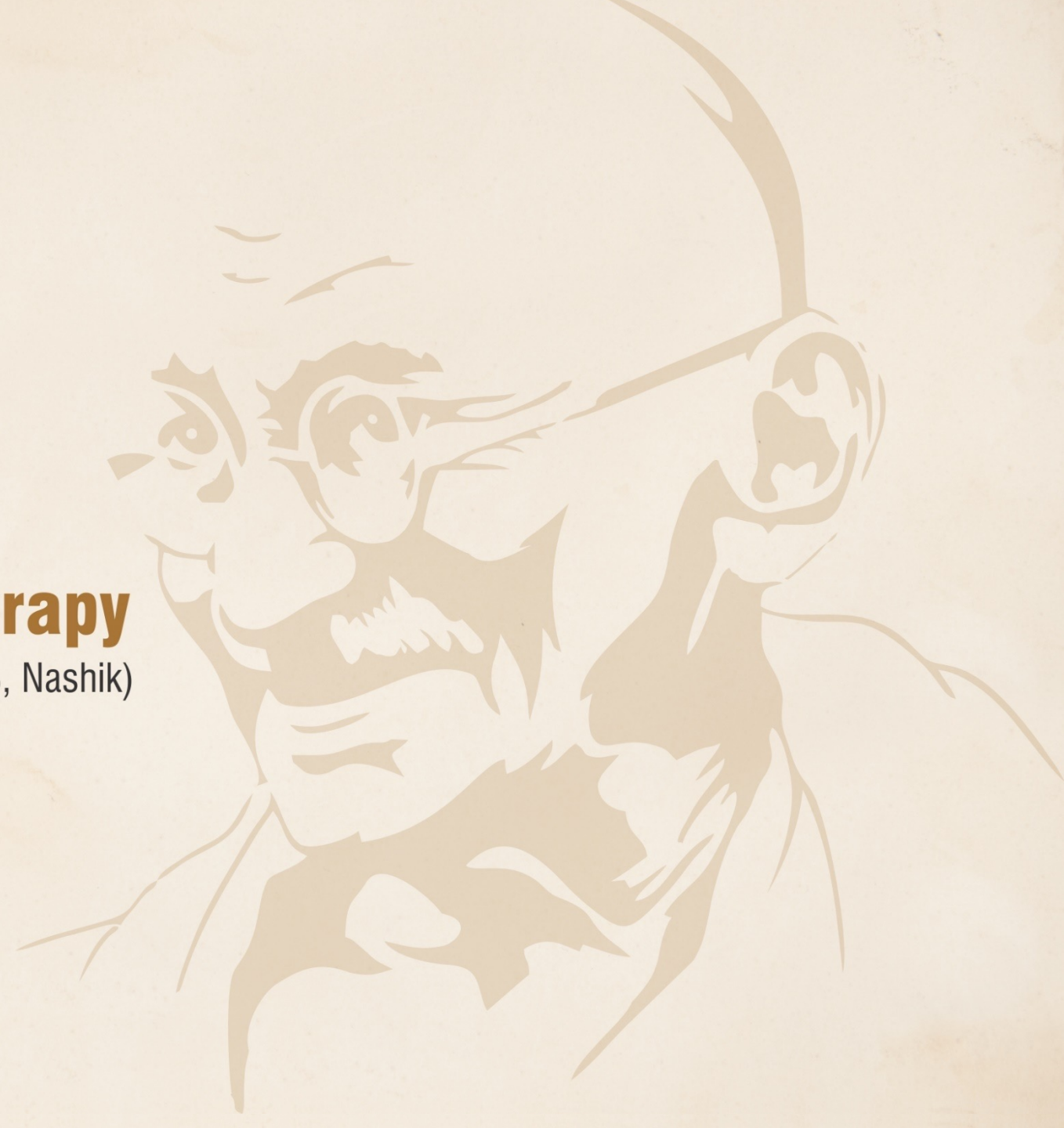
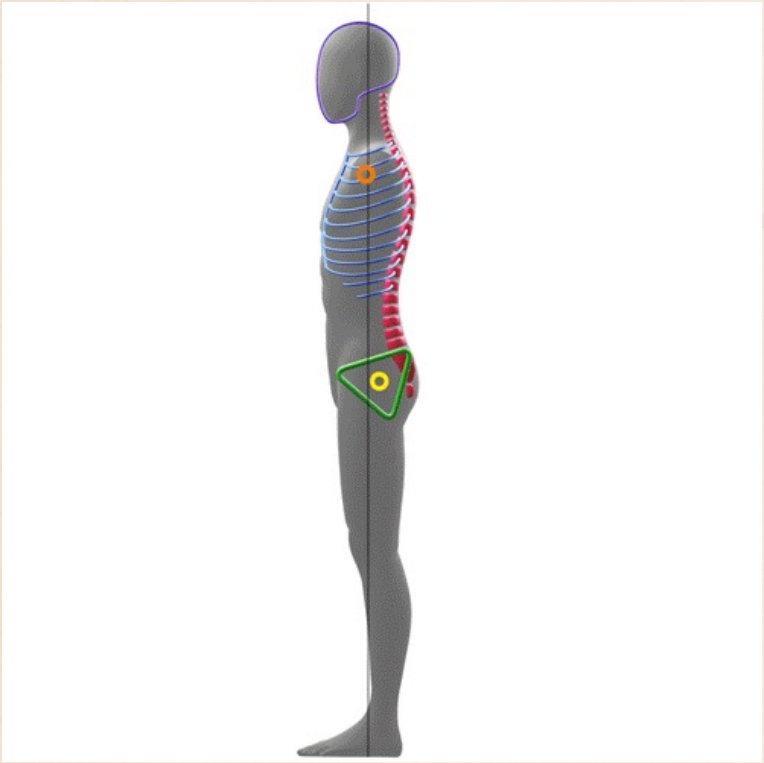
MAHATMA GANDHI MISSION

MGM Institute of Physiotherapy

Chh. Sambhaji Nagar, Maharashtra (Affiliated to MUHS, Nashik)



POSTURE ANALYSIS



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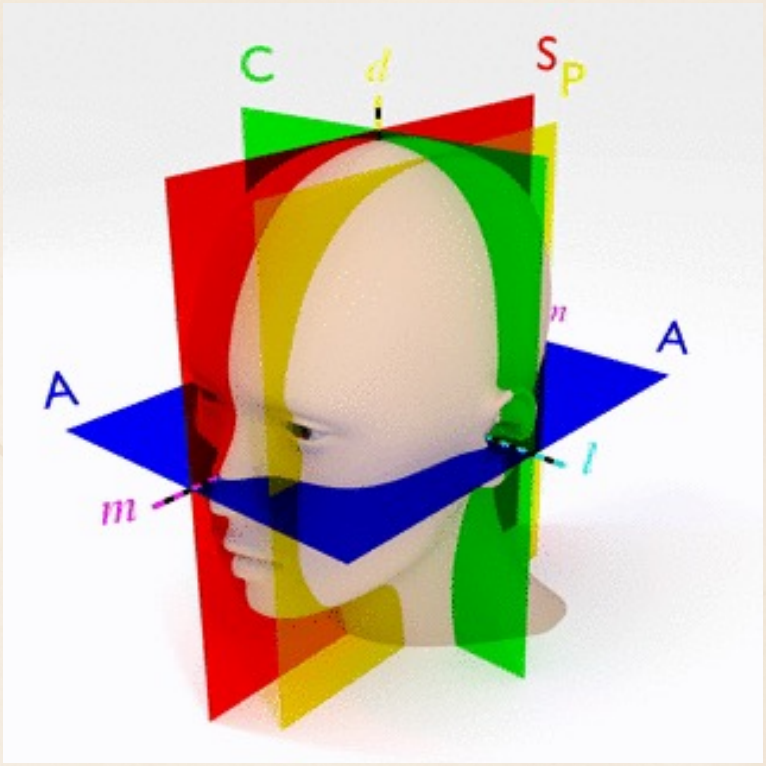

Learning objectives

Analyse normal Human Posture [static &dynamic]

POSTURE ANALYSIS

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QUALITATIVE

OBSERVATIONAL

- Naked eye
- Documentation: Descriptive, pictorial, notation
- Aided by
  - ✓Plumbline
  - ✓Grid
  - ✓Photography

QUANTITATIVE

- Photogrammatic: Camera+ Software for angular detection
- Forced platforms (Posturography)
- Sensors
- EMG activity
- Radiographic method

POSTURE ANALYSIS

- Reference point: Locating body segments in relation to the LoG
- Plumb line, or line with a weight on 1 end : dropped from ceiling---- through external auditory meatus of the ear may be used to rep

POSTURE ANALYSIS-OBSERVATIONAL

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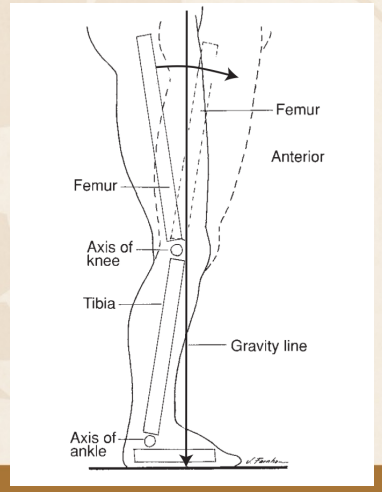
Effects of Anterior and Posterior Gravitational Moments on Body Segments

- Reference point: Locating body segments in relation to the LoG
- LoG : Anterior to head, vertebral column, or joints of LE : gravitational moment will tend to force segment of body superior to joint in an anterior direction & Vice versa

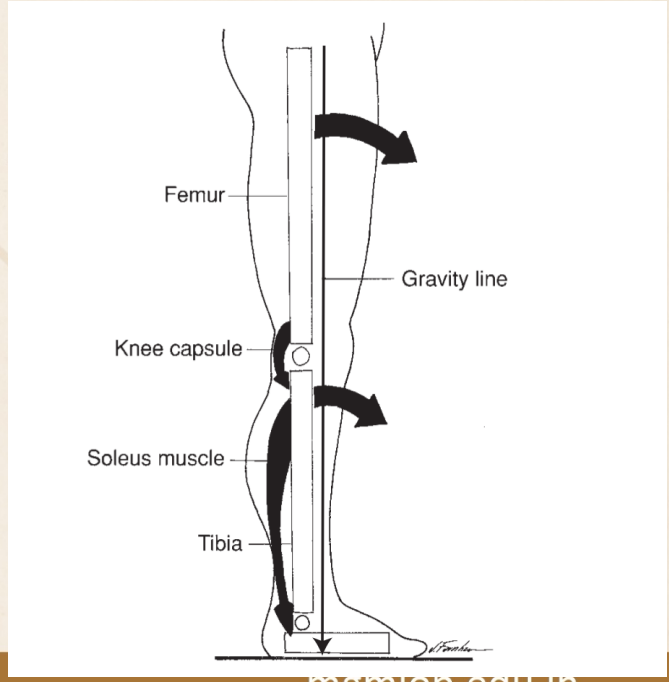


POSTURE ANALYSIS-OBSERVATIONAL

SAGITTAL PLANE ALIGNMENT AND ANALYSIS

Ankle

- Neutral position, or midway b/w DF & PF
- LoG: Slightly ant. to lateral malleolus & therefore, ant. to ankle joint axis.
- External DF moment: must be opposed by an internal PF (GastroSoleus) moment to prevent forward motion of tibia
- Neutral ankle position: No ligamentous checks capable of counterbalancing the external dorsiflexion moment

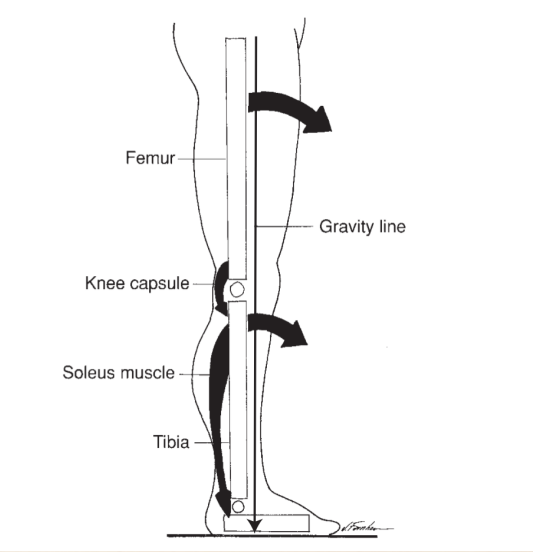


POSTURE ANALYSIS-OBSERVATIONAL

SAGITTAL PLANE ALIGNMENT AND ANALYSIS

Knee

- Full extension & LoG passes anterior to midline of knee & posterior to patella---
- External extension moment.
- Counterbalancing internal flexion moment
  - Passive tension in posterior joint capsule & associated ligaments
  - Small amount of activity hamstrings.
  - Soleus muscle: Augment gravitational extension moment at knee through its posterior pull on tibia as it acts at the ankle joint
  - In contrast, activity of gastrocnemius muscle may tend to oppose the gravitational extension moment because muscle crosses knee posterior to knee joint axis

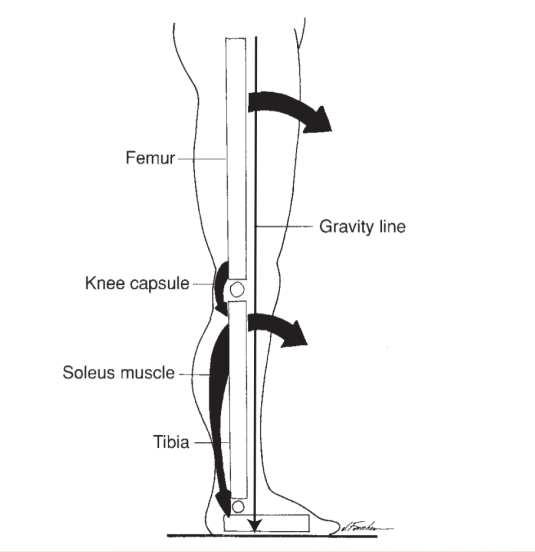


POSTURE ANALYSIS-OBSERVATIONAL

SAGITTAL PLANE ALIGNMENT AND ANALYSIS

Hip & Pelvis

- Neutral position & pelvis is level with no anterior or posterior tilt
- Level pelvis position: lines connecting the symphysis pubis ASISs are vertical & lines connecting ASISs & PSISs are horizontal
- LoG: Slightly posterior to axis of hip joint, through GT---external extension moment---rotate the pelvis (proximal segment) posteriorly on femoral heads
- Internal flexion moment :
  - Iliopsoas
  - Passive tension in the iliofemoral, pubofemoral, and ischio-femoral ligaments

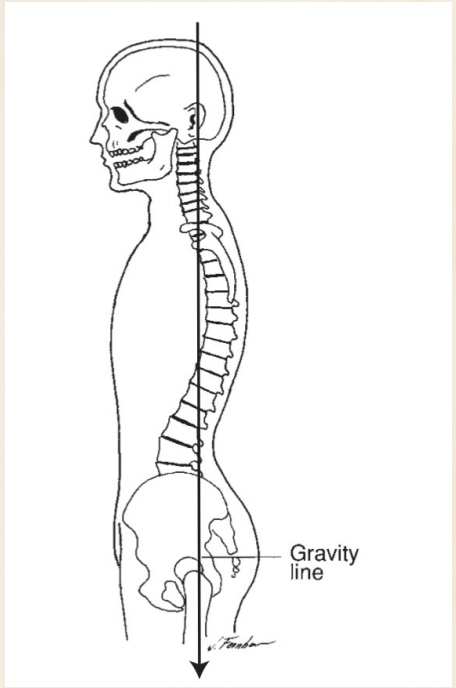


POSTURE ANALYSIS-OBSERVATIONAL

SAGITTAL PLANE ALIGNMENT AND ANALYSIS

Lumbosacral & Sacroiliac joints

- Neutral position & pelvis is level with no anterior or posterior tilt
- LoG:
  - Body of 5th lumbar vertebra & close to axis of rotation of lumbosacral joint:Very slight extension moment at L5- S1 that tends to slide L5 & entire lumbar spine down and forward on S1
  - Slightly ant to SI joint: Anterior superior portion of sacrum to rotate anteriorly & inferiorly, whereas posterior inferior portion tends to move posteriorly & superiorly
- Counterbalance:
  - LS joint: Anterior longitudinal ligament & iliolumbar ligaments
  - SI joint: Passive tension in the sacrospinous & sacrotuberous ligaments

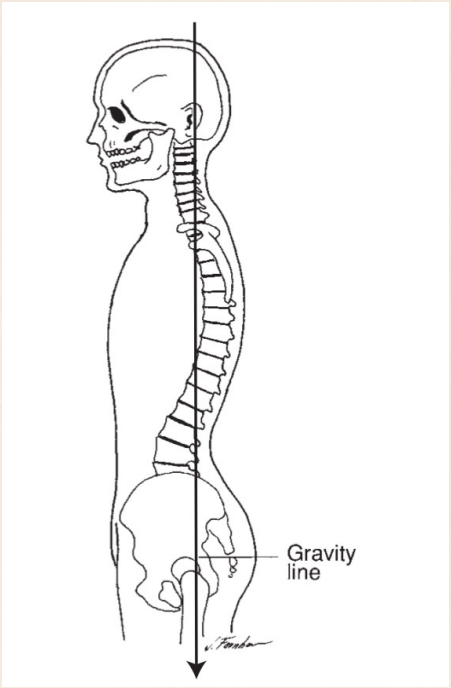


POSTURE ANALYSIS-OBSERVATIONAL

SAGITTAL PLANE ALIGNMENT AND ANALYSIS

Vertebral column

- Optimal position of plumb line LoG : is through midline of trunk
- Longissimus dorsi, rotatores & neck extensor muscles

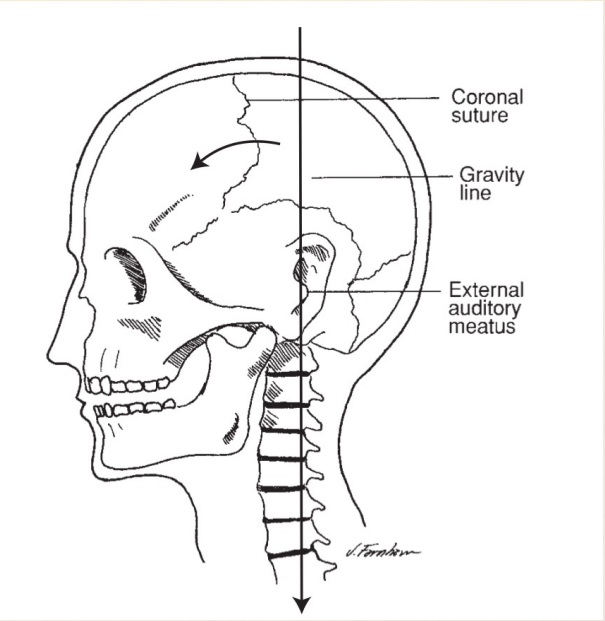


POSTURE ANALYSIS-OBSERVATIONAL

SAGITTAL PLANE ALIGNMENT AND ANALYSIS

Head

- LoG: slightly anterior to the transverse (frontal) axis of rotation for F & E head & creates an external flexion moment
- Counteracted: Ligamentum nuchae, tectorial membrane & posterior aspe the zygapophyseal joint capsules & by activity of the capital extensors

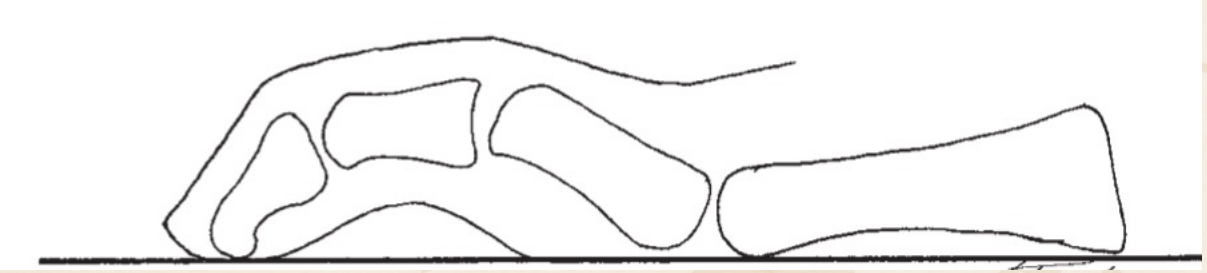


POSTURE ANALYSIS-OBSERVATIONAL

SAGITTAL PLANE ALIGNMENT AND ANALYSIS: Deviations

Foot & Toes

- Claw toes: Hyperextension of MTP joint + flexion of PIP & DIP joints

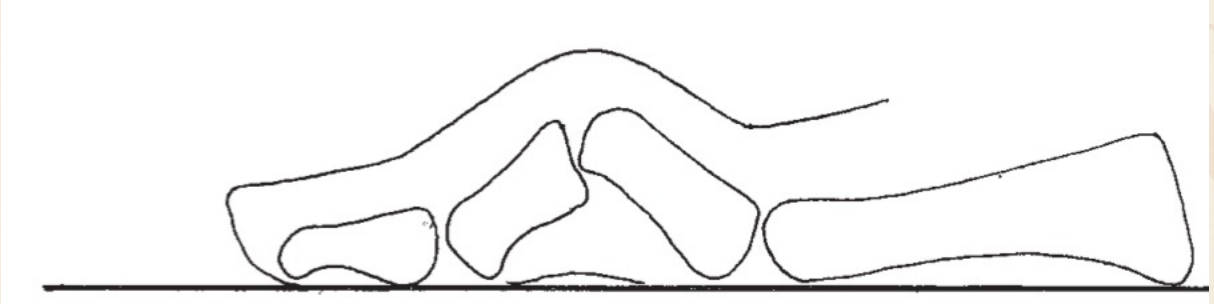


POSTURE ANALYSIS-OBSERVATIONAL

SAGITTAL PLANE ALIGNMENT AND ANALYSIS: Deviations

Foot & Toes

- Hammer toes: Hyperextension of MTP joint, flexion of PIP joint & hyperextension of DIP joint

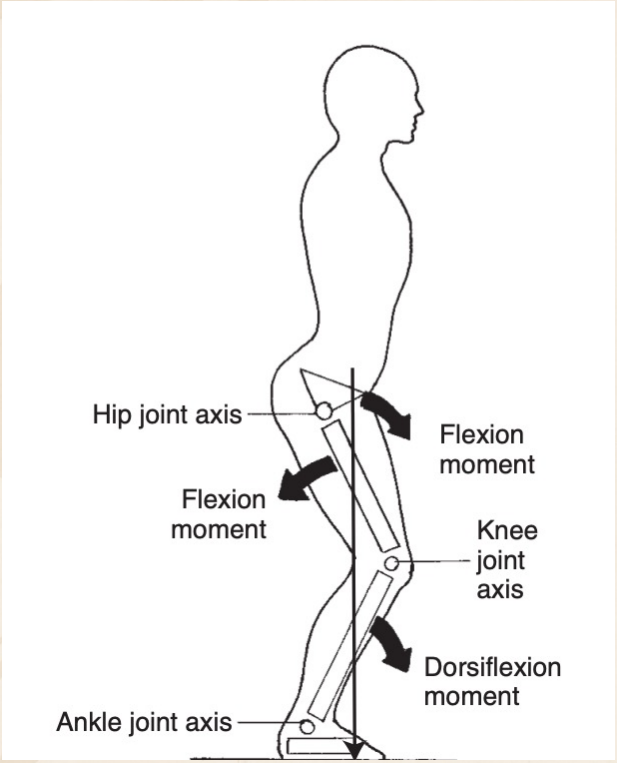


POSTURE ANALYSIS-OBSERVATIONAL

SAGITTAL PLANE ALIGNMENT AND ANALYSIS: Deviations

Knee

- Flexed Knee Posture:
  - Knee flexion contractures, LoG passes posterior to knee joint axes
  - Alters LoG of hip & ankle

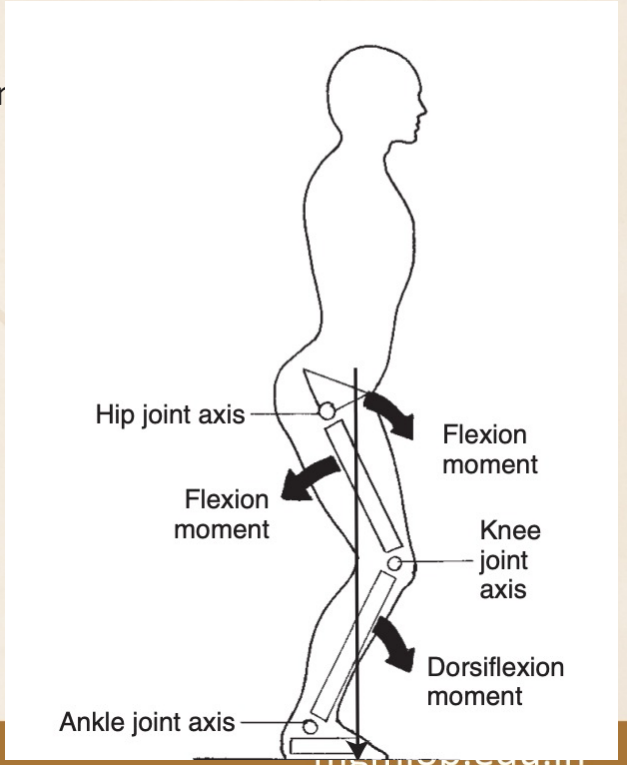


POSTURE ANALYSIS-OBSERVATIONAL

SAGITTAL PLANE ALIGNMENT AND ANALYSIS: Deviations

Knee

- Hyperextended Knee Posture (Genu Recurvatum):
  - LoG is located considerably anterior to knee joint axis
  - ↑external extensor moment acting at knee: ↑ extent of hyperextension & puts posterior joint capsule ur considerable tension stress

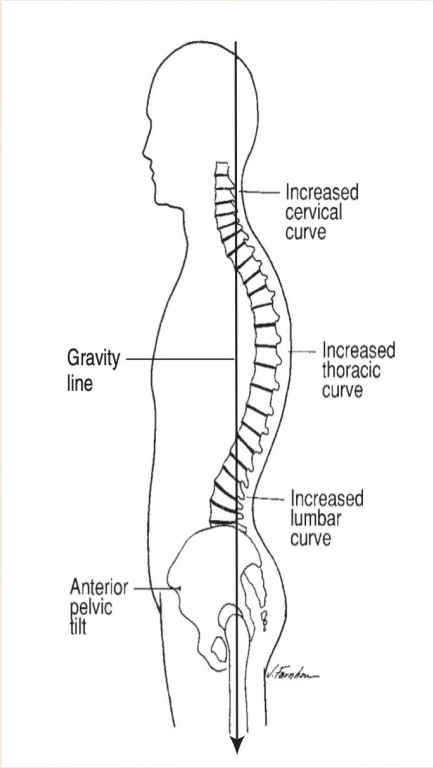


POSTURE ANALYSIS-OBSERVATIONAL

SAGITTAL PLANE ALIGNMENT AND ANALYSIS: Deviations

Pelvis

- Excessive anterior pelvic tilt
  - Pelvis is excessively tilted anteriorly----- lower lumbar vertebrae are forced anteriorly----- upper lumbar vertebrae move posteriorly to keep head over------- sacrum------- increasing lumbar anterior convexity (lordotic curve).
  - LoG------- at a greater distance from lumbar joint axes than is optimal & extension moment in lumbar spine is increased
  - Posterior convexity of thoracic curve increases & becomes kyphotic to balance lordotic lumbar curve & maintain head over sacrum.



POSTURE ANALYSIS-OBSERVATIONAL

SAGITTAL PLANE ALIGNMENT AND ANALYSIS

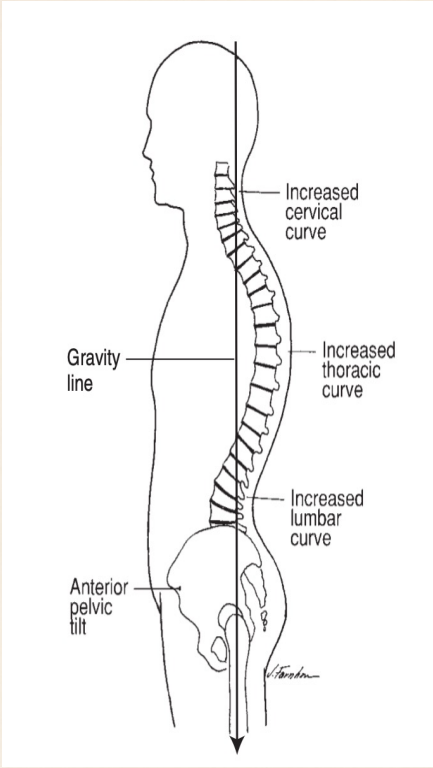
Joints	Line of Gravity	External Moment	Passive Opposing Forces	Active Opposing Forces
Atlanto-occipital	Anterior Anterior-to-transverse axis for flexion and extension	Flexion	Ligamentum nuchae and alar ligament; the tectorial, atlantoaxial, and posterior atlanto-occipital membranes	Rectus capitus posterior major and minor, semispinalis capitus and cervicis, splenius capitis and cervicis, and inferior and superior oblique muscles.
Cervical	Posterior	Extension	Anterior longitudinal ligament, anterior anulus fibrosus fibers, and zygapophyseal joint capsules	Anterior scaleni, longus capitis and colli
Thoracic	Anterior	Flexion	Posterior longitudinal, supraspinous, and interspinous ligaments Zygapophyseal joint capsules and posterior anulus fibrosus fibers	Ligamentum flavum, longissimus thoracis, iliocostalis thoracis, spinalis thoracis, and semispinalis thoracis
Lumbar	Posterior	Extension	Anterior longitudinal and iliolumbar ligaments, anterior fibers of the anulus fibrosus, and zygapophyseal joint capsules	Rectus abdominis and external and internal oblique muscles
Sacroiliac joint	Anterior	Nutation	Sacrotuberous, sacrospinous, iliolumbar, and anterior sacroiliac ligaments	Transversus abdominis
Hip joint	Posterior	Extension	Iliofemoral ligament	Ilipsoas
Knee joint	Anterior	Extension	Posterior joint capsule	Hamstrings, gastrocnemius
Ankle joint	Anterior	Dorsiflexion		Soleus, gastrocnemius

POSTURE ANALYSIS-OBSERVATIONAL

SAGITTAL PLANE ALIGNMENT AND ANALYSIS: Deviations

Vertebral Column

- Lordosis & Kyphosis
  - Lordosis: normal sagittal plane anteriorly convex curves in cervical & lumbar regions of vertebral column
  - Kyphosis refers to normal sagittal plane posteriorly convex curves in thoracic & sacral regions of vertebral column
  - Deviation: Excessive convexity/ concavity
  - Dowager's hump
    - is an easily recognizable excessively kyphotic condition that is found most often in postmenopausal women who have osteoporosis
    - Anterior aspect of the bodies of a series of vertebrae collapse as a result of osteo- porotic weakening. The vertebral body collapse causes an immediate lack of anterior support for a segment of the thoracic vertebral column, which bends forward, causing an increase in the posterior convexity (the hump) and an increase in compression on the anterior aspect of the vertebral bodie



POSTURE ANALYSIS-OBSERVATIONAL

Lateral View

- Lateral line of reference: Ear lobe in line with shoulder (acromion process) and high point of iliac crest: Divides body front & back
- Chin no excessive poking forward
- Each spinal segment normal curve
- Shoulder proper alignment: Forward droop shoulder----rounded shoulder (protracted shoulder)----tight pectoral or weak trapezius
- Chest, abdominal & back muscle appropriate tone
- Chest deformities: Pectus carinatum (undue prominence) & pectus exacavutm (undue depression)
- Normal pelvic angle: PSIS slightly higher than ASIS
- Knee : Normally 0-5 degree of flexion

POSTURE ANALYSIS-OBSERVATIONAL

Anterior View

- Anterior Line of reference: divide the body into right and left halves (Tip of nose in line with manubrium sternum, xiphisternum, and umbilicus.
- Head: Straight on shoulder in midline
- Jaw: gently pressed lips+ teeth slight apart +tip of tongue is behind upper teeth in roof of mouth
- Nose : Tip of nose in line Ant LOR
- Upper trapezius neck line: Equal on both side. The muscle bulk of the trapezius muscles should be equal, & slope of the muscles should be approximately equal. Dominant side slightly lower & slope on the dominant side may be slightly greater
- Shoulder is level and dominant side is slightly lower.
- Clavicles & acromioclavicular joints are level and equal. They should be symmetric; any deviation should be noted

POSTURE ANALYSIS-OBSERVATIONAL

Anterior View

- No protrusion, depression, or lateralization of the sternum, ribs, or costocartilage. If there are changes, they should be noted.
- Waist angles are equal, and the arms are equidistant from the waist. If a scoliosis is present, one arm hangs closer to the body than the other arm. The examiner should also note whether the arms are equally rotated medially or laterally.
- Carrying angles at each elbow are equal. Any deviation should be noted. The normal carrying angle varies from 5° to 15°.
- Palms of both hands face the body in the relaxed standing position. Any differences should be noted and may give an indication of rotation in the upper limb.

POSTURE ANALYSIS-OBSERVATIONAL

Anterior View

- The "high points" of the iliac crest are the same height on each side . With a scoliosis, the patient may feel that one hip is "higher" than the other. This apparent high pelvis results from the lateral shift of the trunk; the pelvis is usually level. The same condition can cause the patient to feel that one leg is shorter than the other.
- The anterior superior iliac spines (ASISs) are level. If one ASIS is higher than the other, there is a possibility that one leg is shorter than the other or that the pelvis is rotated more or shifted up or down more on one side.
- The pubic bones are level at the symphysis pubis. Any deviation should be noted.
- The patellae of the knees point straight ahead. Sometimes the patellae face outward ("frog eyes" patellae) or inward ("squinting" patellae). The position of the patella may also be altered by torsion of the femoral neck (anteversion-retroversion), femoral shaft, or tibial shaft.

POSTURE ANALYSIS-OBSERVATIONAL

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- The knees are straight. The knees may be in genu varum or genu valgum. If the ankles are together & knees are >2 finger width apart : Genu valgum. If ankles are away & knee are touching genu varum

POSTURE ANALYSIS-OBSERVATIONAL

Anterior View

- Head of fibulae at level
- Medial & lateral malleoli at level. Obsrve medial longitudinal arch. (pes cavus- supinated foot or pes planus-pronated foot)
- Feet angle out equally (Fick angle 5-18 degree (Tibia is normally slightly laterally rotated-lateral tibial torsion): Pigeon toes: Medial rotation of tibia (medial tibial torsion)
- No bowing of bones
- Bony & soft tissue contour are equally symmetric on both side

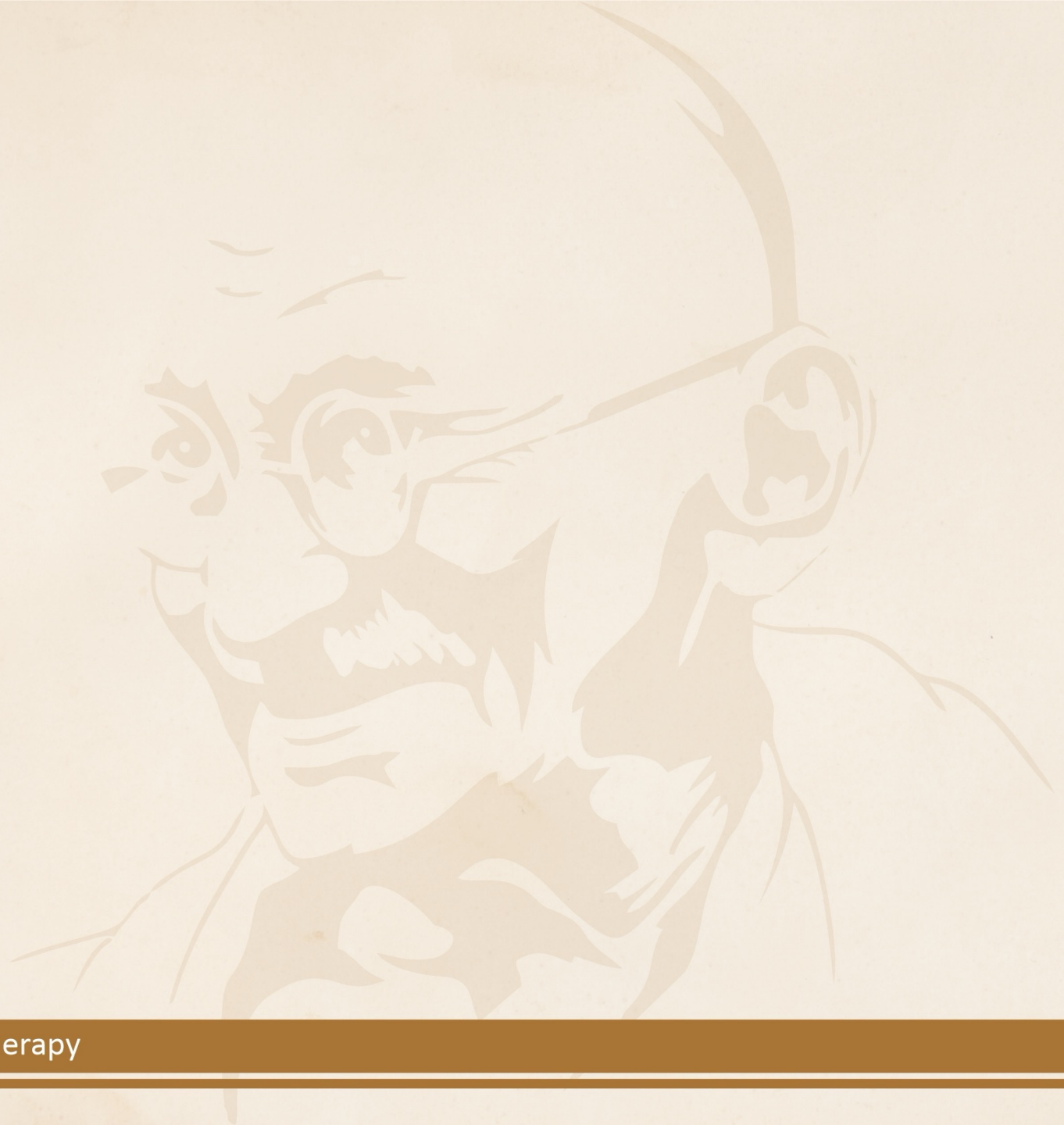
POSTURE ANALYSIS-OBSERVATIONAL

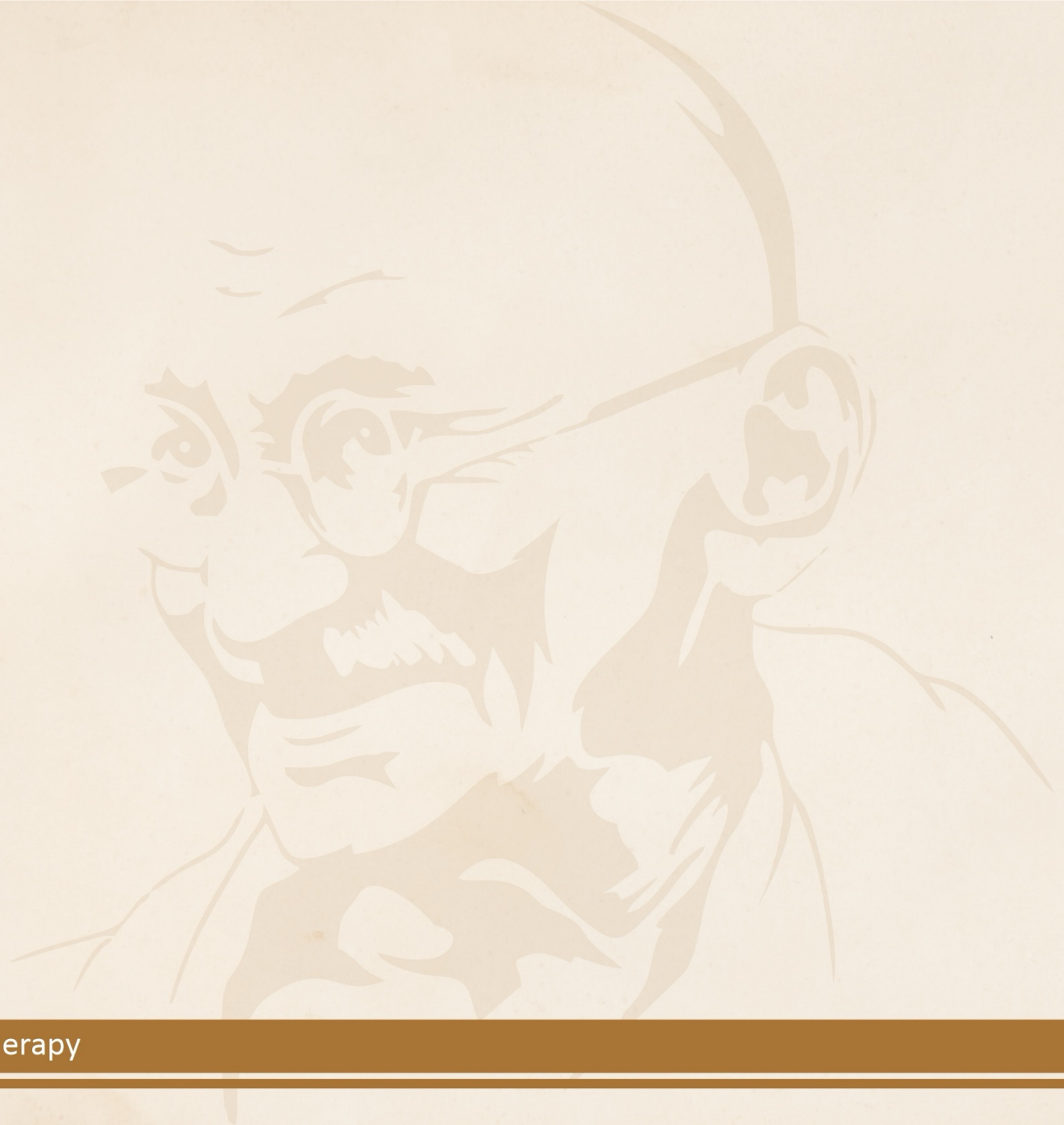
Posterior View

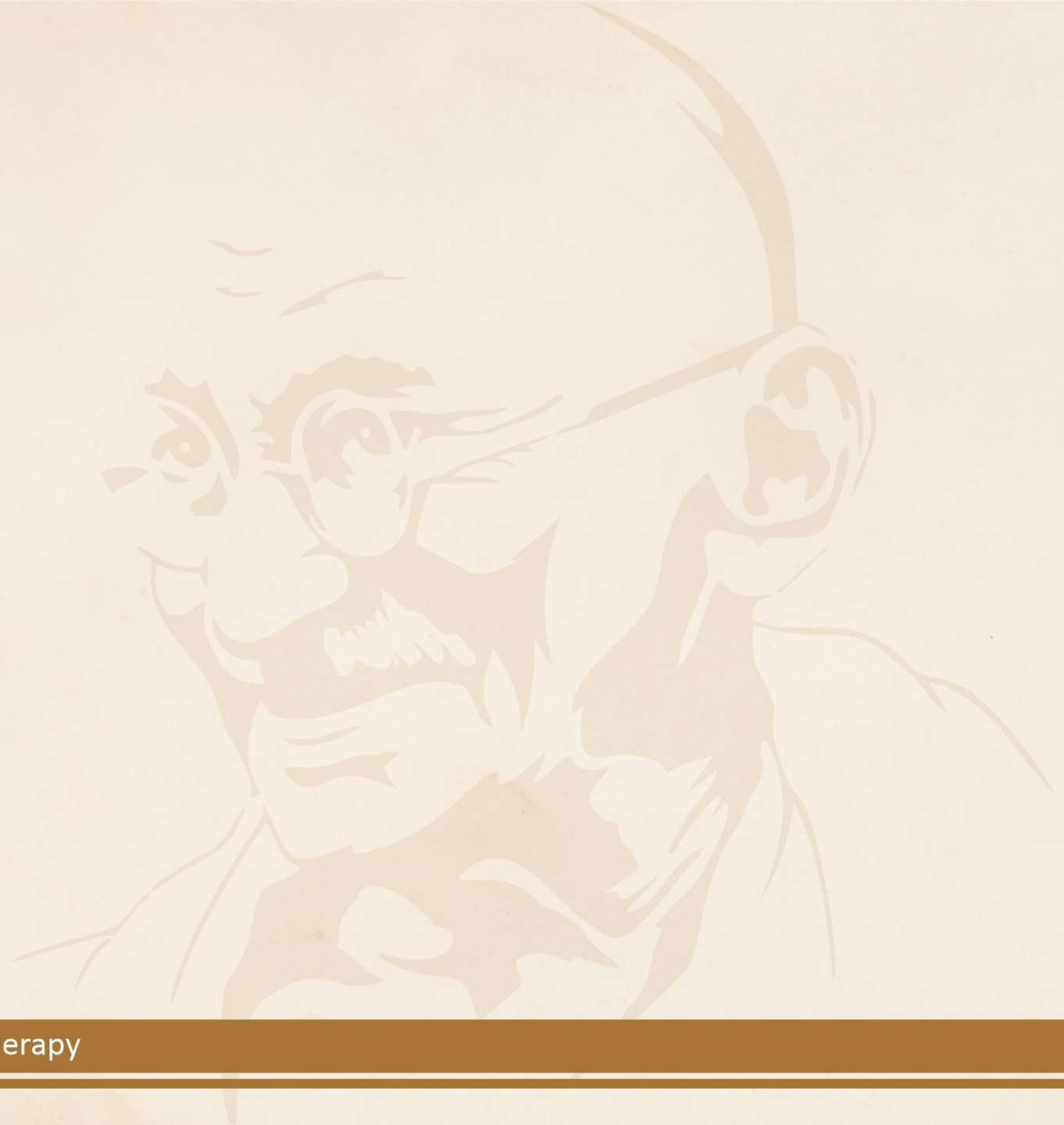
- Posterior reference line: Spinous process of C7 to normally through gluteal cleft
- Head in midline , shoulder level
- Spine & inferior angle of scapulae at level; Medial border of scapulae at level
- Straight spine
- Ribs: Symmetrical
- Waist angle at level
- Arms equidistant from body & equally rotate
- PSIS at level & PSIS slightly higher than ASIS
- Gluteal folds at level
- Knee joints at level
- Achilles tendon descend down to calcaneus. If tendon is angled out it indicates flatfoot deformity (Pes planus)
- Heels are straight or angled in (rearfoot varus) angled out (rearfoot valgus)

Reference

- Pamela Levangie, Cynthia Norkin - Joint Structure And Function. A Comprehensive Analysis







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