Orthopedic Assessment Outline

Head and Face

Cranial nerve testing

1. Olfactory – Identify familiar odors.
2. Optic – test visual fields.
3. Oculomotor – Upward, downward, and medial gaze, reaction to light
4. Trochlear – downward and lateral gaze.
5. Trigeminal – Corneal reflex, face sensation, Clench teeth, separate jaws, push down on chin.
6. Abducens – Lateral gaze.
7. Facial – Close eyes tight, smile, show teeth, whistle, and puff cheeks, identify sweet, sour.
8. Vestibulocochlear – hearing test, hear watch ticking, balance and coordination test.
9. Glossopharyngeal – Gag reflex, ability to swallow.
10. Vagus- Gag reflex, ability to wallow, say “Aaaa”
11. Accessory – resist shoulder shrugs.
12. Hypoglossal – tongue protrusion (if injured deviates towards injured side)

Concussion

1. Grade 1 no symptoms
2. Grade 2 (slight)– post traumatic amnesia >30 min, mild tinnitus, mild dizziness, dull headache, some disorientation,
3. Grade 3 (Moderate) – Posttraumatic amnesia <30 min, retrograde amnesia, residual symptoms, moderate tinnitus, moderate dizziness, headache, moderate disorientation, possible post-concussion syndrome
4. Grade 4 (Severe) – Posttraumatic amnesia >30 min, retrograde amnesia, residual symptoms, severe tinnitus, severe dizziness, headache, severe disorientation, post-concussion syndrome
5. Grade 5 (Severe) - Posttraumatic amnesia <24 hours, retrograde amnesia, residual symptoms, severe tinnitus, severe dizziness, headache, severe disorientation, blurred vision, post-concussion syndrome

Levels of consciousness

1. Alertness – Readily aroused and fully aware.
2. Confusion – impaired memory, confused and disorientated.
3. Lethargy – Sleeps when not stimulated, responds to name, loses train of thought, decreased spontaneous movement.
4. Obtundity – response to loud voice or shake, response to painful stimuli (withdrawal), talks in monosyllables, confused when aroused, speech mumbled and incoherent.
5. Stupor – response to painful stimuli (withdrawal), shaking, groans, mumbles, reflex activity present.
6. Coma – no response to painful stimuli or any other stimuli

Eye examination

1. Six cardinal gazes – position penlight 12-14 inches from patient face and ask patient to follow penlight with eyes.
2. Pupil size – equal
3. Reaction to light – constriction
4. Accommodation-convergence reflex – patient follows object from far to 10cm (4 inches near the nose) – pupils dilate for far object and constrict for near object with eye adducting for near object.
5. Nystagmus - eyes make repetitive, uncontrolled movements. Ask the patient to follow the pen with eye in all six direction and hold each position for few seconds observing for repetitive movement of eye.
6. Visual fields – test for peripheral limits of visions. Confrontation test – examiner covers left eye and patients covers right eye. Open eyes are directly opposite. Practitioner extends right arm, midway between patient and examiner. Practitioner moves hand towards them with fingers waving and patient tells when moving fingers are seen.
7. Visual acuity – tested using vision chart.
8. Symmetry of gazes – the examiner aims the light source 60 cm (24 inches) from the patient, standing directly in front of patient. Patient is asked to stare at light. Light dots on corneas should be at the same locations.
9. Cover uncover test – to detect mild eye deviation.

10. Strabismus – eyes do not align parallel when looking at object. Indicates weakness in muscle or lack of innervation.
11. Hyphema - Accumulation of red blood cells within the anterior chamber of eye. Hyphema can occur after blunt or lacerating trauma, after intraocular surgery, spontaneously, in leukemia, hemophilia, von Willebrand disease, and in association with the use of substances that alter platelet or thrombin function - ethanol, aspirin, warfarin.

Nasal examination

1. Patency
2. Nasal cavities
3. Sinuses
4. Fractures
5. Observation of nasal discharge

Tooth examination

1. Number of teeth
2. Position
3. Movement
4. Condition

Ear examination

1. Whispered voice test – patient covers one ear and listens to whispered phrases. Distance 30 to 60 cm (12-24 inches) from ear. Normal is 50% accuracy.
2. Ticking watch test – test high frequency hearing. 15 cm (6 inches) from ear. Watch is oved toward ear and patient tells when ticking is head.
3. Weber test - The Weber test is a screening test for hearing performed with a tuning fork. It can detect unilateral conductive hearing loss (middle ear hearing loss) and unilateral sensorineural hearing loss (inner ear hearing loss). 512 Hz tuning fork is placed in the middle of the forehead, above the upper lip under the nose over the teeth, or on top of the head equidistant from the patient's ears on top of thin skin in contact with the bone. The patient is asked to report in which ear the sound is heard louder.
4. The Weber test is a screening test for hearing performed with a tuning fork. It can detect unilateral (one-sided) conductive hearing loss (middle ear

hearing loss) and unilateral sensorineural hearing loss (inner ear hearing loss).

5. Weber vibration test: 512 Hz is placed in the middle of the forehead, or above the upper lip under the nose over the teeth, or on top of the head equidistant from the patient's ears on top of thin skin in contact with the bone. The patient is asked to report in which ear the sound is heard louder. A normal Weber test has a patient reporting the sound heard equally in both sides.
    a. In an affected patient, if the defective ear hears the Weber tuning fork louder, the finding indicates a conductive hearing loss in the defective ear.
    b. In an affected patient, if the normal ear hears the tuning fork sound better, there is sensorineural hearing loss on the defective ear.
    c. In the case where the patient is unaware or has acclimated to their hearing loss, the clinician must use the Rinne test in conjunction with the Weber to characterize and localize any deficits.
5. Rinne test - 512 Hz vibrating tuning fork is placed against the patient's mastoid bone and patient is asked to tell when the sound is no longer heard. Once the patient signals, they cannot hear it, the still vibrating tuning fork is then placed 1–2 cm from the auditory canal. The patient is then asked again to indicate when they are no longer able to hear the tuning fork. The Rinne test is used to evaluate loss of hearing in one ear. It compares perception of sounds transmitted by air conduction to those transmitted by bone conduction through the mastoid. A Rinne test should always be accompanied by a Weber test to also detect sensorineural hearing loss and thus confirm the nature of hearing loss
    a. Air conduction should be greater than bone conduction (AC>BC), so the patient should be able to hear the tuning fork next to the pinna (outer ear) after they can no longer hear it when held against the mastoid. That is positive Rinne test
    b. If the patient is not able to hear the tuning fork after it is moved from the mastoid to the pinna, that indicated that bone conduction is greater than their air conduction (BC>AC). Negative Rinne test.
    c. In sensorineural hearing loss the ability to sense the tuning fork by both bone and air conduction is equally diminished. This pattern is the same

to what is found in people with normal hearing, but patients with sensorineural hearing loss will indicate that the sound has stopped much earlier

6. Schwabach test – comparison of patient and practitioners hearing by bone conduction. Vibrating tuning fork is places alternately against mastoid process. Should be the same duration.

Test for expanding intracranial lesions

1. Signs and symptoms of expanding intracranial lesion – altered state of consciousness, nystagmus, pupil inequality, irregular eye movements, abnormal slowing of hear, irregular respiration, severe headache, intractable vomiting,
2. Neurological control test -upper limb – patient stands with arms forward flexed 90 degrees and eye closed for 30 seconds. If one arm move outward and down test is positive for expanding intracranial lesion
3. Neurological control test – lower limb – patient sits at the edge of chair/table and legs extended not touching ground with closed eyes for 30 seconds. In positive test leg tends to move or drift. Lesion in on opposite side.
4. Romberg test – patient stands with feet together arms to the side and eyes open. Observe for balance problems. Patient closes eye for 20-30 seconds. Positive test is if patient sways or falls when eye is closed.
5. Walk or stand in tandem – difficulty walking the line or standing in tandem (more difficult)

Tests for coordination

1. Finger-nose test – eyes open and closed patient brings index finger to nose.
2. Finger-thumb test – each finger of the same hand touches thumb
3. Finger drumming test – patient drums the index and middle finger up and down as quickly as possible on the back of the other hand.
4. Hand-thigh test
5. Past pointing test – examiner holds up index finger 15 cm apart. Patient lifts hands over head and then brings them down to touch patients index fingers to examiner index fingers.
6. Heal to knee test – in lying position patient bring heel to opposite knee

Tests for proprioception

7. Proprioceptive finger-nose test – patient eyes are closed. Examiner touches patient finger and asks patient to touch the nose with that finger. Patient with proprioceptive issue has difficulty without visual help.
8. Proprioceptive movement test – patients' eye closed, examiner moves digits up and down. Patient tells which direction it is moved.

Reflexes and cutaneous distribution

1. Corneal reflex – blink reflex that protects eyes. Tests for pons, facial (Zygomatic branches) and trigeminal (V1) nerve dysfunction. The cornea is touched with pointed cotton. Bilateral blink (normal). Reflex arcs connect both facial nerves.
2. Gag (Pharyngeal) reflex – tongue depressor into posterior pharynx. Test CN IX (sensory) and X (motor), caudal brain stem.
3. Consensual light reflex – constriction of both pupils when light is shined in one eye
4. Jaw jerk (masseter) reflex - is a stretch reflex used to test the status of a patient's trigeminal nerve (cranial nerve V) and to help distinguish an upper cervical cord compression from lesions that are above the foramen magnum. The mandible is tapped at a downward angle just below the lips at the chin while the mouth is held slightly open. In response, the masseter muscles will jerk the mandible upwards. Normally this reflex is absent or very slight. However, in individuals with upper motor neuron lesions the jaw jerk reflex can be quite pronounced.
5. Sensory nerve distribution of head, face, and neck
6. Dermatome distribution of head, face, and neck

Cervical spine

AROM – Magee (AMA Guide to permanent evaluation of impairment)

1. Flexion – 80 degrees or greater, (50 degrees or greater)
2. Extension – 70 degrees or greater, (60 degrees or greater)
3. Lateral (Side) flexion – 20 to 45 degrees (45 degrees)
4. Rotation – 70 or greater (80 degrees)

PROM - Passive movements – if patient did not have full range and to determine the end feel (for all normal is tissue stretch)

1. Flexion
2. Extension
3. Lateral flexion
4. Rotation

RIM – Resisted Isometric Movements

1. Flexion
2. Extension
3. Lateral Flexion
4. Rotation

Myotomes

1. Neck flexion (C1-C2)
2. Neck side flexion (C3)
3. Shoulder elevation (C4)
4. Shoulder joint abduction (C5)
5. Elbow flexion/wrist extension (C6)
6. Elbow extension/wrist flexion (C7)
7. Thumb extension/ulnar deviation (C8)
8. Abduction/adduction of hand intrinsic muscles (T1)

Functional assessment – activities of daily living

1. Breathing with mouth closed
2. Swallowing
3. Looking up at the ceiling
4. Looking down at shoelaces

5. Shoulder check (60-70 cervical rotation needed)
6. Tuck chin in and out

Special tests at cervical spine

1. Foraminal compression (Spurling's) test – Patient side flexes the head and examiner gently pushes straight down on patient's head. Test is positive if pain radiates down the arm towards which the head is flexed. Indicates cervical radiculitis (pressure on nerve root). Pain is in dermatome distribution of nerve root.
2. Distraction test – examiner places one hand under chin and other under occiput and slowly lifts the patient's head. Positive test is if pain is decreased or relieved. Indicates pressure or nerve roots that has been relieved.
3. Upper limb tension test (brachial plexus tension test or Elvey test) - ULTT is equivalent to a SLR in lumbar spine. The main reason for using a ULTT is to check cervical radiculopathy.
    a. ULTT 1 – shoulder depression and abduction to 110 degrees, elbow extension, forearm supination, wrist extension, finger extension, cervical spine contralateral side flexion – median nerve
    b. ULTT2 – shoulder depression and abduction to 10 degrees, elbow extension, forearm supination, wrist and finger extension, shoulder lateral rotation c-spine contralateral side flexion – median nerve, musculocutaneous nerve, axillary nerve
    c. ULTT3 – shoulder depression and abduction to 10 degrees, elbow extension, forearm pronation, wrist flexion and ulnar deviation, finger flexion, shoulder medial rotation, c-spine contralateral side flexion – radial nerve
    d. ULTT4 - hand to ear. Depression, abduction, elbow flexion, supination, wrist extension and radial deviation, shoulder lateral rotation, c-spine contralateral side flexion – ulnar (C8, T1nerve roots)
4. Brachial plexus tension test – abduct and laterally rotate until symptoms appear, then lower arms till symptoms disappear. Examiner holds arms. Patient places hands behind head. + if symptoms return.
5. Bikele's sign - patient sitting, with arm abducted to 90 degrees with elbow flexed, then both extended. Modified ULTT done actively. The test is

positive if radicular pain or other neurologic symptoms are felt on extending the shoulder joint and elbow joint. A positive Bikele's sign indicates a nerve root tension, brachial plexus neuritis and/or meningitis.

6. Shoulder depression test - side flex head to the opposite side and depressed shoulder, if the pain is increased indicated nerve root irritation, compression, foraminal encroachment, adhesions around dural sleeves.
7. Shoulder abduction (relief) test - place hand on the head – relieves symptoms C4. C-5, C-6
6. Romberg test – patient stands with feet together arms to the side and eyes open. Observe for balance problems. Patient closes eye for 20-30 seconds. Positive test is if patient sways or falls when eye are closed. Upper motor neuron lesion.
8. Lhermitte's test – patient sits on examination table legs straight. Examiner passively flexes head and thigh. Positive tests – sharp pain down the spine and into the upper and/or lower limbs – dural, meningeal irritation, cervical myelopathy.
9. Jacksons compression test – patient rotates head to one side and examiner presses down on head. Positive test – pain radiates into the arm. Compression of nerve root. (Modification of foraminal compression test)
10. Valsalva maneuver – patient takes deep breath and holds while bearing down as if moving the bowels. Increases intrathecal pressure – positive if pain increases. Possible cause herniated disc, tumor, osteophytes. Patient can become dizzy and pass out.
11. Tinel's signs for brachial plexus lesions – examiner taps the area of brachial plexus. Patient neck slightly side flexed to opposite side
12. Brachial plexus compression test – examiner squeezes brachial plexus. Positive test – pain radiates into the shoulder, upper extremity.
13. Vertebral artery (Cerebral quadrant) test – patient supine, examiner passively moves patient head into extension and lateral flexion and followed by rotation to the same side. Position is held for 30 seconds. Positive test provokes symptoms. Dizziness, nystagmus, headache.
14. Static vertebral artery test – can be done sitting or supine. Each position is sustained for 30 sec. Symptoms reproduced – nystagmus, dizziness, lightheadedness, visual disturbances. If first position is positive do not proceed to next.

a. Sustained full neck and head extension
b. Sustained full head and neck rotation
c. Sustained full head and neck extension and rotation

15. Hautant's test – – helps to differentiate dizziness caused by articular vs vascular problems. Patient sits arms flexed to 90, eyes closed. If arms move dizziness and vertigo nonvascular. If no movement, patient rotates and extends the head, closes eyes. Arm moves - vascular problem to the brain.
16. Underburg's test – Patient holds arms at 90 degrees of flexion, elbows straight, forearms supinated, patient closes eyes and marches in place while head is held in extension and rotation to one side. Test is positive if there is dropping of arm, loss of balance or pronation of hands – decreased blood supply to the brain
17. Naffziger's test – compress jugular veins standing from behind, hold for 30 seconds and then ask patient to cough – pain indicate nerve root problem or space occupying lesion
18. Barre's test – patient stands with arms flexed forward to 90 degrees, elbows straight and forearms supinated, eyes closed. Hold for 20 seconds. Positive – arms fall with pronation.
19. Temperature (caloric) test – hot/cold over mastoid. Positive test – vertigo – inner ear problem.
20. Dizziness test – examiner rotates patients head as far as possible and holds for 10 seconds, then rotates shoulders head still. Dizziness in both cases, vertebral artery problem and if only when head rotates, inner ear problem
21. Sharp-pusher test – determines subluxation of the atlas on the axis. Examiners one hand is on patient's forehead other hands thumb stabilizes spinous process of C2. RIM of forward flexion. Positive test head slides backward. Test done with extreme caution.
22. Transverse ligament share test – tests for hypermobility in atlantoaxial joint
23. Lateral share test – test for instability in atlantoaxial joint due to odontoid dysplasia

Reflexes checked in cervical spine assessment

1. Biceps – C5 C6
2. Triceps = C6, C7

3. Hoffmann's sign - A positive Hoffmann's sign is suggestive of corticospinal tract dysfunction localized to the cervical segments of the spinal cord I n this regard, it is analogous to the Babinski sign. Conditions such as multiple sclerosis, hyperthyroidism, and anxiety will also result in a positive sign. Systemic disorders usually result in a bilateral response while structural anomalies such as tumors result in a unilateral response.
    a. Examiner loosely holds the middle finger and flicks the fingernail downward, allowing the middle finger to flick upward reflexively.
    b. Positive test - characterized by flexion and adduction of the thumb and flexion of the index finger.

Temporomandibular joint

Active movements
At TMJ: Protraction, Retraction, Elevation (closing), depression (opening)

1. Depression – 30 to 55 mm
2. Protraction – 6 to 12 mm
3. Retraction – 1 to 3 mm
4. Laterotrusion – 8 to 12 mm

Cranial nerve testing: I, II, III, IV, V, VI, VII, VIII, IX, X, XI, XII
Restrictive movements

1. Depression
2. Elevation

Functional assessment – normal daily activities
Special tests

1. Chvostek test – tapping parotid gland, muscle twitch positive test.

Reflexes and cutaneous distribution

1. Jaw reflex

Palpation

1. Mandible
2. Teeth
3. Hyoid bone
4. Thyroid cartilage
5. Mastoid process
6. Cervical spine

Shoulder

Active movements

1. Elevation through abduction is 170-180 degrees, (180 degrees)
2. Elevation through forward flexion is 160-180 degrees, (180 degrees)
3. Lateral (External) rotation is 80-90 degrees, (90 degrees or greater)
4. Medial (Internal) rotation is 60-100 degrees, (80 degrees or greater)
5. Extension is 50-60 degrees, (50 degrees or greater)
6. Adduction is 50-75 degrees, (50 degrees or greater)
7. Horizontal adduction is 0 to 135 degrees
8. Horizontal abduction 0 to 45 degrees
9. Scapular protraction
10. Scapular retraction
11. Apley's scratch test - one hand behind back other behind shoulder, touch fingers behind back. Right arm in lateral rotation and abduction, left arm in medial rotation and adduction. (Then reverse)

Passive movements

1. Elevation through abduction – bone to bone or tissue stretch
2. Elevation through forward flexion – tissue stretch
3. Lateral (External) rotation – tissue stretch
4. Medial (Internal) rotation – tissue stretch
5. Extension – tissue stretch
6. Adduction – tissue approximation
7. Horizontal abduction and adduction – tissue stretch

Resisted isometric movements

1. Flexion
2. Extension
3. Abduction
4. Adduction
5. Medial rotation
6. Lateral rotation
7. Flexion of elbow
8. Extension of elbow

Special tests

1. Anterior shoulder instability
    a. Load and shift test – anterior and posterior instability. Patient sits with the back support and tested arm resting on the thigh. Examiner with one hand stabilizes shoulder with other grasp head of the humerus pushes in and then attempts to slide anteriorly and posteriorly. Transition less than

25% anteriorly of the humeral head is normal. Posterior – 50% translation of humeral head diameter is normal.

b. Apprehension (Crank) test and relocation test – arm and elbow flexed 90 degrees, slowly laterally rotate. Positive – apprehension of the patient during rotation. Relocation – push on shoulder to keep it in.
c. Rockwood test for anterior instability – patient seated; examiner stand behind patient. Examiner laterally rotates the shoulder; Arm is then abducted to 45 degrees and passive lateral rotation is repeated. The same is done at 90 and 120 degrees. Positive test – apprehension at 90 degrees.
d. Rowe test for anterior instability - patient supine and places hand behind the head. Examiners one hand is against posterior humeral head and pushes up while extending arm slightly. Positive – apprehension.
e. Fulcrum test – patient supine, with arm abducted to 90 degrees, examiners one arm under the joint, other extends and laterally rotates the arm. Positive – look of apprehension by patient.
f. Prone anterior instability test - side of the table, patient in prone position. Patient arm abducted to 90 degrees examiner pushes down (forward) on humeral head. Positive – reproduction of patient's symptoms.
g. Anterior drawer test of the shoulder - Patient in supine position. Examiner holds patients' arm, abducts the patient shoulder between the 80 and 120 degree, forward flexed up to 20 degree, laterally rotated up to 30 degree. Examiner then stabilize the patient's scapula with the opposite hand by pushing the spine of the scapula with index and middle fingers, while applying counterpressure on patient's coracoid process with the thumb. Draws the humerus forward (anteriorly) using the hand that is holding patient's arm. Positive test indicates the anterior instability decided by the amount of anterior translation which is accessible comparing with the normal side.

2. Posterior shoulder instability
   a. Load and shift test
   b. Posterior apprehensions stress test – patient supine, arm at 90 degrees flexion, elbow flexion, and shoulder medial rotation. Examiner pushes down on shoulder. Positive – look of apprehension or alarm.
   c. Push-pull test - patient supine, arm at 90 degrees abduction, 90 degrees elbow flexion. Examiner pulls on hand and push down on arm. If more than 50% translation is present or patient becomes apprehensive – positive test.
   d. Norwood stress test for posterior instability – patient supine with shoulder abducted 60 to 100 degrees and laterally rotated 90 degrees and 90 degrees elbow flexion. Examiner stabilizes scapula with one hand and

brings the arm into the forward flexion. Positive test – humeral head slips posteriorly.

e. Posterior drawer test of the shoulder – patient supine, patients elbow flexed to 120 degrees and shoulder between 80 to 120 degrees abduction and 30 degrees flexion. Examiner with one hand rotates forearm medially and with other hands pushes head of the humerus posteriorly.

3. Inferior shoulder instability
   a. Sulcus sign – patient stand with arm by the side, elbow flexed. Examiner pushes down on forearm. Positive – sulcus (depression) under acromion.
   b. Feagin test – modified sulcus test. Arm at 90 degrees abduction with elbow extended resting on examiners shoulder. Examiners with both hands pushes on patients humerus between upper and middle thirds down and forward. Positive tests – look of apprehension.
   c. Row test for multidirectional instability – patient stands forward flexed 45 degrees arm hanging relaxed. Examiners one hands middle and index fingers are over anterior humeral head and thumb over posterior. Examiner pulls the arm slightly with other hand.
4. Impingement
   a. Neer impingement test - The examiner should stabilize the patient's scapula with one hand, while passively and forcibly elevating the patients arm while it is internally rotated. Greater tuberosity in jammed against acromion. Positive test – pain and indicates supraspinatus injury.
   b. Hawkins-Kennedy impingement test – examiner flexes patient arm to 90 degrees and then forcibly medially rotates arm at shoulder. Positive test pain and indicates supraspinatus tendinitis.
   c. Reverse impingement sign – patient supine with arm abducted to 90 degrees and laterally rotated, elbow flexed. Examiner pushes on the head of the humerus inferiorly. Positive – reduction of symptoms.
5. Labral tears
   a. Clunk test – patient supine, examiners one hand is under patients' shoulder, examiner brings arm up into full abduction. Examiners hand under shoulder pushes up while other hand moves arm in lateral rotation. Clunk or grinding positive sign.
   b. Anterior slide test – patient sitting with the hands on the waist. Practitioner pushes one elbow forward, pop or grind – SLAP lesion.
   c. Biceps tension test (Bicep's load test) - The patient is in the supine position with the shoulder in 120 degrees of elevation and full external rotation, while the elbow is in 90 degrees of flexion, and the forearm in supination. The patient is then asked to flex the elbow as the clinician

provides resistance. A positive test is defined as pain experienced during resisted elbow flexion or pain exacerbation during resisted elbow flexion

   d. SLAP Prehension test - The patient is examined in sitting or standing positions. The arm is horizontally adducted across the chest with the elbow extended and the forearm pronated (thumb down). This may cause pain in the bicipital groove with or without an audible or palpable click. It should then be repeated with the arm supinated.

6. Scapular stability
   a. Lateral scapular slide test – determines stability of a scapula during humeral movements. Patient sits with arm at the side. Examiner measures distance from spinous processes T2-T3 to medial border of scapula and from T7-T9 to inferior angle of scapula. Patient is then abducting arm to 45, 90, 120, and 150 degrees and distance is measured. The difference should not be more than 1-1.5 cm.
   b. Scapular assistance test - The examiner stands behind the patient, one hand on the superior boarder of the scapula of the involved shoulder with the fingers over the clavicle, and the other hand on the inferior angle of the scapula with the fingers wrapped laterally around the thorax. The examiner assists the scapula upwards rotation by pushing the inferior angle of the scapula upwards and laterally, and assists posterior tipping of the scapula by pulling the superior angle of the scapula posteriorly, while the patient actively elevates the arm. The test is positive if the symptoms of impingement decrease.
   c. Scapular isometric pinch test - Isometric Scapular Pinch test: Patient in standing position and is asked to actively squeeze or retract the scapulae together as hard as possible. Normal Response: An individual able to hold the squeeze or 15 to 20 sec without any burning pain or noticeable weakness. Positive: Burning pain present.
7. Other tests
   a. Acromioclavicular shear test – Patient sitting, with arm at 90 abduction. Practitioner at the side of tested AC. Examiners one hand is over clavicle and another over spine of scapula. Examiner squeezes hands together. Positive test – pain or abnormal movement in AC joint.
   b. Resisted AC joint extension test - The patient is seated with the therapist standing behind. The patient's shoulder is positioned into 90 flexion and internal rotation, with the elbow placed into 90 flexion. The examiner places hand on the patient's elbow and asks patient to horizontally abduct the arm against isometric resistance. A positive test is pain at the AC joint

c. Ellman's Compression Rotation test – patient lies on the side with affect shoulder up. Examiner compresses the humeral had into joint while the patient rotates the shoulder. Pain or grinding indicates positive test and possible presents or arthritis.
d. Paxino's test - Patient sitting with the affected arm by the side, the examiner's thumb is placed under the posterolateral aspect of the acromion and the index and middle fingers are placed superior to the mid-clavicle The examiner provides pressure to the acromion in an anterosuperior direction with the thumb, while also applying pressure an inferior direction to the mid-clavicle with the index and middle fingers. If pain is elicited or increased in the region of the acromioclavicular joint, the test is considered positive.

8. Ligament pathology
   a. Crank test - Patient is sitting upright with the arm flexed to 90°, the examiner stands adjacent to the affected shoulder forearm holding the flexed elbow or forearm. Joint load is applied along the axis of the humerus with one hand while the other hand performs humeral rotation while the shoulder is being elevated in the scapular plane. A positive test is indicated during the maneuver if there is reproduction of symptoms (pain) with or without a click.
   b. Posterior inferior glenohumeral ligament test – patient sitting, examiner flexes arm between 80 and 90 degrees and horizontally adducts arm 40 degrees with medial rotation. While doing movements examiner palpates posterior-inferior part of shoulder joint. Pain over area can indicate damage to posterior inferior GH ligament.
9. Muscle or tendon pathology
   a. Speed's test (biceps or straight arm test) – examiner resist arm flexion by patient while performing supination/pronation. Positive – increased tenderness in bicipital groove.
   b. Yergason's test – patient elbow flexed at 90 degrees and stabilized against thorax. Patient resists supination and lateral rotation performed by examiner. Positive – tenderness in bicipital groove, biceps or SLAP lesions is suspected.
   c. Ludington's test – patient places both hands behind head with fingers interlocked. Patient contracts and relaxes biceps muscles. On affected side no biceps tendon. Examiner palpates the long head of biceps tendon. Positive – absence of tendon on affected side (ruptured tendon)
   d. Supraspinatus test (empty can test) – patients' shoulder is abducted to 90 degrees and examiner provides resistance to abduction, then arm is moved forward 30 degrees (horizontal adduction) and rotated medially

with thumb facing down and resistance is applied. Positive – pain or weakness indicating supraspinatus problem.

e. Drop arm (Codman's) test – practitioner abduct patients arm to 90 than asks the patient to slowly lower the arm. Supraspinatus damage – arm drops.
f. Lift-off sign (Gerbers test)– arm behind the back hand over gluteal area. Patient attempts to lift of the hand from the body, if cannot do it subscapularis damage.
g. Pectoralis major contracture test – patient supine with both hands placed behind head and arms are lowers until elbows touch the examining bed. Positive – elbows do not touch the table.
h. Abdominal compression (Belly-Press) test - The belly-press test is used to isolate the subscapularis muscle, to test the subscapularis muscle for tear or dysfunction. It is often used as an alternative to the lift-off test, when the lift-off test cannot be performed because of pain or limited internal rotation range of motion of the shoulder. The patient sits or stands with the elbow flexed to 90 degrees, with the palm of the hand on the upper abdomen, just below the xyphoid process. The patient is asked to press the palm of the hand against the abdomen, through shoulder internal rotation. The test is positive for subscapularis muscle dysfunction if the patient compensates the movement through started wrist flexion, shoulder adduction and shoulder extension.
i. Bear hug test - The patient places the palm of the affected side on the opposite shoulder, with the fingers extended and the elbow anterior to the body. The patient is asked to maintain the arm position. The therapist then applies an external rotation resisting force perpendicular on the patient's forearm, the patient resists the therapist by performing internal rotation. The test is positive if the patient could not maintain the position of the hand against the shoulder or showed weakness in resisted internal rotation greater than 20% compared to the opposite side. Positive – subscapularis muscle dysfunction or tear.
j. Lateral rotation lag sign (Spring back test) - Patient is seated with examiner behind patient. The affected arm is brought into maximal internal rotation behind the back (dorsum of patient's hand is against the lumbar region). Examiner controls patient's arm at the elbow and hand which is passively brought into 20 degrees of extension taking the forearm and hand away from the back. Instruct patient to actively maintain this position as examiner releases the hand but maintains support at the elbow. A lag is indicative of a subscapularis tendon tear.

k. Infraspinatus test - The patient should be standing, with the arm in a neutral position and the elbow flexed to 90 degrees. The therapist will apply a medially directed force to the arm while the patient is instructed to resist. The test is considered positive if the patient reports pain or weakness when resistance is applied.
l. Teres minor test (Homblower's sign)– The patient is seated or standing. The examiner places the patient's arm to 90oin the scapular plane and flexes the elbow to 90o. The patient is then asked to externally rotate against resistance. The test is positive if the patient is unable to perform external rotation.
m. Trapezius weakness – patient shrugs the shoulders against resistance
n. Serratus anterior weakness (Punch out test, push up test) - Patient in standing or sitting position, forward flexes arm to 90 degrees, examiner applies backward pressure to the arm. Winging of scapula at medial border shows positive sign. This happens when serratus anterior is weak or paralyzed. This test also can be done by asking patient to do wall push up and for more harder ask patient to do regular floor push up.

10. Neurological function
    a. Upper limb tension test (brachial plexus tension test or Elvey test) - ULTT is equivalent to a SLR in lumbar spine. The main reason for using a ULTT is to check cervical radiculopathy.
        - ULTT 1 – shoulder depression and abduction to 110 degrees, elbow extension, forearm supination, wrist extension, finger extension, cervical spine contralateral side flexion – median nerve
        - ULTT2 – shoulder depression and abduction to 10 degrees, elbow extension, forearm supination, wrist and finger extension, shoulder lateral rotation c-spine contralateral side flexion – median nerve, musculocutaneous nerve, axillary nerve
        - ULTT3 – shoulder depression and abduction to 10 degrees, elbow extension, forearm pronation, wrist flexion and ulnar deviation, finger flexion, shoulder medial rotation, c-spine contralateral side flexion – radial nerve
        - ULTT4 - hand to ear. Depression, abduction, elbow flexion, supination, wrist extension and radial deviation, shoulder lateral rotation, c-spine contralateral side flexion – ulnar (C8, T1nerve roots)

b. Tinel's sing – tapping over area above clavicle over scalene triangle. Positive – tingling sensation in one or more nerve root.

11. Thoracic outlet syndrome tests
    a. Wright test - Patient's arm is passively brought into abduction and external rotation to 90 without tilting the head. The elbow is flexed no more than 45 degrees. The arm is then held for 1 min and the tester measure radial pulse and monitor patient symptoms onset. Then examiner monitors the patient's symptom onset and the quality of the radial pulse. The test is repeated in full elevation through abduction. A decrease in the radial pulse and/or reproduction of the patient's symptoms. Detects compression in costoclavicular space.
    b. Costoclavicular syndrome test (Military brace test) – palpate pulse than draw shoulder down and back. Positive test – absence of pulse. Good test for patients who complaint of pain wearing backpack or coat.
    c. Adson test (maneuver) - find the patients radial pulse, the patient head is rotated to the test shoulder side. Patient extends the head while practitioner extends and laterally rotates the patient's arm. Patient takes a deep breath and holds it. Positive test - no pulse.
    d. Halstead maneuver – examiner finds the radial pulse and applies downward traction to the extremity while patient extends and rotates head to the opposite side. Positive test – no pulse
    e. Allen test – examiner fins radial pulse, shoulder is taken into horizontal abduction (extension) and lateral rotation with elbow flexed at 90 degrees. Pulse disappears when patient rotates head to the opposite side.

Reflexes and cutaneous distribution

1. Biceps reflex (C5, C6)
2. Triceps reflex (C6, C7)

Referred pain to the shoulder

1. R shoulder – lung, gallbladder, elbow, neck
2. L shoulder – heart, lung, diaphragm, spleen, neck

Elbow

Active movements

1. Flexion is 140-150 degrees, (140 or greater)
2. Extension is 0-10 degrees, (0 degrees)
3. Supination is 90 degrees, (80 degrees or greater)
4. Pronation is 80-90 degrees, (80 degrees or greater)

Passive movement

1. Flexion
2. Extension
3. Supination
4. Pronation

Resisted isometric movement

1. Flexion
2. Extension
3. Supination
4. Pronation

Special test

1. Ligamentous instability test (Varus and Valgus test of elbow) – Valgus: The examiner places the patients elbow in approximately 20 degrees of flexion while palpating the medial joint line and stabilizing the distal humerus with one hand and applying a valgus stress to the elbow with the other hand. The test is considered positive if the patient experiences pain or excessive laxity is noted compared to the contralateral side. As with the varus stress test, this test can be repeated in varying degrees of elbow extension to test different portions of the MCL. Varus: With the patient is standing, the therapist places the patient's elbow in slight flexion while palpating the humeroulnar joint line. The therapist then applies a varus force to the elbow. This test is considered positive if the patient experiences pain or excessive laxity is noted and compared to the contralateral side. The test can be repeated in varying degrees of elbow flexion. Test LCL.
2. Medial epicondylitis (Golfer's elbow) – while examiner palpates medial epicondyle patients' forearm is supinated and the elbow and wrist are extended.
3. Lateral epicondylitis test (Tennis elbow)
    a. Cozen's (method 1) – examiner stabilizes elbow (thumb of stabilizing hand is on the lateral epicondyle). Patient is asked to make a fist, pronate forearm, laterally deviate, and extend the wrist while examiner resists the motion. Positive – sudden severe pain in the area of lateral epicondyle.

b. Mill's (method 2) – while palpating lateral epicondyle examiner pronates the patient's forearm, flexes fully the wrist and extends the elbow. Positive – pain over lateral epicondyle.
c. Method 3 – examiner resists extension of the third digit distal to the proximal interphalangeal joint, stressing the extensor digitorum muscle. Positive pain over lateral epicondyle.

4. Tinel's sign at the elbow – tapping in the groove between olecranon and medial epicondyle. Positive – tingling sensation in the ulnar distribution.
5. Wartenberg's sign – patient sits with hands on the table. Examiner separates patient fingers and asks patient to bring them together. Inability to bring the little finger back indicates ulnar neuropathy.
6. Elbow flexion test – patient flexes elbows and extends the wrists, and shoulder depression. Patient maintains this position for 3 to 5 min. Positive – tingling or numbness in ulnar nerve distribution.
7. Test for Pronator Teres syndrome – patient sits with elbow flexed to 90 degrees. Examiner strongly resists pronation. Positive – tingling or numbness in median nerve distribution.
8. Pinch Grip test – patient is asked to pinch the tips of index finger and thumb together. If cannot – positive sign for anterior interosseous nerve problem.

Reflexes and cutaneous distribution

1. Reflexes
   a. biceps (C5, C6 from musculocutaneous nerve)
   b. triceps (C6, C7 from the radial nerve)
   c. brachioradialis (C5, C6 from radial nerve)

Forearm, wrist, and hand

Common deformities

1. Swann-Neck – flexion of MCP and DIP, with extension of PIP. Due to RA or trauma.
2. Claw finger – due to lack of intrinsic muscle action and overactivity of extrinsic extensor muscles. MCP hyperextended and PIP, DIP flexed. Due to median and ulnar nerve palsies.
3. Ulnar drift – ulnar deviation of the digits at MCP joints. Seen in RA.
4. Extensor plus deformity – deformity is caused by shortening or adhesion of extensor digitorum tendon proximal to MCP joints. Results in inability to simultaneously flex MCP and PIP joints.
5. Trigger finger (digital tenovaginitis stenosans) – thickening of the flexor tendon sheath causing sticking of the tendon when patient tries to flex the

finger. There is swelling and constriction. When the patients attempt to flex the finger, tendon sticks, and finger lets go often with the snap. As it gets worse eventually finger will flex but will not let go and will need to be passively moved. Usually affects 3 and 4 fingers. Those most at risk include women, people with diabetes or arthritis, and people whose regular activities strain their hands. Symptoms include stiffness, a popping or clicking sensation, and tenderness in the affected finger. Triggering is usually worse in the morning. Treatment includes splinting, medications, and surgery.

6. Ape hand – wasting of thenar eminence due to median nerve palsy and thumb falls back in line with fingers. Patient is unable to oppose or flex the thumb.
7. Bishop's hand – wasting of hypothenar muscles, interosseous muscles, and tow medial lumbricals due to ulnar palsy. Flexion of 4 and 5^{th} digits.
8. Boutonnière Deformity. Boutonnière deformity is the result of an injury to the tendons that straightens the middle joint of finger. The result is that the middle joint of the injured finger will not straighten, while the fingertip bends back. Boutonnière deformity is generally caused by a forceful blow to the top (dorsal) side of a bent (flexed) middle joint of a finger. It also can be caused by a cut on the top of the finger, which can sever the central slip (tendon) from its attachment to the bone. The tear looks like a buttonhole. In some cases, the bone can pop through the opening. Boutonnière deformities may also be caused by arthritis.
9. Drop wrist – hand cannot be extended due to radial nerve damage.
10. "Z" deformity – thumb flexed at MCP and extended at IP. In RA or hereditary.
11. Dupuytren's contracture - In patients with Dupuytren's disease, this palmar fascia slowly begins to thicken, then tighten. Dupuytren's is first detected when lumps of tissue, or nodules, form under the skin in the palm. This may be followed by pitting on the surface of the palm as the diseased tissue pulls on the overlying skin. As Dupuytren's progresses, bands of fascia in the palm develop into thick cords that can tether one or more fingers and the thumb into a bent position. This is called a "Dupuytren's contracture." Although the cords in the palm may look like tendons, the tendons are not involved in Dupuytren's. Etiology unknown. Risk factors: Men, People of northern European (English, Irish, Scottish, French, and Dutch) and Scandinavian (Swedish, Norwegian, and Finnish) ancestry, Dupuytren's often runs in families. Steroid injection, surgery.
12. Mallet finger – rupture or avulsion of extensor tendon from bone. Distal phalanx rests in flexed position.

Active movements

1. Wrist abduction (radial deviation) is 20 degrees or greater
2. Wrist adduction (ulnar deviation) is 30-45 degrees, (30 degrees or greater)
3. Wrist flexion is 80-90 degrees (60 degrees or greater)
4. Wrist extension is 70-90 degrees (60 degrees or greater)
5. Finger flexion
    a. MCP flexion is 90 degrees
    b. PIP flexion is 100-115 degrees (100 degrees or greater)
    c. DIP flexion is 80-90 degrees, (70 degrees or greater)
6. Finger hyperextension
    a. MCP hyperextension is 30-45 degrees, (20 degrees or greater)
    b. PIP hyperextension is 0 degrees
    c. DIP hyperextension is 0 degrees
7. Finger abduction 20-30 degrees
8. Finger adduction is 0 degrees
9. Thumb flexion
    a. CMC joint is 45-50 degrees
    b. MCP (MP) joint is 50-55 degrees, (60 degrees)
    c. IP joint is 85-90 degrees, (80 degrees or greater)
13. Thumb extension
    a. MCP is 0 degrees
    b. IP is 0 degrees
14. Thumb hyperextension (Passive)
    a. MCP (MP) joint is 40 degrees
    b. IP joint is 30 degrees
15. Thumb abduction is 60-70 degrees, (50 degrees or greater)
16. Thumb adduction is 30 degrees
17. Opposition (tip to tip)

Passive movements

1. Supination of the forearm
2. Pronation of the forearm
3. Wrist flexion
4. Wrist extension
5. Wrist abduction
6. Wrist adduction
7. Finger flexion
8. Finger extension

9. Finger abduction
10. Thumb extension
11. Thumb abduction
12. Opposition

Resisted isometric movements

1. Supination of the forearm
2. Pronation of the forearm
3. Wrist flexion
4. Wrist extension
5. Wrist abduction
6. Wrist adduction
7. Finger flexion
8. Finger extension
9. Finger abduction
10. Thumb extension
11. Thumb abduction
12. Opposition

Functional assessment – Grip

Special tests

1. Ligament instability test for fingers – examiner stabilizes finger with one hand proximal to the joint. Other hand holding finger distal to joint tested applies valgus or varus tests.
2. Thumb ulnar collateral ligament instability test (Gamekeepers or skiers' thumb)– examiner stabilizes patient hand and takes thumb into extension and applies valgus test to MCP joint stressing ulnar collateral ligament.
3. Test for tight collateral ligaments. Greater than 35 degrees movement tear of ligament.
4. Test for tight retinacular ligaments – test structures around PIP joints. PIP is held in neutral position while examiner flexes DIP joint. If the distal joint does nor flex retinacular (collateral) ligaments and/or capsule are tight. If the PIP is flexed and DIP flexes normally, capsule is normal.
5. Lunatotriquetral (Reagan's) test – examiner holds triquetrum and lunate with both hands and moves the lunate up and down. Look for pain, crepitus, laxity – indicates instability.
6. Murphy's sign – patient is asked to make a fist. If the head of third metacarpal is at level with second and fourth metacarpal indicates lunate dislocation.

7. Watson (scaphoid shift) test - the patient rests his arm with his elbow on the table and his forearm lifted. The examiner sits across the table and places his arm next to the patient's arm (like in an arm-wrestling position right to right or left to left). The patient's hand is slightly pronated, and the examiner places his thumb on the palmar side of the scaphoid, his other fingers are wrapped around the back of the wrist. With his other hand the examiner holds the patient's hand at the metacarpal level. The hand is put into ulnar deviation and in slight dorsal flexion; in this position the scaphoid lies almost 'in line' with the ulna. From this position the hand is moved passively by the examiner into radial deviation and slight palmar flexion. Meanwhile a constant pressure is given by the thumb on the scaphoid. During the radial deviation and slight palmar flexion, the distal part of the scaphoid tilts forward and thereby pushes against the examiner's thumb (which is pushing in the opposite direction) causing stress on the joints. This stress is overcome in a normal wrist but results in a dorsal displacement ('shift') of the scaphoid in relation to the other carpal bones in the wrist of a patient with ligamentous laxity.
8. Scaphoid stress test – examiner hold scaphoid and patient tries radially deviate the wrist. In norm no deviation if laxity deviation. (Modified Watson)
9. Piano keys test – patient sitting with hands in pronation. Examiner stabilizes hand that the examiners index finger pushes on distal ulna. Examiners other hand supports patient hand. Examiner pushes down on distal ulna like on piano key. Positive – laxity, pain – indicates instability at distal radioulnar joint.
10. Axial load test – examiner stabilizes patients' wrist with one hand and with other grasps thumb or other finger and applies gentle axial compression. Pain or crepitation indicates positive test for metacarpal fracture.
11. Finkelstein test - the examiner grasps the thumb and ulnar deviates the hand sharply. If sharp pain occurs along the distal radius, Pain is over abductor pollicis longus and extensor pollicis brevis. de Quervain's tenosynovitis is likely.
12. Eichhoff's test - the examiner grasping and ulnar deviating the hand when the person has their thumb held within their fist. If sharp pain occurs along the distal radius, Quervain's tenosynovitis is suspected.
13. Boyes test – test the central slip of extensor hood. Examiner holds fingers to be examined in slight extension at PIP. Patient is asked to flex DIP. Cannot or difficult – positive test. Evaluate the integrity of the central slip in patients with extensor tendon injuries to the hand. Extensor

Tendon Injuries (Hand), Central Slip Extensor Tendon Injury, Boutonniere Deformity

14. Tinel's sign at the wrist – examiner taps over carpal tunnel at the wrist. Positive – tingling, paresthesia's into the thumb, index, and middle fingers.
15. Phalen's test - The patient places her flexed elbows on a table, allowing her wrists to fall into maximum flexion. The patient is asked to push the dorsal surface of her hands together and hold this position for 30-60 seconds. This position will increase the pressure in the carpal tunnel, in effect compressing the median nerve between the transverse carpal ligament and the anterior border of the distal end of the radius. Another way to describe the standard Phalen's test: the patient elbows bent between 0-30 degrees, the therapist asks the patient to supinate forearm, the therapist carries a maximum palmar flexion of the wrist and holds it for 60 seconds. Positive – tingling in the thumb, index, and middle fingers.
16. Reverse Phalen's test - the patient maintains a position of full wrist and finger extension for two minutes. The pressure on the carpal tunnel increases after 10 seconds. The longer the position is held, the greater the pressure on the wrist and carpal tunnel.
17. Carpal compression test – examiner holds supinated wrist in both hands and applies direct even pressure over median nerve in the carpal tunnel and holds for up to 30 seconds.
18. Froment's sign - The patient is asked to make a strong pinch between the thumb and index finger and grip a flat object such as a piece of paper between the thumb and index finger. The examiner then attempts to pull the object out of the patient's hand. There is weakness of the adductor pollicis innervated by the ulnar nerve which would keep the IP joint relatively straight; instead, the FPL muscle which is innervated by the median nerve is used and causes the IP joint to go into a hyper flexed position.
19. Wrinkle test (O'Riain's or Leukens' wrinkle test) is a test of peripheral nerve function. The fingers are placed in warm water for approximately 10-20 minutes. If the fingers do not wrinkle, this is a sign of denervation.
20. Weber's (Moberg's) Two-Point discrimination test - The two-point threshold, the smallest distance between two points where a person determines that it is two points and not one. A person should be able to recognize two points separated by 2 to 8 mm on fingertips, 2 to 4 mm on lips, 8 to 12 mm on palms and 30–40 mm on the shins or back. The posterior column-medial lemniscus pathway is responsible for carrying

information involving fine, discriminative touch. Therefore, two-point discrimination can be impaired by damage to this pathway or to a peripheral nerve.

21. Allen test – is a first-line standard test used to assess the arterial blood supply of the hand. Patient is asked to open and close the hand several times as quickly as possible and then squeeze the hand tightly. Examiner presses on radial and ulnar arteries. Patient opens the hand while pressure on arteries is held. Then one artery is release and perfusion observed. Both arteries are tested.

18. Reflexes and cutaneous distribution

Thoracic Spine

Active movements

1. Forward flexion is 20-45 degrees
2. Extension is 25-45 degrees
3. Lateral (Side) flexion is 20-45 degrees
4. Rotation is 35-50 degrees, (30 degrees or greater)
5. Costovertebral expansion
6. Rib motion

Passive movements

1. Flexion
2. Extension
3. Lateral flexion
4. Rotation

Rested isometric movements

1. Flexion
2. Extension
3. Lateral flexion
4. Rotation

Chest deformities

1. Pigeon chest (pectus carinatum) – sternum project forward and downward. Congenital deformity.
2. Funnel chest (pectus escavatum) – sternum pushed posteriorly by overgrowth of ribs. Congenital deformity.
3. Barrel chest – increased in anterior-posterior chest diameter. Emphysema

Special tests

1. Slump test - is a neural tension test used to detect neural tissue sensitivity. Patient is asked to slump forward (Thoracic and lumbar

spine), if no symptoms patient es the head/neck, if no symptoms passively extend the patients knee, if no symptoms passive dorsiflex the foot. Symptoms – impingement of the dura, spinal cord, nerve root

Lumbar spine

AEOM

1. Forward flexion is 40-60 degrees (60 degrees or greater)
2. Extension is 20-35 degrees, (25 degrees or greater)
3. Lateral flexion is 15-20 degrees, (25 degrees or greater)
4. Rotation is 3 to 18 degrees

PROM

1. Flexion
2. Extension
3. Lateral flexion
4. Rotation

RIM

1. Flection
2. Extension
3. Lateral flexion
4. Rotation

Myotomes

1. L2 – hip flexion
2. L3 – knee extension
3. L4 – ankle dorsiflexion
4. L5 – great toe extension
5. S1 – plantar angle flexion, ankle extension, hip extension
6. S2 – knee flexion

Activity and increase in disc pressure at L3 level

1. Coughing and sneezing – 5 to 35%
2. Laughing – 40 to 50 %
3. Walking – 15$
4. Side bending 25%

5. Small jumps – 40%
6. Bending forward – 150%
7. Rotation – 20%
8. Lifting 20 kg weight with back straight and knees bent – 70%
9. Lifting 20 kg weight with back bent and knees straight – 170%

Types of disc herniation – protrusion, prolapse, extrusion, sequestration
Special tests

1. Quick test – squatting as far as can down while on toes. Test's hip, knee, ankle and foot joints.
2. Slump test - Slump test - is a neural tension test used to detect neural tissue sensitivity. Patient is asked to slump forward (Thoracic and lumbar spine), if no symptoms patient es the head/neck, if no symptoms passively extend the patients knee, if no symptoms passive dorsiflex the foot. Symptoms – impingement of the dura, spinal cord, nerve root
    a. ST1 – cervical spine flexion, thoracic and lumbar spine flexion, hip flexion 90degrees +, knee extension, ankle dorsiflexion – spinal cord, cervical and lumbar spinal nerve roots, sciatica nerve
    b. ST2 - cervical spine flexion, thoracic and lumbar spine flexion, hip flexion 90 degrees+ and abduction, knee extension, ankle dorsiflexion – obturator nerve
    c. ST3 – side lying - cervical spine flexion, thoracic and lumbar spine flexion, hip flexion 20 degrees, knee flexion, plantar flexion – femoral nerve
    d. ST4 - long sitting – cervical spine flexion and rotations, thoracic and lumbar flexion, hip flexion 90 degrees +, knee extension, ankle dorsiflexion – spinal cord, cervical and lumbar nerve roots. Sciatica nerve
3. Straight leg raising test (Lasegue's sign, Lasegue test or Lazarevic's sign) - to determine whether a patient with low back pain has an underlying nerve root sensitivity, often located at L5. With the patient lying down on their back on an examination table or exam floor, the examiner lifts the patient's leg while the knee is straight.

a. SLR Basic – hip flexion and abduction, knee extension, ankle dorsiflexion – sciatica nerve, tibial nerve
b. SLR 2 - hip flexion, knee extension, ankle dorsiflexion, foot eversion, toe extension – tibial nerve
c. SLR 3 - hip flexion, knee extension, ankle dorsiflexion, foot inversion – Sural nerve.
d. SLR 4 - hip flexion and medial rotation, knee extension, ankle plantar flexion, foot inversion – common peroneal nerve
e. SLR 5 – well leg hip flexion, knee extension, ankle dorsiflexion – disc prolapse/nerve root
f. Pain at hip flexion 35-70 degrees – nerves
g. Pain increases at hip flexion past 70 degrees – joint problem
h. Stress on sacroiliac joint from 0 to 70 degrees, after 70 degrees stress on lumbar spine

4. Prone knee bending test – patient lies prone, and examiner passively flexes the knee as far as possible that the foot rests on the buttocks. Examiner ensures that the hip is not rotating. If flexion is not possible past 90 degrees at the knee, test can be performed by passive extension of the hip while the knee is flexed as much as possible. Pain in lumbar area, gluteal area, and posterior thigh may indicate L2, L3 nerve root lesions. This test also stretches femoral nerve and quadriceps muscle.
5. Brudzinski – Kernig test - severe neck stiffness causes a patient's hips and knees to flex when the neck is flexed. Patient in supine position, gently grasp the patient's head from behind and place the other hand on the patient's chest, gently flex the neck, bringing chin to chest, positive sign is involuntary flexing of hips and knees – positive for meningitis
6. Naffziger’s test – patient lies supine while examiner gently compresses jugular veins for 10 seconds. The patients face flushes and patient is asked to cough. If coughing causes pain in lower back spinal theca (dura, arachnoid, pia) is being compressed.
7. Valsalva maneuver – seated patient is asked to take a breath, hold it, and bear down like when evacuating bowels. If pain increases, that indicates increased intrathecal pressure.

8. Frontal nerve traction test – patient lies on unaffected side with unaffected lower extremity slightly flexed at the hip and knee. Back straight and neck slightly flexed. Examiner extends the affected sides hip and knee. Knee is then flexed. Pain in anterior thigh is positive for femoral nerve involvement, also it can indicate L2, L3, L4 nerve root involvement.
9. Bowstring test - This provocative test is used to evaluate lumbar nerve root compression (lumbar disc herniation or sciatic nerve irritation). Patient at supine lying position, examiner performs SLR, at the point of maximum pain (positive SLR) the examiner will slightly flex the patient's knee thereby reducing the pain, examiner applies pressure (via thumb) on the hamstring muscle if no pain is elicited then apply pressure on the popliteal fossa (sciatic nerve). Positive – radicular symptoms, sciatica nerve involvement
10. Sitting root test – knee is actively extended while hip is bent at 90 degrees. Sciatica nerve.
11. Babinski test – examiner runs pointed object along plantar surface of the foot. Positive – extension of the big toe and abduction of other toes. Indicated upper motor lesion.
12. Oppenhein test – examiner runs fingers along crest of patient tibia. Positive Babinski reflex.
13. Trendelenburg test - A positive Trendelenburg sign usually indicates weakness in the gluteus medius, gluteus minimus. The patient is asked to stand on one leg for 30 seconds without leaning to one side the patient can hold onto something if balance is an issue. The therapist observes the patient to see if the pelvis stays level during the single-leg stance. A positive Trendelenburg Test is indicated if during unilateral weight bearing the pelvis drops toward the unsupported side. The patient also can be asked to go up and down on toes. If cannot possible S1 nerve root lesion.

Hip joint

AROM

1. Flexion is 110-120 degrees, (100 degrees or greater)
2. Extension is 10-15 degrees, (30 degrees or greater)
3. Abduction is 30-50 degrees, (40 degrees or greater)

4. Adduction is 30 degrees, (20 degrees or greater)
5. Lateral rotation is 40-60 degrees, (50 degrees or greater)
6. Medial rotation is 30-40 degrees, (40 degrees or greater)

PROM

1. Flexion
2. Extension
3. Abduction
4. Adduction
5. Lateral rotation
6. Medial rotation

RIM

1. Flexion
2. Extension
3. Abduction
4. Adduction
5. Lateral rotation
6. Medial rotation

Special tests

1. Patrick (Faber) test – the patient supine, the leg is placed in a figure-4 position (hip flexed and abducted with the lateral ankle resting on the contralateral thigh proximal to the knee. While stabilizing the opposite side of the pelvis at the anterior superior iliac spine, an external rotation, abduction, and posterior force is then lightly applied to the ipsilateral knee until the end range of motion is achieved. A further few small-amplitude oscillations can be applied to check for pain provocation at the end range of motion. A positive test is one that reproduces the patient's pain or limits their range of movement. The FABER test is used to identify the presence of hip pathology by attempting to reproduce pain in the hip, lumbar spine or sacroiliac region. Sacroiliac Joint Pain on external hip rotation - Sacroiliac Joint Dysfunction, Sacroiliitis. Groin Pain on external hip rotation - Iliopsoas Strain or Iliopsoas Bursitis, Intraarticular Hip Disorder, Hip Impingement (femoral acetabular impingement), Hip Labral Tear, Hip loose bodies, Hip

chondral lesion, Hip Osteoarthritis. Posterior Hip Pain on external hip rotation - Posterior Hip Impingement

2. Trendelenburg test - A positive Trendelenburg sign usually indicates weakness in the gluteus medius, gluteus minimus. The patient is asked to stand on one leg for 30 seconds without leaning to one side the patient can hold onto something if balance is an issue. The therapist observes the patient to see if the pelvis stays level during the single-leg stance. A positive Trendelenburg Test is indicated if during unilateral weight bearing the pelvis drops toward the unsupported side. The patient also can be asked to go up and down on toes. If cannot possible S1 nerve root lesion.
3. Craigs test – measures femoral anteversion.
4. Torque test – tests for hip joint stability. Patient lies supine close to the edge of table. Test leg gets abducted and extended until pelvis start to move. Examiner the starts with one hand to medially rotate the femur and other hand applies posterior lateral pressure on neck of femur for 20 seconds.
5. Ortolani's sign – the test is performed with the Barlow maneuver and inspection of the hip joint and legs. It relocates the dislocation of the hip joint that has just been elicited by the Barlow maneuver. The Ortolani test is performed by an examiner first flexing the hips and knees of a supine infant to 90°, then with the examiner's index fingers placing anterior pressure on the greater trochanters, gently and smoothly abducting the infant's legs using the examiner's thumbs.
6. Barlow maneuver – examiner adducts the hip (bringing the thigh towards the midline) while applying pressure on the knee, directing the force posteriorly.
7. Sign of the buttock – examiner preform SLR, if there is limitation examiner flexes patient knee and sees if there is increase in range. If there is no increase in range lesion is in buttock and not in hip or sciatica.
8. Thomas test – assess hip flexion contracture. Patient in supine and examiner check for excessive lordosis. Patient brings one leg that is flexed at knee to chest. If there is flexor contracture straight leg rises.

9. Rectus femoris test – the patient lies supine with the knees bent over the end of the edge of the table. Patient brings one knee to the chest. The opposite leg should stay on the table.
10. Ely's test – patient lies prone, and examiner flexes the patient knee. On knee flexion patient hip flexes from the table. Indicates tight rectus femoris.
11. Ober's test – assessment of tensor fascia latae. Patient on the side with lover leg flexed at the hip and knee. Examiner passively extends and abducts upper limb at the hip joint. Examiner slowly lowers the limb. If there is contracture limb stays up.
12. Hamstring contracture test – patient sits with one knee flexed and other fully extended. Patient tries to touch the toes of extended lower extremity. If patient cannot touch toes indicates hamstring tightness.

Knee joint

AROM

1. Flexion is 0 to 135 degrees, (110 degrees or greater)
2. Extension is 0-15 degrees (0 degrees)
3. Medial rotation (tibia on the femur) is 20-30 degrees
4. Lateral rotation (tibia on the femur) is 30-40 degrees

PROM

1. Flexion
2. Extension
3. Medial rotation
4. Lateral rotation

RIM

1. Flexion
2. Extension
3. Medial rotation
4. Lateral rotation

Restraints of the knee

1. Anterior translation – ACL assisted by MCL, LCL, mediolateral capsule, popliteus corner, iliotibial band, semimembranosus
2. Posterior translation – PCL assisted by MCL, LC, popliteus tendon, anterior and posterior meniscofemoral ligaments
3. Valgus rotation (medial gapping) – MCL assisted by ACL, PCL, semimembranosus, posterior capsule when knee fully extended
4. Varus rotation (lateral gapping) – LCL assisted by ACL, PCL, posterior capsule when knee fully extended
5. Lateral rotation – MCL, LCL, assisted by popliteus corner
6. Medial rotation – ACL, PCL, assisted by anterolateral capsule, semimembranosus corner, anterolateral ligament

Instability tests

1. Abduction (valgus) stress test - The examiner applies a valgus stress (pushes the knee medially) at the knee while the ankle is stabilized in slight lateral rotation either with the hand or with the leg held between the examiner's arm and trunk. The knee is first in full extension, and then it is slightly flexed (20 to 30 degrees) so that it is "unlocked
    a. With knee bent 20 to 30 degrees tests – MCL, PCL and Posterior oblique ligament
    b. Hughston's valgus stress test - the examiner faces the patient's foot, placing his or her body against the patient's thigh to help stabilize the upper leg in combination with one hand, which can also palpate the joint line. With the other hand, the examiner grasps the patient's big toe and applies a valgus stress, allowing any natural rotation of the tibia
    c. Swain test - For this test, the patient is seated with the knees flexed to 90 degrees over the edge of the examining table. The examiner then passively laterally rotates the tibia on the femur of the good leg followed by the injured leg. A positive test is indicated by pain along the medial side of the joint
2. Adduction (varus) stress test) - The examiner applies a varus stress (pushes the knee laterally) at the knee while the ankle is stabilized. The test is first done with the knee in full extension and then with the knee in 20 to 30 degrees of flexion.

    a. At 20 to 30 degrees affects – LCL, ITB, Biceps femoris tendon, Posterolateral capsule, Arcuate popliteus complex
    b. Hughston's varus stress test - the examiner grasps the fifth and fourth toes and applies a varus stress to the knee that is in extension and slight flexion at 20 to 30 degrees.
3. Varus-valgus test – The patient lies supine with the knee extended and then flexed, the examiner holds the ankle between waist and forearm, palpates the medial and lateral joint lines with fingers and with heels applies varus and valgus stresses
4. Lachman test – best test for ACL injury. The patient lies supine with the involved leg beside the examiner. The examiner holds the patient's knee between full extension and 30 degrees of flexion. The examiner stabilized the patient's femur with one hand while the other hand moves the proximal aspect of tibia forward. Tibia should be slightly in lateral rotation. Lachman test has seven modifications:
    a. Modification 1 - The patient sitting with the leg over the edge of the examining table. The examiner sits facing the patient and supports the foot of the test leg on the examiner's thigh so that the patient's knee is flexed 30 degrees. The examiner stabilizes the thigh with one hand and pulls the tibia forward with the other hand
    b. Modification 2 - The patient lies supine with the knee resting on the examiner's knee. One of the examiner's hands stabilizes the femur against the examiner's thigh, and the other hand applies an anterior stress to the tibia.
    c. Modification 3 - The patient lies supine, and the leg to be examined is abducted off the side of the examining table and the knee is flexed to 25 degrees. The examiner stabilizes the femur against the table with one hand and the patient's foot is held between the examiner's knees. The examiner with other hand applies the anterior translation force to the tibia.
    d. Modification 4 - the patient lying supine while the examiner stabilizes the foot between the examiner's thorax and arm. Both hands are placed around the tibia, the knee is flexed 20° to 30°, and an anterior drawer movement is performed.

e. Modification 5 - The examiner grasps the femur with one hand and the tibia with the other hand. The tibia is pulled forward, and any abnormal motion is noted
f. Modification 6 - the patient lies prone, and the examiner stabilizes the patient's foot between the examiner's thorax and arm and places one hand around the tibia. The other hand stabilizes the femur. The examiner applies forward force on tibiae assisted by gravity.
g. Modification 7 - the patient lies supine with the knee over the examiner's forearm so that the knee is flexed approximately 30 degrees. The patient is asked to actively extend the knee, and the examiner watches for anterior displacement of the tibia relative to the unaffected side.
h. Modification 8 (Maximum quadriceps test) - the patient lies supine with the knee over the examiner's forearm so that the knee is flexed approximately 30 degrees. The patient is asked to actively extend the knee while examiner is holding the foot down on the table.
i. Structures tested
    - Anterior cruciate ligament (especially the posterolateral bundle)
    - Posterior oblique ligament
    - Arcuate-popliteus complex

5. Drawer sign – the patient is supine with the hip flexed to 45 degrees and knee flexed to 90 degrees. The examiner sits on the patient's forefoot to stabilize it. The examiner draws tibia forward with both hands. The movement is no more than 6 mm.
    j. Anterior cruciate ligament
    k. Posterolateral capsule
    l. Posteromedial capsule
    m. Medial collateral ligament
    n. Iliotibial band
    o. Posterior oblique ligament
    p. Arcuate-popliteus complex
6. Godfrey (Gravity) test - The patient lies supine, and the examiner holds both legs while flexing the patient's hips and knees to 90 degrees. If there is posterior instability, a posterior sag of the tibia is seen. Posterior pressure may increase posterior displacement.

7. Posterior sag sing (Gravity drawer test) - The patient lies supine with the hip flexed to 45 degrees and the knee flexed to 90 degrees. In this position the tibia drops or sags back, on the femur because of gravity if the posterior cruciate ligament is torn.
8. Reverse Lachman test - The patient lies prone with the knee flexed to 30 degrees. The examiner holds the tibia with one hand while fixing the femur with the other hand. Hamstring muscle should be relaxed. The examiner pulls the tibia up (posteriorly), noting the amount of movement and the quality of the end feel. It is a test for the posterior cruciate ligament. This test is not as accurate for the posterior cruciate ligament as the posterior drawer test because.
9. Slocum test – assess both anterior rotation instabilities. The patient's knee is flexed to 80-90 degrees, and the hip is flexed to 45 degrees. The foot is first placed in 30 degrees medial rotation. The examiner then sits on the patient's forefoot to hold the foot in position and draws the tibia forward. If there is instability excessive movement will occur primarily on the lateral side of the knee. The following structures can be affected:
    a. Anterior cruciate ligament
    b. Posterolateral capsule
    c. Arcuate-popliteus complex
    d. Lateral collateral ligament
    e. Posterior cruciate ligament
    f. Iliotibial band

    In the second part of the test, the foot is placed in 15 degrees of lateral rotation, and the tibia is drawn forward by the examiner. If the test is positive, the movement occurs primarily on the medial side of the knee. The following structures can be affected
    a. Medial collateral ligament
    b. Posterior oblique ligament
    c. Posteromedial capsule
    d. Anterior cruciate ligament
10. Lelli test (Lever sign) - The patient is in supine position with the knee fully extended. The examiner places a closed fist under the proximal third of the patient's calf. The examiner's other hand lowly applies a moderate downward force to the distal third of the femur.

a. If the anterior cruciate ligament is intact, the patient's heel will lift off the examining table.
b. If the anterior cruciate ligament is partially or completely torn the heel will not raise off the examining table and the tibial plateau will slide forward relative to the femoral condyles.

11. Lateral pivot shift maneuver (test of Macintosh) - This is the primary test used to assess ALRI of the knee and is an excellent test for ruptures (third-degree sprains) of the anterior cruciate ligament. The pivot shift test closely correlates with patient's outcome. The presence of a pivot shift after surgery often would not allow return to sports, can be associated with continuation of symptoms, and increases the likelihood of osteoarthrosis.
12. Losee test - clinical duplication of the ALRI mechanism of injury. Examiner laterally rotates the foot and flexes the knee to 30 degrees. With other hand examiner applies valgus force. Just before full extension there will be clunk (tibia subluxate anteriorly) – positive test.

Test for meniscal injury

1. Mc Murray test - The patient lies in the supine position with the knee completely flexed (the heel is at the buttock). The examiner then medially rotates the tibia and extends the knee. This can cause a snap or click that can be accompanied by pain. The amount of flexion can be changed that allows to examine different parts of meniscus. To test the medial meniscus, the examiner performs the same procedure with the knee laterally rotated.
2. Apley's test - The patient lies in the prone position with the knee flexed to 90 degrees. The examiner anchors patient's thigh with the knee. The examiner medially and laterally rotates the tibia, combined first with distraction, while noting any restriction, excessive movement, or discomfort. Then the process is repeated using compression instead of distraction. If rotation plus distraction is more painful or shows increased rotation relative to the normal side, the lesion is probably ligamentous. If the rotation plus compression is more painful or shows decreased rotation relative to the normal side, the lesion is probably a meniscus injury.

3. Bounce home test - The patient lies supine position and examiner holds patients heel and knee is completely flexed. Knee is then allowed to go in passive extension. If extension is not complete or has a rubbery end feel, the most likely cause of a block is a torn meniscus
4. Childress sing (Duck walk test) – patient is asked to fully squat and walk forward. Pain in joint line or clicking can indicate posterior meniscal horn injury

Tests for swelling

1. Brush, stroke, or bulge test – used to assess minimal effusion. This test can show 4-8 mL of extra fluid. The fluid wave may take 2 seconds to appear. Test is performed by examiner stroking up over medial area of the knee and down over lateral area of the knee and looks for the bulge on medial joint line.
2. Fluctuation test – alternatively pressing above and below patella.
3. Indentation test – disappearance of indentation during knee flexion is positive test.
4. Patellar tap test (floating patella)

Test for patella-femoral dysfunction

1. Active patellar grind test – examiner palpates for crepitus during passive knee extension.

Other tests

1. Measurement of leg length – measure from ASIS to lateral or medial malleolus.

Ankle joint

AROM

1. Plantar flexion is 50 degrees, (40 degrees or greater)
2. Dorsiflexion is 20 degrees or greater
3. Inversion (supination) is 45 to 60 degrees, (30 degrees or greater)
4. Eversion (pronation) is 15 to 30 degrees, (20 degrees or greater)

PROM

1. Plantar flexion

2. Dorsiflexion
3. Inversion (supination)
4. Eversion (pronation)

RIM

1. Plantar flexion
2. Dorsiflexion
3. Inversion (supination)
4. Eversion (pronation)
5. Supination is made up of inversion of the hindfoot, adduction of the forefoot, and plantarflexion of the talocrural (ankle) regions. Pronation is made up of eversion of the hindfoot, abduction of the forefoot, and dorsiflexion of the talocrural (ankle) regions.

Special tests

1. Neutral position of the talus - The patient lies prone with the foot extended over the end of the examining table. The examiner grasps the patient's foot over the fourth and fifth metatarsal heads with the index finger and thumb of one hand. The examiner palpates both sides of the talus on the dorsum of the foot. The examiner then passively and gently dorsiflexes the foot until resistance is felt. While maintaining the dorsiflexed position, the examiner moves the foot back and forth through an arc of supination and pronation. As the arc of movement is performed, there is a point in the arc at which the foot appears to fall off to one side or the other more easily. This point is the neutral, non–weight-bearing position of the subtalar joint. This prone test position is best for determining the relation of the hindfoot to the leg.
2. Leg heel alignment - The patient lies in the prone position with the foot extending over the end of the examining table. The examiner places a mark over the midline of the calcaneus at the insertion of the Achilles tendon. The examiner makes a second mark approximately 1 cm distal to the first mark and as close to the midline of the calcaneus as possible. A calcaneal line is then made to join the two marks. Next, the examiner makes two marks on the lower third of the leg in the midline. These two marks are

joined, forming the tibial line, which represents the longitudinal axis of the tibia. The examiner then places the subtalar joint in the prone neutral position. While the subtalar joint is held in neutral, the examiner looks at the two lines. If the lines are parallel or in slight varus (2 to 8 degrees), the leg-to-heel alignment is considered normal. If the heel is inverted, the patient has hindfoot varus; if the heel is everted, the patient has hindfoot valgus

3. Forefoot heel alignment - The patient lies supine with the feet extending over the end of the examining table. The examiner positions the subtalar joint in supine neutral position. While maintaining this position, the examiner pronates the midtarsal joints maximally and then observes the relation between the vertical axis of the heel and the plane of the second through fourth metatarsal heads. Normally, the plane is perpendicular to the vertical axis. If the medial side of the foot is raised, the patient has a forefoot varus; if the lateral side of the foot is raised, the patient has a forefoot valgus
4. Test for tibial torsion - The patient lies prone with the knee flexed to 90 degrees. The examiner views from above the angle formed by the foot and thigh, after the subtalar joint has been placed in the neutral position, noting the angle the foot makes with the tibia. This method is most often used in children because it is easier to observe the feet from above.
5. Anterior drawer sign of the ankle - This test is designed primarily to test for injuries to the anterior talofibular ligament, the most frequently injured ligament in the ankle. The patient lies supine with the foot relaxed. The examiner stabilizes the tibia and fibula, holds the patient's foot in 20 degrees of plantar flexion, and draws the talus forward in the ankle mortise. In the plantar-flexed position, the anterior talofibular ligament is perpendicular to the long axis of the tibia. By adding inversion, which gives an anterolateral stress, the examiner can increase the stress on the anterior talofibular ligament and the calcaneofibular ligament. A positive anterior drawer test may be obtained with a tear of only the anterior talofibular ligament, but anterior translation is greater if both ligaments are torn.
6. Prone anterior drawer test - The patient lies prone with the feet extending over the end of the examining table. With one hand, the examiner pushes the heel steadily forward). Excessive anterior movement and a sucking in of

the skin on both sides of the Achilles tendon indicate a positive sign. The test, indicates instability of the anterior talofibular ligament

7. Talar tilt - The patient lies in the supine or side-lying position with the foot relaxed This test is to determine whether the calcaneofibular ligament is torn. The normal side is tested first for comparison. The foot is held in the 90-degree position, which brings the calcaneofibular ligament perpendicular to the long axis of the talus. The talus is then tilted from side to side into inversion and eversion. Inversion tests the calcaneofibular ligament. Eversion stresses the deltoid ligament and posterior tibiotalar ligaments.
8. Thompson test - The patient lies prone or kneels on a chair with the feet over the edge of the table or chair. While the patient is relaxed, the examiner squeezes the calf muscles. The absence of plantar flexion when the muscle is squeezed indicates a positive test and a ruptured Achilles tendon (third-degree strain).

Foot joints

AROM

1. Toe flexion
    g. MTP is 40 degrees
    h. PIP is 35 degrees
    i. DIP is 60 degrees
2. Toe extension
    q. MTP is 40 degrees
    r. PIP is 0 degrees
    s. DIP is 30 degrees
3. Great toe flexion
    a. MTP is 45 degrees
    b. IP is 90 degrees
4. Great toe extension
    a. MTP is 70 degrees

b. IP is 0 degrees