

## MUSCULOSKELETAL EXAMINATION

Examination of the musculoskeletal (MS) system can be one of the most complex aspects of the general physical exam. The extent of the examination must vary according to the problem(s) being assessed and the time available to perform the exam. Levels of complexity of the exam can be expressed as follows:

1. Screening exam of MS system: performed on nearly all patients; detects abnormalities of function not always apparent on history and may provide diagnostic clues to clinical questions.
2. Detailed examination of symptomatic region of the musculoskeletal system (e.g., the patient complaining of knee pain).
3. Examination of the patient with established systematic disorder affecting the musculoskeletal system (e.g., rheumatoid arthritis) under treatment.
4. Examination of the new patient with diffuse musculoskeletal complaints.

The “screening” exam can concentrate on inspection and observation of function. Pathology involving the joints very rarely produces symptoms without effect on function.

Prior to specific examination of the musculoskeletal regions, the patient’s general appearance, bodily proportions and ease of movement should be noted.

### **Required Equipment:**

No additional equipment is required

### **Optional Equipment**

Gonimeter (to measure angles)

Stethoscope (to auscultate temporomandibular joint (TMJ))

Non-elastic tape measure

### **Examination Techniques:**

Inspection – Visual examination, range of motion of joints (active and passive)

Palpation – Joint muscle examination, use finger tips and thumbs

Percussion – Use ulnar surface of fist for spine examination

Motor Examination – Neuromuscular testing for strength, sensation and reflexes.

(will be covered in neurology section of course)

Auscultation – Use stethoscope on TMJ and audible tendinous rubs

Special maneuvers – Techniques used to elicit otherwise occult findings

## **Screening Approach to the Patient without a Targeted Complaint.**

Any abnormal findings should be followed up with a detailed exam.

### **Patient Seated on Examination table facing the examiner.**

Hands/Wrists:

1. Assess Range of Motion (Actively, done by patient)
  - a. Finger flexion, extension, abduction and adduction
  - b. Thumb flexion, extension, abduction, and adduction
  - c. Wrist flexion, extension, radial deviation (adduction) and ulnar deviation (abduction).
2. Inspect digits for joint enlargement or deformity
3. Inspect dorsum of the hands for intrinsic atrophy (prominence of extensor tendons)
4. Inspect palms of hands for palmar nodules, hypthenar, or thenar muscle atrophy

Elbows:

1. Assess Range of Motion (Actively, done by patient)
  - a. Instruct patient to flex and fully extend elbows
  - b. With Elbows flexed to 90°, have patient supinate and pronate each hand
2. Inspect the humeral epicondyles, olecranon for deformity
3. Palpate the lateral and medial humeral epicondyles for tenderness (Tennis elbow, Golf Elbow)

Shoulders:

1. Assess Active Range of Motion. Instruct patient to:
  - a. Raise (Abduct) both arms above the head
  - b. Place hands behind the neck to assess abduction and external rotation
  - c. Place hands behind the small of the back to assess internal rotation
2. Inspect the shoulders for Asymmetry (height, muscle bulk, position, bony prominences)

Cervical Spine:

1. Note position of cervical spine, kyphosis, posture
2. Ask patient to flex and extend, rotate right and left, and sidebend right and left, note any pain or restrictions of movement.

### **Patient Lying Supine on Examination Table**

#### Hips:

1. Assess Passive Range of motion – flexion, internal and external rotation
2. Gently palpate the Greater Trochanters of both femurs for tenderness

#### Knees:

1. Inspect for valgus or varus deformities, joint line hypertrophy, effusion
2. Passively flex and extend knees while palpating for crepitus

### **Patient Standing**

#### Feet:

1. Inspect for foot and ankle deformities:
  - a. pes planus, pes cavus
  - b. Hallux Valgus
  - c. Hammertoes, Claw Toes
2. Instruct patient to walk, inspect for internal or external rotation of feet during gait

### **Patient Standing, with his/her Back to the examiner**

#### Thoracolumbar Spine

1. Inspect for scoliosis, rib asymmetry, thoracic kyphosis, lumbar lordosis
2. Ask patient to flex forward, extend backward, rotate to the right and left (while stabilizing the pelvis), and sidebend right and left, note any restrictions of movement.

#### Scapular Position

1. inspect for any scapular winging

## Description of a Detailed Musculoskeletal Examination

*Patient in gown seated on examination table. Examiner stands facing patient.*

### A. Hands

1. Inspect hands  
Note: Swelling                      Deformity  
          Redness                      Muscular atrophy  
          Nodules                      Joint symmetry  
          Ability to make fist (tests function)
2. Assess range of motion (active range of motion, done by the patient)
  - a. Instruct patient to flex and extend fingers of both hands; patient should attempt to touch tips of fingers to palmar crease at level of metacarpophalangeal joints.
  - b. Have patient make fist with thumbs across the knuckles
3. Palpate the following interphalangeal joints
  - Distal
  - Proximal
  - MetacarpophalangealNote: Swelling, boggieness (soft, water logged or swollen deeper tissues that hinder function), tenderness, bony enlargement

### B. Wrists

1. Inspect wrists  
Note: Swelling                      Deformity  
          Redness                      Muscular atrophy  
          Nodules                      Joint symmetry
2. Assess active range of motion (done by patient)  
With arms extended palms turned down, instruct patient to:
  - a. Flex wrist to  $90^{\circ}$  downward
  - b. Extend wrist to  $90^{\circ}$  upward  
With arms in neutral position (handshake position), instruct patient to:
  - a. Supinate wrist to  $90^{\circ}$
  - b. Pronate wrist to  $90^{\circ}$Note: Supination and pronation are motions that originate from the elbow but are demonstrated at the wrists.

3. Place thumb on dorsum of patient's wrist with fingers beneath it. Palpate the following joints:

- Metacarpocarpal
- Carporadial
- Carpoulnar

Note: Swelling  
Synovial Bogginess  
Tenderness

4. Clinical correlate: Carpal tunnel syndrome – compression of the median nerve between the flexor retinaculum and the deeper carpal bones. Neuropathic symptoms (pain and paresthesias) are present along a median nerve distribution (affecting the thumb, index, middle fingers and the lateral half of the ring finger).

Tinel's sign – Hyperextend the wrist and tap the median nerve with your middle finger or reflex hammer. A positive sign is pain or paresthesias radiating down the palm into the index, middle, and lateral half of ring finger (median nerve distribution).

Phalen's test – Flex the wrist to  $90^{\circ}$  and maintain it for at least 40-60 seconds. A positive test would be pain or paresthesias in the median nerve distribution. Phalen's test is more sensitive than Tinel's sign.

Median Nerve Compression test – The most accurate physical exam test for carpal tunnel syndrome. Firmly compress the median nerve with your thumb at the flexor retinaculum for about 40 seconds. A positive test would be pain or paresthesias in the median nerve distribution. This test is also called the carpal compression test.

### C. Elbows

1. Assess active range of motion
  - a. Instruct patient to extend and flex elbow
  - b. With arms extended, have patient supinate and pronate each hand
2. With patient's forearm supported and elbow flexed to about  $70^{\circ}$  palpate the following:

- Extensor surface of ulna
- Olecranon process

Note: Swelling                      Nodules

- Groove on either side of olecranon process. Remember, the ulnar nerve  
Runs through the medial groove.

Note: Thickening                      Swelling  
Tenderness

3. Clinical correlate: ulnar nerve entrapment at ulnar groove leading to neuropathy and distal muscle atrophy of hypothenar muscles (the digiti minimi muscles).
4. Press on the lateral epicondyles  
Note: Tenderness
5. Clinical correlate: Tennis elbow or lateral epicondylitis – tenderness of extensor tendons originating at the lateral epicondyle.

#### **D. Shoulders and Environs**

1. Inspect shoulders and shoulder girdle anteriorly  
Note:      Swelling              Joint symmetry  
              Deformity              Muscular atrophy
2. Inspect scapula and related muscles posteriorly
3. Assess active range of motion
  - Screen for shoulder abnormalities by having patient clasp hands behind head and extend arms so that elbows are “up against the wall” parallel to coronal plane.
  - With arms at sides, abduct arm to  $90^{\circ}$  (abduction)
  - With scapular motion elevate arm to  $180^{\circ}$  (move arms to a vertical position near head)
 Note: Symmetry and rhythm of movement

With patient's arm at side ( $0^{\circ}$ )

- a. Flex shoulder forward to  $180^{\circ}$
  - b. Flex shoulder backward to  $60^{\circ}$  (without scapular motion)
  - c. Adduct shoulder to  $30^{\circ}$
  - d. Have patient place hands behind small of back (internal rotation to  $90^{\circ}$ )
  - e. Place hands behind neck with elbows out to side (external rotation to  $90^{\circ}$ )
4. Palpate the following:
    - Acromioclavicular joint
    - Greater tubercle of humerus
    - Biceps groove
    - Coracoid process
    - Glenohumeral joint
    - Subdeltoid bursa
 Note: Tenderness              Fluid
  5. Clinical correlates: deltoid muscle atrophy and shoulder joint effusion.

6. Clinical Correlate: Hawkins impingement test for supraspinatus tendonosis. The examiner gently but firmly, internally rotates the proximal humerus when the arm is forward flexed to  $90^{\circ}$  and slightly adducted.

## E. Head and Neck

1. Inspect Neck

Note: Deformities                      Abnormal posture

2. Assess active range of motion for cervical spine (head and neck)

Instruct patient to:

- a. Touch chin to chest (flex neck) – Normal is  $45^{\circ}$  of flexion.
- b. Touch chin to each shoulder (rotate neck) – Normal is  $70^{\circ}$  of rotation, each side.
- c. Touch ear to corresponding shoulder (lateral bending) – Normal is  $40^{\circ}$  of lateral bending, each side
- d. Put head back (extend neck) – Normal is  $45^{\circ}$  of hyperextension of neck.

3. With index fingers, gently palpate the following joints:

- a. Sternoclavicular
- b. Manubriosternal
- c. Costochondral

Note:            Fluid                      Tenderness  
                  Swelling

4. With finger pads, palpate the following structures:

- a. Cervical spine
- b. Paracervical muscles
- c. Trapezius muscles
- d. Rhomboids

Note:            Tender nodules in muscles or specific tender areas.

5. Palpate temporomandibular joint (TMJ)

- Place first two fingers of each hand in front of tragus of ear and have patient open and close mouth
- Instruct patient to open and close mouth; assess degree of maximal opening (patient should be able to place 3 vertically-placed fingers in mouth).
- Also, with mouth open, mandible should move laterally to each side at least 1.5cm.

Note:            Range of motion    Tenderness  
                  Swelling                      Crepitus  
                  Pain

6. Auscultate TMJ, if crepitus suspected, while patient opens and closes mouth.

7. Spurling's test or Vertex Compression test (for cervical radicular pain or paresthesia)  
Forcibly press down vertically on top of the head to compress the cervical nerve roots. Normally this is well tolerated. Avoid doing this test on elderly, frail individuals or patients with serious spine disease or injury (also see k.4.)

*Patient seated with legs hanging over table. Examiner sits in front of patient.*

## **F. Feet**

1. Inspect feet

Note:      Swelling                      Calluses  
                 Deformity                      Corns  
                 Nodules                          Flat feet

2. Have patient curl and extend toes, then "cup" the arch of the foot to screen for abnormalities. This also assesses active range of motion. Note any deformity like claw toe or hammer toe (see lecture slides).
3. Compress the forefoot between thumb and fingers at the level of the metatarsal phalangeal joints. A painful interdigital neuroma (Morton's neuroma) is usually found by palpating between the 3<sup>rd</sup> and 4<sup>th</sup> metatarsal bones, using thumb and index finger.
4. With thumbs on sole of foot and fingers on top of foot, bilaterally palpate the following joints and entheses:
  - Distal interphalangeal
  - Proximal interphalangeal
  - Metatarsophalangeal
  - Origin of plantar fascia into calcaneus (plantar fasciitis leads to tenderness to palpation at this site)
5. Bilaterally assess passive range of motion (done by examiner)
  - Stabilize heel
  - Rest heel in one hand and grip forefoot with other hand:
    - a. Invert foot
    - b. Evert foot
    - c. Flex toes on metatarsophalangeal joint
6. Palpation of the foot
  - Palpate for any bony deformity
  - Compress forefoot gently, then firmlyNote: Presence of metatarsal disease (tenderness)

## **G. Ankles**

1. Inspect ankles
2. To screen for abnormalities, have patient flex, extend, invert and evert the foot (active range of motion).
3. Palpate anterior surface of ankle joint
4. Palpate Achilles (gastrocnemius) tendon assess for tendonitis  
Note: Nodules                      Tenderness (at insertion into calcaneus)
5. Assess passive range of motion (done by examiner)  
With thumb on top of foot and four fingers underneath, grip foot
  - a. Dorsiflex the ankle
  - b. Plantar flex the ankleNote: Subtibial motion

To stabilize ankle, grip calcaneus and subtalar joint from behind with one hand and heel with other hand:

- a. Invert foot
  - b. Evert foot
- Note: Subtalar motion

Still stabilizing ankle:

- c. supinate forefoot
  - d. pronate forefoot
- Note: Transverse tarsal joint motion

*Patient supine. Examiner stands at foot of table.*

## **H. Knees**

1. Inspect knees  
Note: Alignment – valgus (lateral malalignment of lower leg) or varus (medial malalignment deformity)  
Deformity  
Quadriceps atrophy  
Absence of normal hollows around patella (suggests fluid in joint or fat around knee)  
Knock knee (genu valgum)  
Bowleg deformity (genu varum)  
Popliteal fossa swelling (possible Baker's cyst)



9. Lachman's test: Flex knee slightly to about  $20^{\circ}$  and one hand stabilizes the lower femur while the other holds the tibia above the tibial tuberosity and then pulls and pushes the tibia to assess laxity of anterior and posterior cruciate ligaments.
10. Drawer test: Patient is supine, knee is flexed about  $90^{\circ}$ , examiner sits on patient's foot, grabs the upper leg and pulls it anteriorly and posteriorly to assess for laxity of the respective cruciate ligaments. When done properly Lachman's test is more sensitive.

*Patient supine with legs straight together. Examiner begins standing to right of examination table and then moves to the left.*

## **I. Hips**

1. Assess passive range of motion
  - a. Rotate each extended leg externally and internally and then return to original position. Repeat maneuver with each knee and hip partially flexed at knee. Should have about  $45^{\circ}$  of internal and external range of motion.
  - b. Check for full extension of hip ( $0^{\circ}$ ) and active flexion ( $\sim 110^{\circ}$ ) as well as passive flexion ( $\sim 130^{\circ}$ ).
  - c. Thomas test (to detect occult hip flexion contracture): Have patient flex right knee and pull firmly against abdomen. This flattens the normal lumbar lordosis.  
 Note: Degree of flexion of left hip  
 Position of left hip (If hip remains on table, it's a negative test, if hip flexes and thigh is off the table, it's a positive test.)  
 Repeat for left hip
  - d. With the leg extended
    - Abduct hip to  $60^{\circ}$
    - Adduct hip to  $30^{\circ}$
 Repeat maneuver for other leg
  - e. With patient prone, straighten one leg on examination table to stabilize pelvis and extend other leg to  $15^{\circ}$ . (Repeat for other leg) this tests for normal hyperextension.
2. Patrick's or FABER test (flexion, abduction, external rotation of the hip) to test for hip or sacroiliac joint disease.
  - a. Place patient's left foot on the right distal quadriceps just above the patella. Gently but firmly press the left knee to the exam table.  
 Note: Tenderness of posterior hip or back.

Repeat the maneuver with the other leg.

3. See special maneuvers (k) for Trendelenburg test (k.1.a.)

*Patient stands with back to examiner. Gown parted to allow adequate spine visualization.*

## **J. Spine**

1. Inspect spinal profile

Note: Cervical lordosis                      Shoulder height symmetry  
Dorsal kyphosis                              Iliac crest symmetry  
Lumbar lordosis                              Lateral curvature (concave or convex)—scoliosis  
Skin creases below buttocks

2. Inspect patient's gait

Note: Smoothness  
Uninterrupted motion  
Antalgic gait related to pain

*Patient bends slowly forward as far as possible with back to examiner*

3. Inspect dorsolumbar spine

Note: Symmetry of movement as patient flexes and extends  
Smooth curve of spine  
Range of motion (how far can patient bend); Normal is about 90°  
Compare convexity of lumbar curve  
Rib hump (elevated shoulder) or lateral curvature of the spine (scoliosis)

*Patient stands with back to examiner. Examiner seated and stabilizes patient's pelvis with hands.*

4. Assess active range of motion

Have patient perform the following maneuvers:

- a. Bend to the right and then left (lateral bending, 35°)
- b. Bend back towards examiner (extension, 35°)
- c. Twist shoulders to right then left (rotation, 30°)

*Patient stands with back to examiner. Examiner sits or stands behind patient.*

5. Palpate spinous processes

Note: Tenderness

6. Palpate paravertebral muscles

Note: Spasm

Tenderness

Firmness or hypertonicity

7. Palpate intervertebral spaces

8. Percuss spine

Use ulnar surface of fist

Note: Pain

Tenderness

9. When patient is supine, can perform straight leg raising test (see k.1.b. below)

**K. Special Maneuvers**

1. Perform the following maneuvers on patients suspected of having sacroiliac disease, herniated nucleus pulposus (disc), hip abnormality, or neurologic disease which may involve the legs.

a. Trendelenburg sign (to detect gluteal weakness)

- Assess both hips
- Having patient stand on one leg and note if opposite hip remains parallel or slightly elevated (normal or negative). A positive Trendelenburg sign occurs when the opposite hip falls below the parallel plane. This indicates weak intrinsic muscles of the hip opposite to the fallen one.

b. Straight leg raising test (to detect hip or sciatic disease)

- With patient supine, raise patient's leg up to  $70^{\circ}$  from examination table, then sharply dorsiflex the forefoot; this indicates a positive test if there is pain radiating down the posterior leg to at least the popliteal fossa. Raising the leg beyond  $70^{\circ}$  is not necessary.
- Increased pain down the affected leg when the opposite (contralateral) leg is raised is a positive crossed straight leg raising sign.

c. Patrick's Test (to detect hip or sacroiliac disease) or FABER test

- With patient supine, have patient place right ankle on left knee just proximal to patella.
- Stabilize pelvis and sharply, externally rotate hip, with right knee approaching the table.
- Repeat for other side.

d. Pelvic compression (to detect sacroiliac disease)

- With patient lying on side, apply pressure to hip joint.
- Repeat for other side.

- e. Modified Shober's test (to detect and quantify restrictions of lumbar flexion)
  - With patient standing, locate posterior iliac spines (indicated by "dimples of venus") and mark site over spine at their level.
  - From this line, measure 10cm superiorly and make second mark.
  - Holding 0-point of tape measure at first mark, have patient bend over and attempt to touch toes.
  - Note maximum excursion of second mark and record. Normal excursion is 5-7 cm.
  
- 2. Measure the length of each leg by placing tape measure at anterior iliac spine and measuring to the medial malleolus.
  
- 3. McMurry's Test (see Judge p.397) to test for meniscal tears in the knee. Can also hyperextend and hyperflex the knee to assess for pain on the medial or lateral knee joint, corresponding to the respective meniscus.
  
- 4. Vertex Compression test (to assess neck and arm pain from cervical nerve root compression). Place both hands on top of head and press downward. Reproduction of the pain is a positive test.
  
- 5. Adson's test for thoracic outlet syndrome. Patient takes a deep breath, hyperextends his/her head and rotates head to the affected side while examiner palpates the radial pulse. A decrease pulse is a positive test. If negative, repeat maneuver with the head rotated to opposite side.
  
- 6. If spondylitis (arthritis of the spine) is suspected, measure the patient's chest expansion in full inspiration and expiration. Use non-elastic tape measure and place at level of xiphoid process. Measure the circumference.