

Musculoskeletal Assessment

Introduction

Focused musculoskeletal assessment begins with a thorough health history. While doing so, observe carefully for signs of pain or discomfort. Order of examination is performed as inspection, palpation, range of motion, and special maneuvers. The full musculoskeletal assessment takes place as head-to-toe regional joint examinations.

Exam methods

- **Inspection.** Examine for joint symmetry, deformities or malalignment. Inspect the surrounding tissues, noting any swelling, muscle atrophy or skin changes.
- **Palpation.** Palpate the musculoskeletal structures keeping in mind the underlying anatomy of the joints. Note any crepitus, tenderness, fluid collection, or inflammation.
- **Range of motion (ROM).** Assess the two phases of range of motion: active and passive. Note any limitations in movement or joint instability.
- **Special maneuvers.** Special maneuvers can help identify common conditions specific to certain joints. Perform stress maneuvers (if indicated) to assess joint stability, ligaments, tendons, and bursae.

Temporomandibular Joint (TMJ)

- **Inspection.** Assess for swelling or redness, noting the laterality. Observe for symmetry.
- **Palpation.** Palpate the masseter, temporal, and pterygoid muscles.
 - The masseter muscle is located at the angle of the mandible.
 - The temporal muscles are palpated at the temple bilaterally with clenching and relaxation of the jaw.
 - The pterygoid muscles are located internally between the tonsillar pillars and can be difficult to palpate.
- **ROM.** Observe for crepitus or clicking upon opening and closing of the mouth. Observe for symmetry of motion. Range of motion of the TMJ includes three movements:
 - Opening and closing of the mouth
 - Protrusion and retraction (pushing the mandible forward)
 - Lateral (side-to-side) motion of the mandible

Shoulder

- **Inspection.** Anterior inspection of the shoulder involves the shoulder girdle, with posterior inspection of the scapula and related muscles. Observe for swelling, bulges, atrophy, deformity, fasciculations, or abnormal positioning.
- **Palpation.** Observe carefully for tenderness, crepitus, and deformities. Palpate from the sternoclavicular joint along the clavicle laterally to the acromioclavicular joint. Posteriorly, follow the bony spine of the scapula laterally and upward until fingers meet the acromion. Identify the anterior tip of the acromion. Then place your thumb on the distal end of the clavicle at the acromioclavicular joint. Moving the thumb immediately and down, the coracoid process of the scapula is then identified. To palpate the biceps tendon, your thumb should remain on

the coracoid process with fingers on the lateral aspect of the humerus. Then place your index finger midway between the coracoid process and the greater tubercle on the anterior surface of the arm. Then palpate the subacromial subdeltoid bursa and the SITS muscles (supraspinatus, infraspinatus, teres minor, and subscapularis) by lifting the elbow posteriorly, rotating the structures to position them anterior to the acromion. Lastly, palpate the capsule and synovial membrane beneath the anterior and posterior acromion.

- **ROM.** The shoulder girdle accommodates six movements: flexion, extension, abduction, adduction, internal rotation, and external rotation. These motions are assessed by the following, observing for crepitus, deformity, or pain:
 - *Flexion.* Ask the patient to raise arms in front and overhead.
 - *Extension.* Ask the patient to raise arms behind him/her.
 - *Abduction.* Ask the patient to raise arms out to the side and overhead.
 - *Adduction.* Ask the patient to cross his/her arm across the front of their body.
 - *Internal rotation.* Ask the patient to reach behind to touch their shoulder blade, noting the highest midline spinous process they can reach.
 - *External rotation.* Ask the patient to place their hand behind his or her neck.
- **Special Maneuver.**
 - If atrophy of the shoulder muscles is noted, assess for scapular winging. Have the patient extend both arms and push either against your hand or against a wall; observe the scapulae. If the scapulae protrude away from the thorax, this is a positive finding for scapular winging.

Elbow

- **Inspection.** Support the patient's forearm with the elbow flexed to 70°. Inspect the contours of the elbow, extensor surface of the ulna and olecranon process for nodules or swelling.
- **Palpation.** Palpate the olecranon process and epicondyles observing for tenderness or warmth. The synovium and olecranon bursae are not normally palpable.
- **ROM.** The elbow accommodates four movements: flexion, extension, pronation, and supination. These motions are assessed by the following, observing for crepitus, deformity, or pain:
 - *Flexion.* Ask the patient to bend arm at the elbow.
 - *Extension.* Ask the patient to extend their arm.
 - *Pronation.* Ask the patient to turn their palms up.
 - *Supination.* Ask the patient to turn their palms down.
- **Special Maneuver.**
 - *Cozen test.* This tests for lateral epicondylitis (tennis elbow). Palpate the lateral epicondyles, then ask the patient to pronate and extend the wrist against resistance. If pain is reproduced along the lateral aspect of the elbow, the Cozen test is positive.

Wrist and Hand Joints

- **Inspection.** Inspect the position of the hands while in motion and at rest. The wrist, hand, and finger bones should be observed for swelling, deformities, atrophy, thickening, or contractures.
- **Palpation.** Observe for swelling or tenderness while palpating the distal radius and ulna, as well as the grooves of each wrist joint on the dorsum of the wrist. Palpate the anatomic snuff box, a hollow depression distal to the radial styloid process at the base of the thumb. This is identified more easily with abduction of the thumb. The carpal bones should be palpated proximally to distally, followed by the metacarpophalangeal (MCP), proximal interphalangeal (PIP), and distal

interphalangeal (DIP) joints assessing for boggy, tenderness, bony enlargement, or swelling. Also palpate along tendons to assess for inflammation, tenderness, or focal thickening.

- **ROM.** The wrist joint accommodates for flexion, extension, adduction, and abduction. The fingers and thumb also accommodate the same movements, but with different maneuvers.
 - *Wrist flexion.* Ask the patient to point his/her fingers towards the floor with their palm facing downward.
 - *Wrist extension.* Ask the patient to point his/her fingers upwards with their palm facing downward.
 - *Wrist adduction.* Ask the patient to move fingers towards midline with the palm facing downward.
 - *Wrist abduction.* Ask the patient to move fingers away from midline with the palm facing downward.
 - *Fingers and thumb flexion.* Ask the patient to make a fist.
 - *Fingers and thumb extension.* Ask the patient to straighten out his/her fingers and thumb.
 - *Fingers and thumb adduction and abduction.* Ask the patient to spread his/her fingers apart and then back together.
 - *Thumb opposition.* Ask the patient to cross the thumb over the palm to the base of the fifth digit.
- **Special Maneuvers.**
 - *Handgrip strength.* Ask the patient to squeeze the examiner's index and middle finger. Of note, assess whether weakness is related to pain or an inability to perform the task (which could indicate a neurologic dysfunction).
 - *Finkelstein test.* Ask the patient to grasp the thumb against the palm and move wrist towards midline in ulnar deviation (similar to casting a fishing rod). Pain indicates de Quervain tenosynovitis, otherwise known as "gamers thumb."
 - *Phalen sign.* Ask the patient to hold their wrists in full flexion against each other for 60 seconds with the elbows fully extended. Resulting numbness and tingling are suggestive of carpal tunnel syndrome involving the median nerve.
 - *Tinel sign.* Repeatedly tap over the course of the median nerve along the carpal tunnel on the dorsum of the wrist. Resulting shooting pain, aching, or numbness are suggestive of carpal tunnel syndrome involving the median nerve.

Spine

- **Inspection.** With the patient standing, visually assess the spinous processes, paravertebral muscles on either side of the midline, the iliac crests, posterior superior iliac spines from both the side and from behind the patient. The spinal curvatures should also be assessed, noting any deviation of the spine from the midline, excessive curvatures, or abnormal prominences. The shoulders and iliac crests should be at equal heights unless abnormal curvature of the spine or unequal leg lengths are present.
- **Palpation.** Palpate the spinous processes of each vertebra from the cervical to lumbar spine, including the facet joints between C1 and C2 vertebrae and the sacroiliac joint. Observe for tenderness, vertebral "step-offs" (unusual prominence or recession), or deformities. Also, palpate the paravertebral muscles, noting any tenderness, spasm, or radiation of pain through the buttocks, perineum, or legs.

- **ROM.** The cervical spine and thoracolumbosacral spine can accommodate flexion, extension, rotation, and lateral bending. These are assessed through the following maneuvers, taking note of any pain, tenderness, crepitus, or stiffness:
 - *Cervical flexion.* Ask the patient to bring their chin to chest.
 - *Cervical extension.* Ask the patient to look to the ceiling.
 - *Cervical rotation.* Ask the patient to look to the right and the left.
 - *Cervical lateral bending.* Ask the patient to touch each ear to their shoulder.
 - *Thoracolumbosacral flexion.* Ask the patient to bend forward as though touching their toes.
 - *Thoracolumbosacral extension.* Ask the patient to bend back as far as possible.
 - *Thoracolumbosacral rotation.* Ask the patient to twist at the waist, side to side.
 - *Thoracolumbosacral lateral bending.* Ask the patient to bend side to side at the waist.
- **Special Maneuvers.**
 - *Spurling test.* While positioned behind the patient, ask the patient to look over their shoulder and up to the ceiling. Then carefully apply downward pressure on the patient's head. Neck pain with radiation to the arm on the same side the patient's head is turned would be suggestive of cranial nerve root compression.

Hip

- **Inspection.** Observe the patient's gait making note of stance, swing, and stride. A waddling, or Trendelenburg, gait can result from abductor weakness, arthritis, unequal leg lengths, or hip subluxation. Symmetrical leg length and the anterior/posterior aspects of the hip should also be observed. Asymmetrical leg length is concerning for hip fracture with shortening and internal rotation being common on the affected side.
- **Palpation.** Examine for tenderness, pain, deformity, or crepitus.
 - *Anterior hip.* Palpate the iliac crest following downward the anterior curve to the iliac tubercle and continuing down to the anterior superior iliac spine. Thumb should be placed on the anterior superior spines and fingers moved downward and laterally from the iliac tubercles to identify the greater trochanter of the femur. Continue medially and obliquely to the pubic tubercle lying at the same level as the greater trochanter. Focal tenderness may indicate tendinitis or bursitis. Finally, with the patient lying supine, position the heel of the leg being examined on the opposite knee to palpate along the inguinal ligament. Bulging along the ligament suggests inguinal hernia.
 - *Posterior hip.* Palpate and place the left thumb and index finger over the posterior superior iliac spine, locating the greater trochanter laterally with fingers at the level of the gluteal fold to place the thumb medially on the ischial tuberosity. The sacroiliac joint may be difficult to palpate, however tenderness should be assessed at this location. Tenderness may indicate tendinitis or bursitis.
- **ROM.** The hip can accommodate flexion, extension, abduction, adduction, internal rotation, and external rotation. Observe for tenderness, pain, swelling, instability, or crepitus.
 - *Flexion.* Ask the patient to bring their knee to the chest and pull against the abdomen while lying supine.
 - *Extension.* Ask the patient to lie face down, lifting their knee off the table.
 - *Abduction.* Ask the patient to move their lower leg away from the midline while lying supine.
 - *Adduction.* Ask the patient to move their lower leg across the midline while lying supine.

- *Internal rotation.* Ask the patient to bend at the knee and turn the lower leg and foot away from the midline while lying supine.
- *External rotation.* Ask the patient to bend at the knee and turn the lower leg and foot toward the midline while lying supine.
- **Special Maneuvers.**
 - *Patrick or FABER test.* The Patrick test, also known as FABER (Flexion, Abduction, External Rotation) test is performed by positioning the leg into 90° of flexion and externally rotating and abducting with ipsilateral ankle resting distal to the knee on the contralateral leg while the patient is lying supine. If pain is elicited, this may suggest sacroiliac joint pathology.
 - *Kendall test:* The Kendall test is performed to test for hip flexion deformity. Have the patient seated with their thighs half off the exam table, legs dangling. Then ask them to lie down and flex one leg toward the chest and hold long until the lower back is flat against the table. The posterior thigh on the other leg should touch the table and that knee should be able to passively flex.

Knee

- **Inspection.** Observe the gait for knee flexion and inspect the knee and quadriceps for alignment, contour, swelling, atrophy, or bruising.
- **Palpation.** Examine the muscles, tendons, and ligaments for areas of tenderness, pain, swelling, bulging, deformity, instability, or crepitus which may suggest injury or arthritis.
 - *Tibiofemoral joint.* Place thumbs in the soft tissue depressions on either side of the patellar tendon, identifying the group for the tibiofemoral joint while in the flexed position. Pressing the thumbs downward, the edge of the tibial plateau can be felt. Follow medially and laterally until stopped by converging femur and tibia, and then upward toward the midline of the top of the patella to the distal femur, identifying the margins of the joint.
 - *Medial meniscus.* Press on the medial soft tissue along the upper edge of the tibial plateau with tibia slightly internally rotated. Slightly flex the knee and palpate the lateral meniscus along the lateral joint line.
 - *Medial joint compartment.* With the knee flexed on the examining table at approximately 90°, palpate the tibiofemoral joint while moving thumbs medially and upward to palpate the medial femoral condyle. Palpate posteriorly to assess the adductor tubercle and inferiorly to palpate the medial tibial plateau. Along the medial aspect posteriorly, also identify the MCL (medial collateral ligament) connecting the medial epicondyle of the femur to the medial surface of the tibia.
 - *Lateral joint compartment.* Palpate the tibiofemoral joint in the same position, lateral to the patellar tendon moving thumbs upward to palpate the lateral femoral condyle and downward to palpate the lateral tibial plateau. Ask the patient to cross one leg so the ankle rests on the opposite knee to assess the LCL (lateral collateral ligament) connecting the lateral epicondyle of the femur to the head of the fibula.
- **ROM.** The knee joint can accommodate flexion and extension.
 - *Knee flexion.* Ask the patient to bend at the knee.
 - *Knee extension.* Ask the patient to extend their leg at the knee.
- **Special Maneuvers.**
 - *McMurray test.* With the patient supine, grasp the heel and flex the knee with the opposite hand at the knee joint with fingers and thumb along the medial joint line. With

the leg externally rotated, apply pressure on the lateral side to apply valgus stress on the medial meniscus. The leg is slowly extended in external rotation. The same technique is repeated with internal rotation to stress the lateral meniscus. A palpated click or pain is suggestive of meniscal tear.

- *Valgus stress test.* Also known as abduction stress test, the patient lies supine with the knee slightly flexed and the thigh about 30° laterally to the side of the table. Place one hand on the lateral knee to stabilize the femur and the other hand around the medial ankle, pushing medially against the knee and laterally at the ankle to open the knee joint on the medial side. Assess for excessive widening of the joint that may signal ligamentous injury.
- *Varus stress test.* Also known as the adduction stress test, the patient lies supine with the knee slightly flexed and the thigh about 30° laterally to the side of the table. Place one hand on the medial knee to stabilize the femur and the other hand around the lateral ankle, pushing laterally against the knee and medially at the ankle to open the knee joint on the lateral side. Assess for excessive widening of the joint that may signal ligamentous injury.
- *Anterior drawer sign.* As the patient lies supine with hips flexed and knees flexed at 90° with feet flat on the table, wrap your hands around the knee with the thumbs on the medial and lateral joint line and fingers on the medial and lateral insertions of the hamstrings. Sit on the patient's foot to anchor it while drawing the tibia forward and observing if it slides forward from under the femur with comparison to the opposite knee. Excessive movement may indicate anterior cruciate ligament injury.
- *Lachman test.* Position the knee in 15 degrees of flexion and slight external rotation. Hold the lateral side of the distal femur with one hand and the medial side of the proximal tibia with the other, placing your thumb on the joint line. Forcefully and simultaneously pull the tibia forward and the femur back. There should be a firm endpoint to any forward movement. Absence of a firm endpoint with excessive movement may indicate an ACL injury.
- *Posterior drawer sign.* As the patient lies supine with hips flexed and knees flexed at 90° with feet flat on the table, wrap your hands around the knee with thumbs at the medial and lateral joint line of fingers on the medial lateral insertions of the hamstrings. Sit on the patient's foot to anchor it while pushing the tibia posteriorly, observing it for backward movement to the femur. Excessive movement suggests a posterior cruciate ligament injury.

Ankle and Foot Joints

- **Inspection.** Observe the ankle and foot for deformities, swelling, nodules, and skin impairments.
- **Palpation.** Palpate the ankle joint and foot for swelling, tenderness, crepitus, and deformities. Use your thumbs to assess the anterior aspect of the ankle joint for boggy or swelling, and your fingertips to assess the Achilles tendon for nodules or tenderness, as the hands are wrapped around the ankle. Palpation should extend over the medial and lateral ankle ligaments and the medial and lateral malleolus. Continuing to the metatarsophalangeal joints, compress the forefoot between the thumb and the fingers exerting pressure just proximal to the heads of the first and fifth metatarsal to assess for tenderness or crepitus.
- **ROM.** The ankle and foot accommodate flexion (plantar flexion), extension (dorsiflexion), inversion, and eversion. Observe for tenderness or crepitus on movement.
 - *Flexion.* Ask the patient to point their foot downward.

- *Extension*. Ask the patient to point their foot upward.
- *Inversion*. Ask the patient to point the sole of their foot towards midline.
- *Eversion*. Ask the patient to point the sole of their foot laterally.

PEARLS

- Restricted range of motion occurs in bursitis, capsulitis, connective tissue tears, and tendinitis.
- Unequal shoulder heights may be suggestive of scoliosis or abnormal curvature of the spine.
- Radiating pain down extremities elicited by spinal range of motion maneuvers is concerning for spinal nerve involvement.
- Internal rotation and shortening of the leg are suggestive of hip fracture.
- Tenderness of the MCL on palpation is suggestive of injury or tear.

Reference:

Bickley, L. S., Szilagy, P. G., Hoffman, R. M., & Soriano, R. P. (2021). *Bate's Guide to Physical Examination and History Taking* (13th ed.). Wolters Kluwer Health: Philadelphia.