

Class 2

Orthopedic Assessment

Postural assessment

Correct posture – is the position in which minimum stress is applied to each joint or the optimal alignment of the patient's body that allows the neuromuscular system to perform actions requiring the least amount of energy to achieve the desired effect.

Factors affecting posture

1. Structural anatomic factors
 - a. Bony contours – hemivertebrae
 - b. Leg length discrepancy (bone length)
 - c. Extra or less vertebra
 - d. Laxity of ligamentous structures
 - e. Fascial and musculotendinous tightness (tensor fascia latae, pectoralis, hip flexors)
 - f. Muscle tone (erector spinae, gluteus maximus, abdominals)
 - g. Pelvic angle (normal is 30 degrees)
 - h. Joint position and mobility
 - i. Neurogenic outflow and inflow
2. Age
3. Physiological issues
4. Pathological issues (Parkinsonism)
5. Recreational
6. Environment
7. Social/cultural

Vertebral column = spine. Cervical, thoracic, lumbar, sacral, coccygeal.

Primary curve – **concave** anteriorly (**Convex** posteriorly). Thoracic , (sacral) – stays as primary curve. Cervical curve will start to change at 3 month of age and lumbar spine starting 6-8 month and will become concave posteriorly.

- Cervical and lumbar – lordosis type of curve
- Thoracic, sacral – kyphotic type of curve

The most common problem is posture due to **prolonged** sitting, standing.

Maintenance of correct posture requires muscles that are **strong**, flexible, and easy adaptable to environmental change. To maintain an upright posture.

Examination

1. Observation

a. Standing – front, sides, back

- b. Forward flexion – front, side, back
- c. Sitting – front, side, back
- d. Supine lying
- e. Prone lying

- 2. Examination – assessment of posture primarily involves history and observation, but examination can be conducted and should include at least:
 - a. Leg length measurement
 - b. Slump test
 - c. Other areas of examination are based on examinations of each specific region

- 3. Functional assessment – static postural analysis, balance, flexibility and movement

Normal alignment in the standing posture – anterior view

- 1. Head – eyes and ears level and symmetrical.
- 2. Right and left angles between shoulders and neck should be symmetrical, clavicles symmetrical
- 3. Ribs on each side symmetrical
- 4. Right and left waist angles symmetrical
- 5. ASIS level
- 6. Patella symmetrical and facing straight ahead
- 7. Malleoli symmetrical and feet parallel, toes straight

Normal alignment in the standing position – lateral view

- 1. Earlobe in line with acromion process (tip of the shoulder)
- 2. Upper back normally rounded
- 3. Trunk erect
- 4. Abdomen flat

5. Lower back normally curved
6. Pelvic angle tilt 7 to 15 degrees (13 +/- 6)
7. PSIS slightly higher than ASIS – 1 to 3 finger width higher

Normal alignment in the standing position – posterior view

1. Head in the midline, Earlobe in line
2. Shoulders at level
3. Spine of the scapula at level
4. Inferior angle of the scapula at level
5. Spine straight, no lateral curves
6. Ribs symmetrical
7. Iliac crest. Waist angle at level
8. PSIS at level
9. Greater trochanters at level
10. Gluteal folds at level
11. The Knee joint at level
12. Achilles's tendons descend straight
13. Heels are straight

Common spinal deformities

Lordosis (Hyperlordosis)

Anterior curvature of the spine. Pathology when it is exaggerated.

1. Causes
 - a. Postural or functional deformity
 - b. Lax abdominals and tight hip flexors and lumbar extensors
 - c. Heavy abdomen
 - d. Compensatory mechanisms from another deformity
 - e. Spondylolisthesis
 - f. Wearing high heeled shoes
2. Two types of exaggerated lordosis – pathological lordosis and swayback deformity
3. Changes associated with pathological lordosis
 - a. Sagging shoulders – protracted scapula with medially rotated arms

- b. Medial rotation of the legs
- c. Poking forward head (in front of center of gravity)
- d. Anterior tilted pelvis, knees hyperextended, ankle joints slightly plantar flexed
- e. Muscle elongated and weak (in front/anterior) – **abdominals, multifidus and rotators**, thoracic erector,
- f. Muscles shorter and strong (posterior) – **lumbar erector spinae**, hip flexors, upper trapezius, pectoralis major and minor, levator scapula, SCM, scalene, suboccipital
- g. Joints affected – lumbar joints, hip, thoracic, glenohumeral, atlantooccipital, Cervical, TMJ
- h. Increased pelvic angle to 40 degrees
- 4. Observation – sagging shoulders, arms medially rotated, medial rotation of the legs and poking forward of the head

Swayback deformity

- 1. Increased pelvic inclination to 40 degrees, and the thoracolumbar spine exhibits a kyphosis.
- 2. **Results from spine bending back at the lumbosacral angle.** The entire pelvis shifts anteriorly that hips to move into extension.
- 3. To maintain the center of gravity in its normal position, the thoracic spine flexes on the lumbar spine. The result is increase in lumbar and thoracic curves
- 4. Lower lumbar area flattens. Long kyphosis with the pelvis the most anterior body segment. Lower lumbar area flattens. Hip and knee joints hyperextended.
- 5. Muscle elongated and weak – lower abdominals, external obliques, lower thoracic extensors, neck flexors
- 6. Muscles short and strong – hamstrings, hip extensors, upper fibers of internal oblique, internal intercostal
 - a. Low back musculature short but weak
- 7. Joints affected – pelvic joint, hip joints, thoracic spine, glenohumeral joints, cervical, atlantooccipital, TMJ

Kyphosis (Hyperkyphosis) – Kyphosis is a posterior curvature of the spine. Pathologically, it is an exaggeration of the normal curve found in the thoracic spine.

1. Causes
 - a. Compensation in conjunction with lordosis
 - b. Tumors
 - c. Senile osteoporosis
 - d. Vertebral compression fracture
 - e. Ankylosing spondylitis
 - f. Tuberculosis
 - g. Congenital anomalies
 - h. Scheuermann's disease
 - i. Compression fractures
 - j. Paralysis

Types of abnormal kyphosis curves – round back, Gibbus, Flat back, Dowager's hump

1. Round back
 - a. Pelvic inclination (angle) is **<30 degrees** and thoracolumbar kyphosis. Patient presents with flexed trunk and decreased lumbar curve., with tight hip extensors and trunk flexors and weak hip flexors and lumbar extensors.
 - b. Body – head held forward with cervical spine hyperextended. Protracted scapula, increased thoracic kyphosis, hip flexed, knees hyperextended. Head is the most anteriorly placed part
 - c. Long and weak muscles – neck flexors, upper erector spine, external obliques, thoracic erector spinae, rhomboids
 - d. Short and strong muscles – neck extensors, hip flexor, upper abdominals, intercostals
2. Humpback or Gibbus
 - a. Localized, sharp posterior angulation in the thoracic spine. Structural deformity as the result of fracture or pathology
3. Flat back
 - a. Pelvic inclination around 20 degrees

- b. Loss of lordosis with posterior pelvic tilt, hip and knee joint hyperextension, forward head posture and with increased flexion of upper thoracic spine
- c. Muscle elongated and weak – hip flexors, lumbar extensors, multifidus and rotators, scapular protractors, thoracic erector spinae
- d. Joint – Lumbar, pelvic
- e. (Military, dancers)
- 4. Dowager's hump
 - a. Old female with osteoporosis with degeneration of vertebral bodies and wedge in anterior direction, that results in kyphosis

Other spinal abnormalities

- 1. Kypholordotic posture
 - a. Head held forward with cervical hyperextension, increased lumbar lordosis, increased thoracic kyphosis, pelvic anterior tilt, hips flexed, knees hyperextended, head is most anterior body segment
 - b. Long and weak muscles – neck flexors, upper erector spinae, thoracic erector spinae, middle and lower trapezius, rhomboids
 - c. Short and strong muscles – neck extensors, hip flexors, intercostals
 - d. Joints affected – lumbar, cervical, thoracic, glenohumeral
- 2. Scoliosis
 - a. Lateral curves on the spine.
 - b. The most visible spinal deformity
 - c. Structural or non-structural, idiopathic or acquired
 - d. Nonstructural or functional
 - Postural problems
 - Hysteria
 - Nerve root irritation
 - Inflammation
 - Compensation caused by leg length discrepancy
 - Contracture in the lumbar spine
 - **Curve can disappear on forward flexion**
 - e. Structural scoliosis involves body deformity – congenital or acquired, or excessive muscle weakness.
 - Does not disappear on forward flexion

- Progressive
- f. Torticollis – neuromuscular problem congenital (Abnormal SCM), ear problems, TMJ
- g. Idiopathic scoliosis accounts for 75 to 85% of all cases of structural scoliosis
 - a. Single or double lateral curves, may be compensatory curve, ribs protrude on one side and hollow on other side. One leg is shorter.
 - b. Long and weak – muscles on the convex
 - c. Short and strong muscles – on concave side

Cervical postural strain

1. Cervical curve is flattening and/or head is positioned forward
2. Head hangs on ligaments, muscles, that leads to tension, pain and spasm
3. Gradual
4. Symptoms start in lateral spine and upper trapezius
5. Bilateral
6. Aching, tenderness, lumps, knots, feeling of pressure in cervical spine
7. Pain gets worst in arms are raised and unsupported
8. AROM – normal
9. PROM - normal
10. RIM – normal strength, with discomfort
11. Special test – Chin to chest – reproduction of increase of symptoms in 1-2 minutes

Spondylolisthesis

1. Slipping forward of one vertebra upon another
2. Due to presence of bony defect at the pars interarticularis
3. Back or leg pain
4. Most common level is L5
5. Standing, bending increases pain, sitting reduces pain
6. X-ray

Spondylolysis

1. Bony defect at the pars interarticularis
2. X-ray

Tumors of the spine

1. Most are metastatic
2. Persistent pain
3. Can mimic disc disease
4. Can cause kyphosis and scoliosis
5. X-ray and MRI

Ankylosing spondylitis

1. Insidious onset
2. More in males
3. Pain in lower back, can change all the spine
4. Flattening of cervical and lumbar curves
5. AROM – limited
6. PROM – limited
7. RIM – normal
8. X-ray (Bamboo spine)

Fractures

1. Compression fractures of the spine
 - a. Wedge fractures
 - b. Body fracture
 - c. Axial loading with flexion movement
 - d. Osteoporosis
 - e. Pain on the movement
2. Fatigue fracture
 - a. Foot
 - b. Stress, march, or insufficiency fracture
 - c. Pain at rest, that increases with activity
3. Fatigue fracture of medial epicondyle at the elbow
 - a. In children who play baseball (Pitchers)
 - b. Pain and swelling epicondyle

