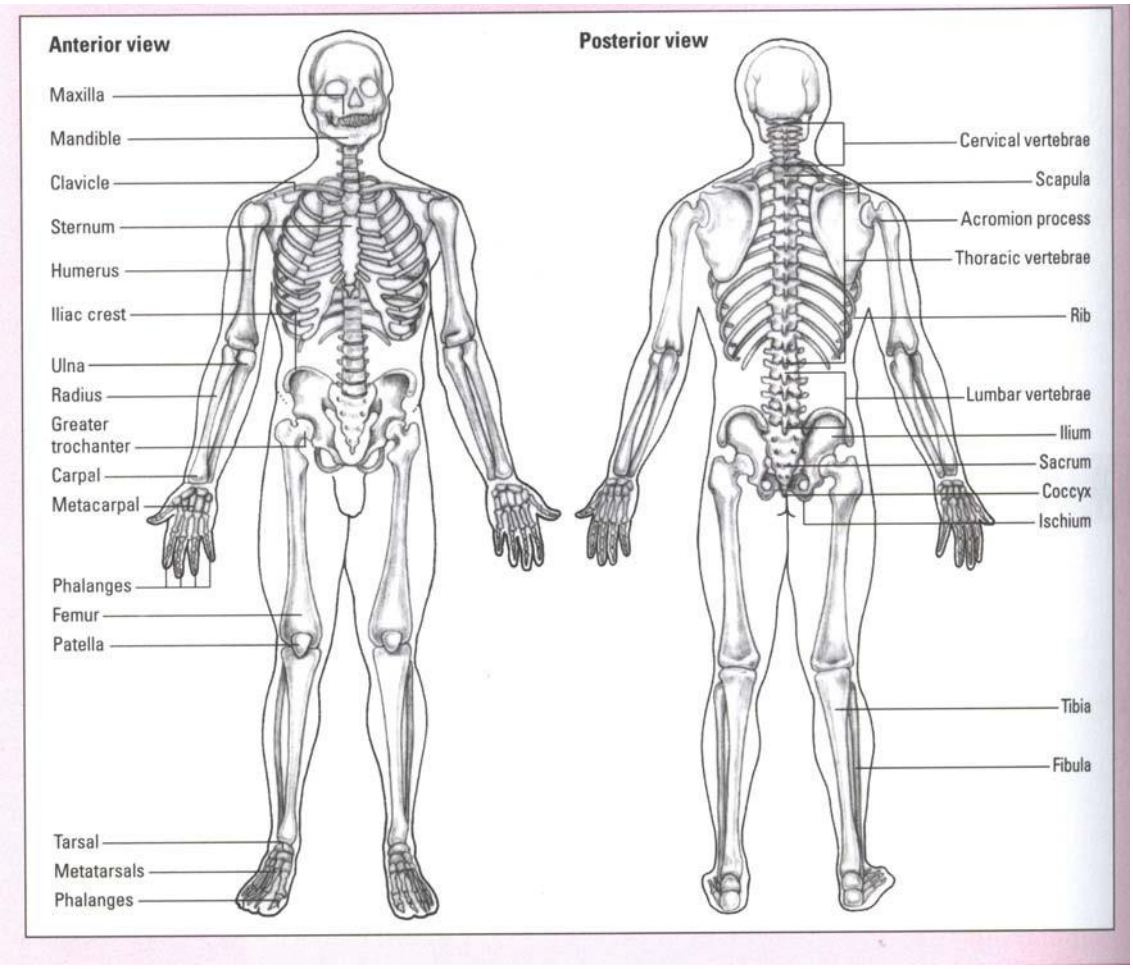
5. Coordination and Gait: cerebellar circuits



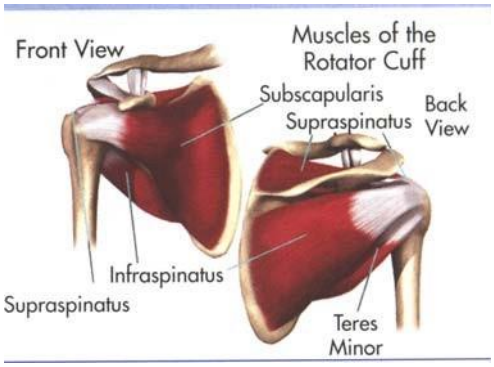
C. Walters, MD and H. Blumenfeld, MD, PhD

Clinical Anatomical Landmarks for "GALS" Exam

Bone and joint landmarks: cervical, thoracic and lumbar spine, glenohumeral joints, acromioclavicular joints, sternoclavicular joints, proximal and distal radioulnar joints, wrists, fingers, metacarpals, metacarpophalangeal (MCP) joints, iliac crests, patellae, fibulae, metatarsals, metatarsophalangeal (MTP) joints



Supraspinatus muscle



4. List of Maneuvers to be Demo/Practiced

Motor Exam, Reflexes, Coordination and Gait

Motor Exam: Drift. Rapid hand and foot tapping. Upper and lower extremity tone. Strength in several proximal and distal muscles in the upper and lower extremities bilaterally (esp. finger extensors, finger abductors, wrist extensors, biceps, triceps, deltoids, iliopsoas, quadriceps, foot/toe dorsiflexors, knee flexors).

Reflexes: Bilateral biceps, brachioradialis, patellar, Achilles tendon and plantar reflexes.

Coordination and Gait: Finger-nose-finger and heel-shin tests bilaterally. Gait and tandem gait (see also "GALS" exam for gait testing).

Note: When clinically appropriate, more detailed testing should be performed for specific parts of the exam.

See video demonstrations (see list above) at http://www.neuroexam.com for details of how to perform these maneuvers.

"GALS" exam of the gait, arms, legs, and spine

Inspection with patient standing:

Identify the following bone, joint and muscle landmarks on your partner:

Cervical, thoracic, lumbar spine, glenohumeral joints, acromioclavicular joints, sternoclavicular joints, proximal and distal radioulnar joints, wrists, fingers, metacarpals, metacarpophalangeal (MCP) joints, iliac crests, patellae, fibulae, metatarsals, metatarsophalangeal (MTP) joints

Gait: inspect the patient walking, turning, and walking back

Spine: inspect the patient standing from three views: from

behind—observe normal spine (and lower limb) features from the side—ask the patient to "bend forward and touch toes"

Examination with patient standing:

palpate over the midpoint of each supraspinatus muscle to elicit hyperalgesia of fibromyalgia.

from the front---lateral cervical flexion--ask the patient to "try to place your ear on your left then your right shoulder in turn"

Arms: Still observing from the front, ask the patient to "place both hands behind your head, elbows back"; "place both hands down by your side, elbows straight"; "place both hands out in front, palms down, fingers straight", "turn both hands over"; "make a tight fist with each hand"; and "place the tip of each finger onto the tip of your thumb in turn".

Squeeze across the second to fifth metacarpals to elicit tenderness due to metacarpophalangeal joint synovitis (which may not be evidenced by swelling)

Inspection with patient standing, then supine:

Legs: Inspect from the front for normal lower limb appearances.

Examination with patient supine: passive flexion of each hip and knee while holding the heel with one hand and the knee with your opposite palm (confirming full knee flexion, no knee crepitus)

passive internal rotation of each hip in flexion (no pain, restriction of motion)

press on each patella for patellofemoral tenderness and palpate for an effusion

squeeze across the metatarsals for tenderness (due to metatarsalphalangeal disease)

inspect both soles for calluses, reflecting abnormal weight bearing (spine, hip, knee, or foot abnormality)

5. Procedural Tips

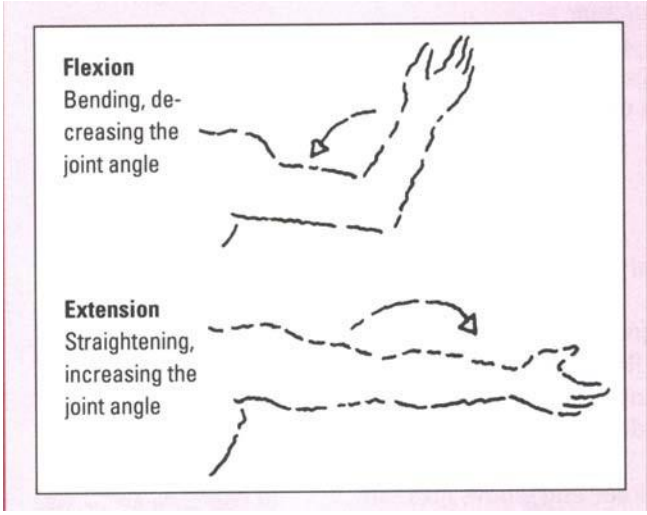
Memory Testing:

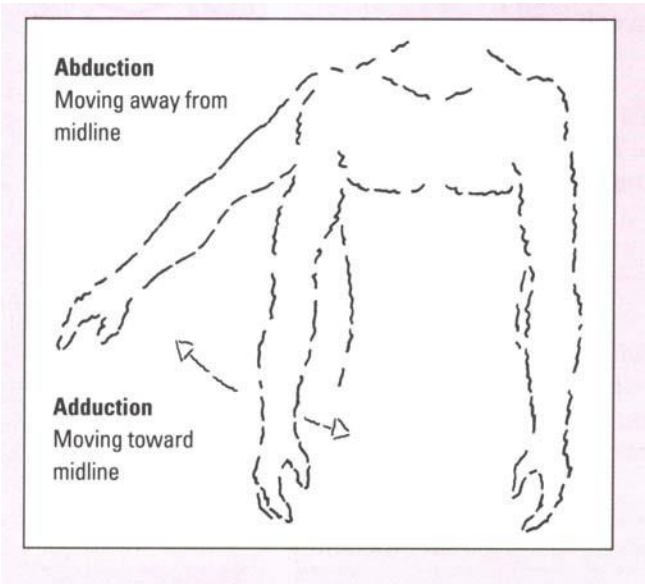
Ask patient to recall three words. Establish their ability to repeat them back immediately to ensure there is no problem with initial registration. Wait 3-5 minutes, while distracting patient with other tests. To avoid forgetting (!) to ask them the words, and to ensure sufficient time has past, it is best to use a timer (stopwatch/alarm on digital watch). If this is not available, always ask for the words at a consistent interval later in the exam—e.g. after completing the cranial nerve examination (mnemonic: tongue exam reminds you to ask for the words).

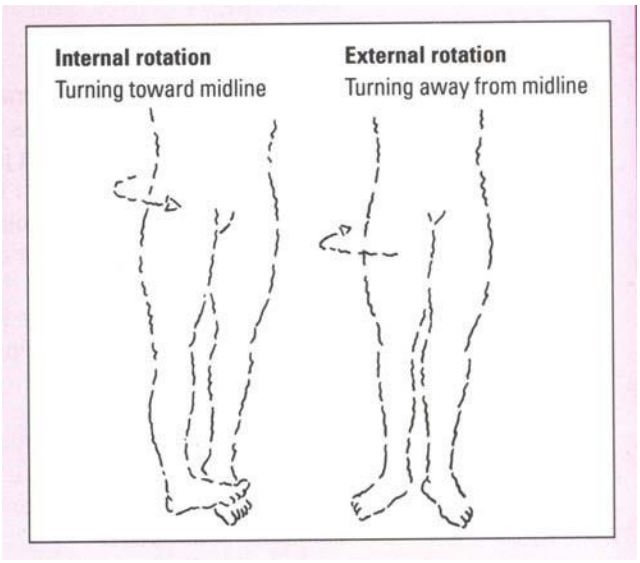
See also http://www.neuroexam.com for additional procedural details.

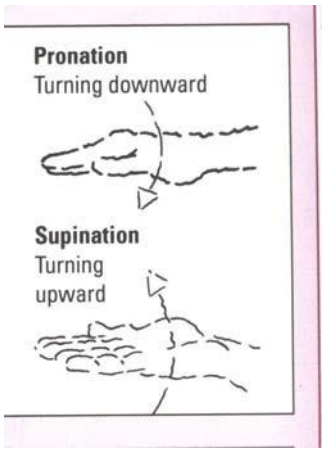
"GALS" exam of the gait, arms, legs, and spine:

Compare and contrast the range of motion of ball-and-socket with that of hinge joints. The shoulder and hip are ball-and-socket joints allowing for flexion, extension, adduction, abduction, and internal and external rotation. In contrast, the knee and elbow are hinge joints only allowing for flexion and extension. Point out that the proximal and distal radioulnar joints allow for pronation/supination of the forearms.









6. Perceptual Tips

Gait Testing This is a crucial functional test that should be performed on ALL patients unless medically contraindicated. Observe patient walking naturally approximately 15 feet, turn and then walk back to starting position. Observe that normally:

1. Patient can rise from chair unassisted, and can walk without support.

2. Both arms swing slightly with each step in a symmetrical manner.

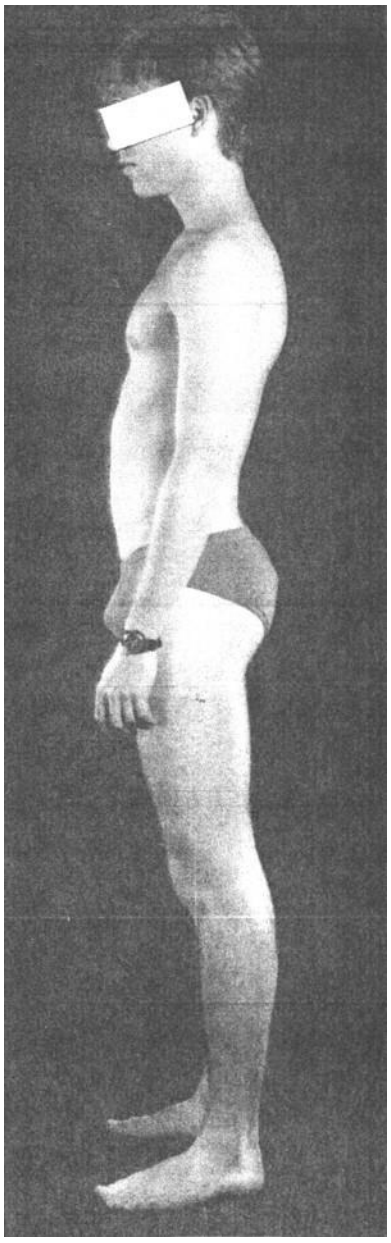
3. Legs are no farther apart than approximately shoulder width.

4. The knees bend smoothly, and legs swing nearly straight forward and back.

5. Turn is executed in no more than 2-3 steps.

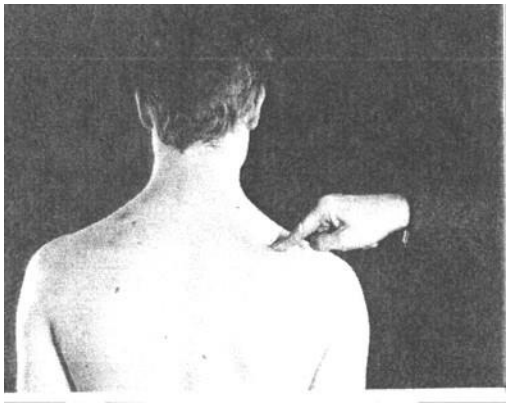
6. Posture is upright, and gait is fluid and stable.

<u>Appreciating normal locomotor function</u>:



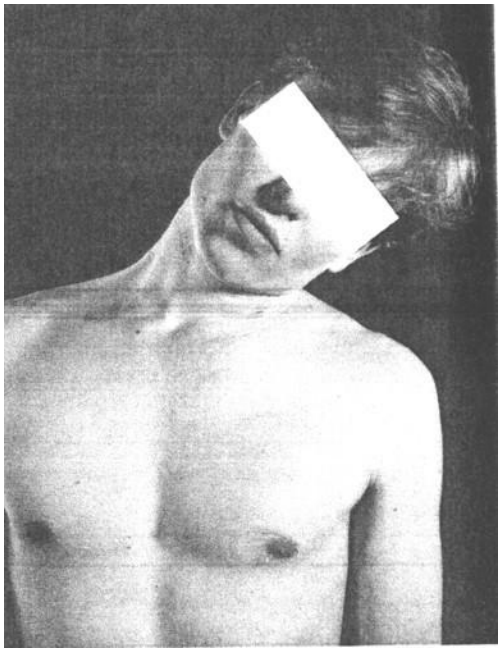
Maneuver: Inspection from the side for normal spinal curvatures

Observation: Normal cervical and lumbar lordosis (concavity)
Normal (mild) thoracic kyphosis (convexity)



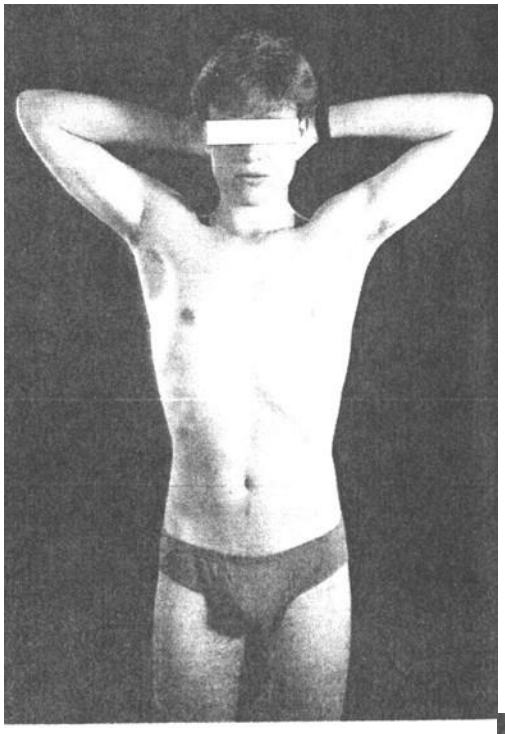
Maneuver: Palpation over the midpoint of each supraspinatus muscle

Observation: Absence of hyperalgesia of fibromyalgia



Maneuver: Lateral neck flexion

Observation: Normal range of lateral neck flexion (45 degrees toward each shoulder)

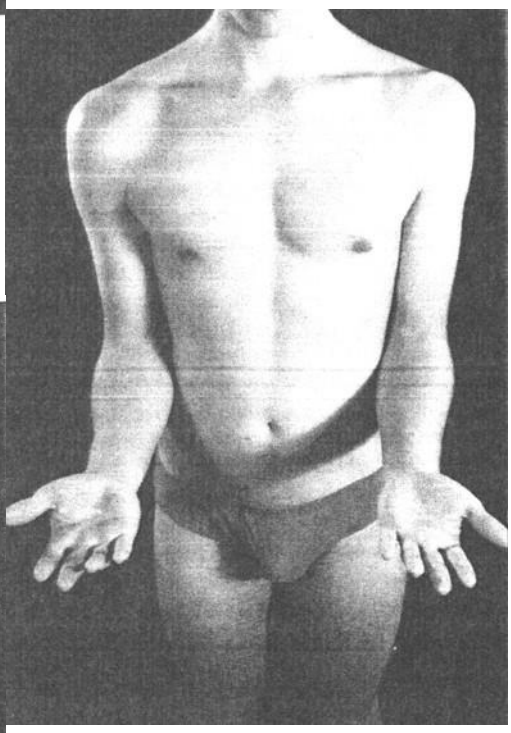


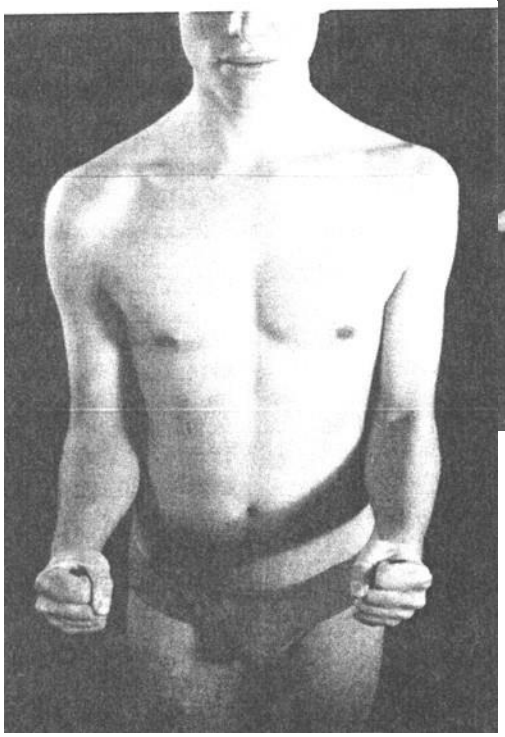
Maneuver: Arms behind head, elbows back

Observation: Normal pain free range of motion of the shoulder (a combination of glenohumeral and scapulothoracic -- acromioclavicular and sternoclavicular—joint range of motions— abduction 120 degrees and external rotation 45 degrees)

Maneuver: Pronation/supination of forearms
Extension of fingers

Observation: Normal range of motion of proximal and distal radioulnar joints
Normal palms (absence of swelling, muscle wasting, erythema)
Ability to fully extend fingers



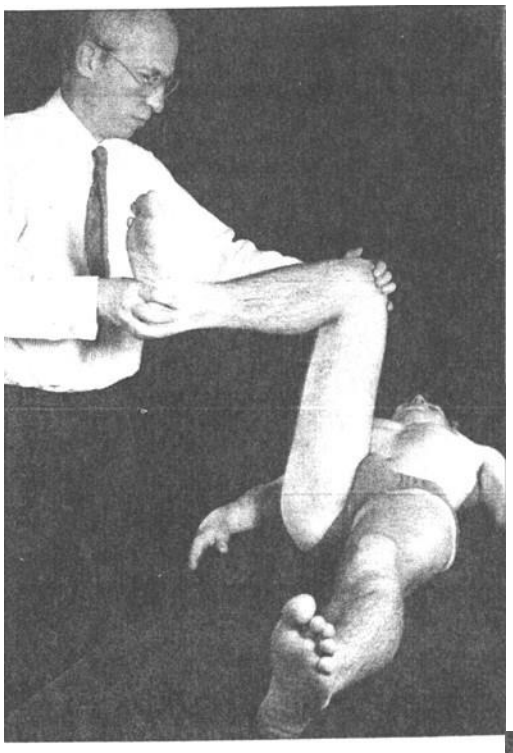


Maneuver: Hand grip

Observation: Normal grip

Maneuver: Squeeze across the second to fifth metacarpals

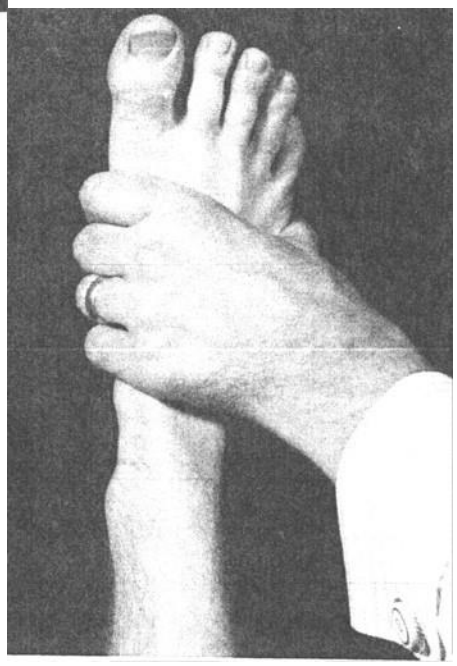
Observation: Normal metacarpophalangeal (MCP) joints (absence of tenderness due to MCP joint synovitis –which may not be evidenced by swelling)



Maneuver: Flex each hip and knee while holding the knee
Passively internally rotate each hip in flexion

Observation: Full passive knee flexion (135 degrees from an extended position) and absence of knee crepitus
Absence of hip pain or restriction of motion

Maneuver: Squeeze across the first to fifth metatarsals



Observation: Normal metatarsophalangeal (MTP) joints (absence of tenderness due to MTP joint disease)

7. Description of Key Features will be covered in a separate session on the write-up of the neurologic exam and musculoskeletal exam.