Mat Evaluation

Mat evaluation findings provide the foundation for wheelchair seating and positioning recommendations

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Employed by Reliable Medical Supply, durable medical equipment vendor

This information is disclosed in the interest of transparency. No financial relationships influenced the education content of this presentation.

Learning objectives

1

Describe purpose of mat evaluation

2

List components of mat evaluation

3

Describe main deformities of the spine and hips that can affect positioning

Purpose of Mat Evaluation

-To assess for patient's posture as it relates to equipment and mobility device.

-To determine limitations and how they will affect patient's position and function and determining ways to alleviate or correct said limitations

-To determine fixed (non-reducible) vs flexible (reducible) postural asymmetries

Reducible vs Non Reducible

- Getting your patient in supine will help determine if their posture or asymmetries are **reducible vs non reducible** (fixed vs flexible)
- If posture is flexible (**reducible**) then the goal will be to correct their posture
- If the posture is fixed (**non-reducible**), the goal will be to accommodate for their postural needs and prevent further deformity.

(Permobil, 2023)

Components of a Mat Evaluation

-Strength/ROM/Tone Assessment

- Assess key areas for ROM

-Supine Assessment

-Sitting/Postural Assessment

-Measurements

-Interviewing your patient-why is your patient presenting to seating clinic

-Technically observing your patient from when you encounter them

(Lange, 2022)

Information gathered during the mat evaluation informs clinical reasoning and supports appropriate seating recommendations

Limited hip flexion (<90 degrees)
→ open seat to back angle

Posterior Pelvic tilt due to tight hamstrings
→adjust seat depth / open seat angle

Fixed pelvic obliquity or rotation
→Accommodate with positioning such as an obliquity wedge

Flexible trunk asymmetry
→Trial correction with positioning supports such as chest harness

(Lange, 2022)

OT/PT and ATP role

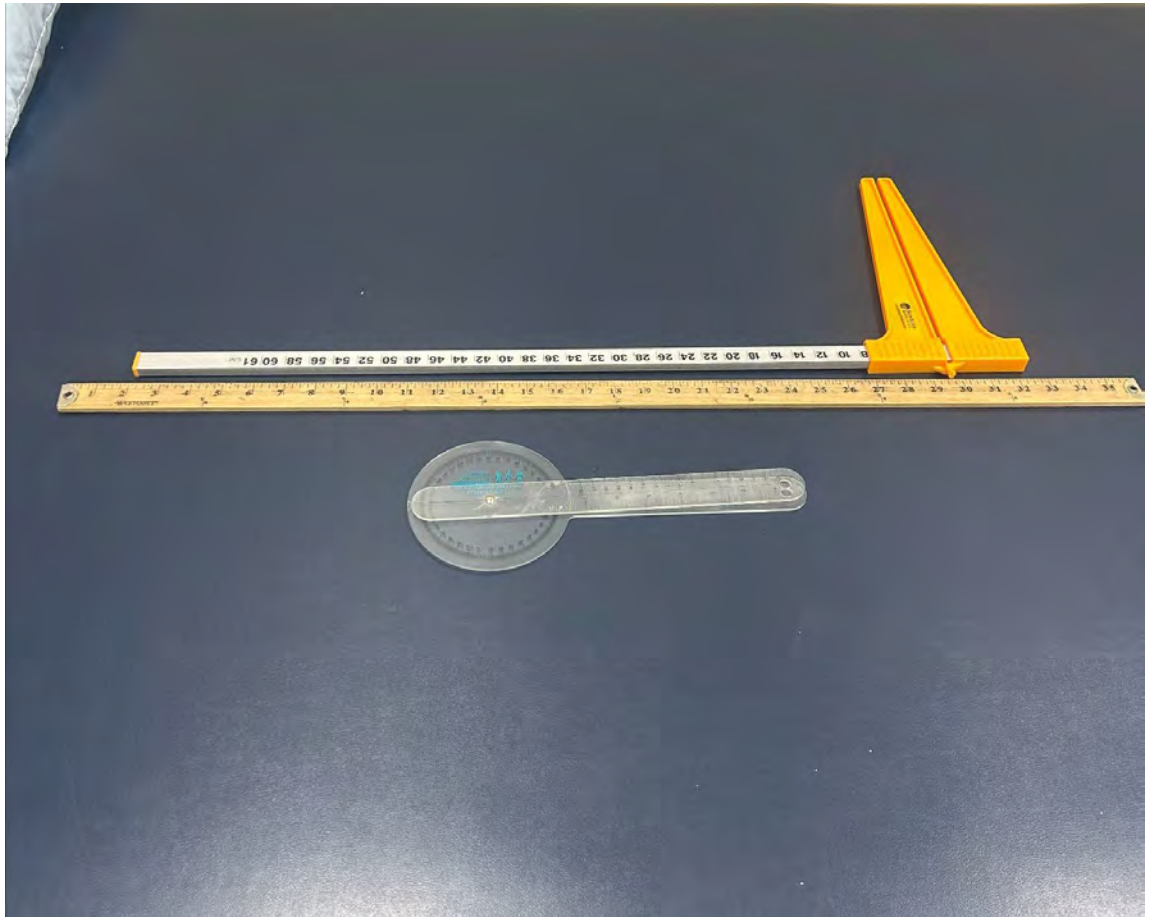
- OT/PT
  - Leads the clinical evaluation
  - As noted: assess posture, ROM, tone, function
  - Identifies goals and clinical priorities
- ATP
  - Brings equipment expertise
  - Advises on frame, components, and configuration
  - Ensures recommendations are technically feasible

Tools utilized for postural assessment

-Yard stick

-Calipers

-Goniometer



Strength/ROM/Tone Assessment

Strength can be assessed seated in chair or during supine evaluation

Overall strength is important to note as it relates to wheelchair mobility and propulsion	When on the mat, you can see how much trunk strength balance your patient has	You can see how much support your patient may need at edge of mat

ROM is easiest assessed during the supine assessment

Make note of all and any contractures or limitations in ROM

Tone can also be assessed in seated or during supine evaluation

Make note of positioning that can assessed with breaking up tone

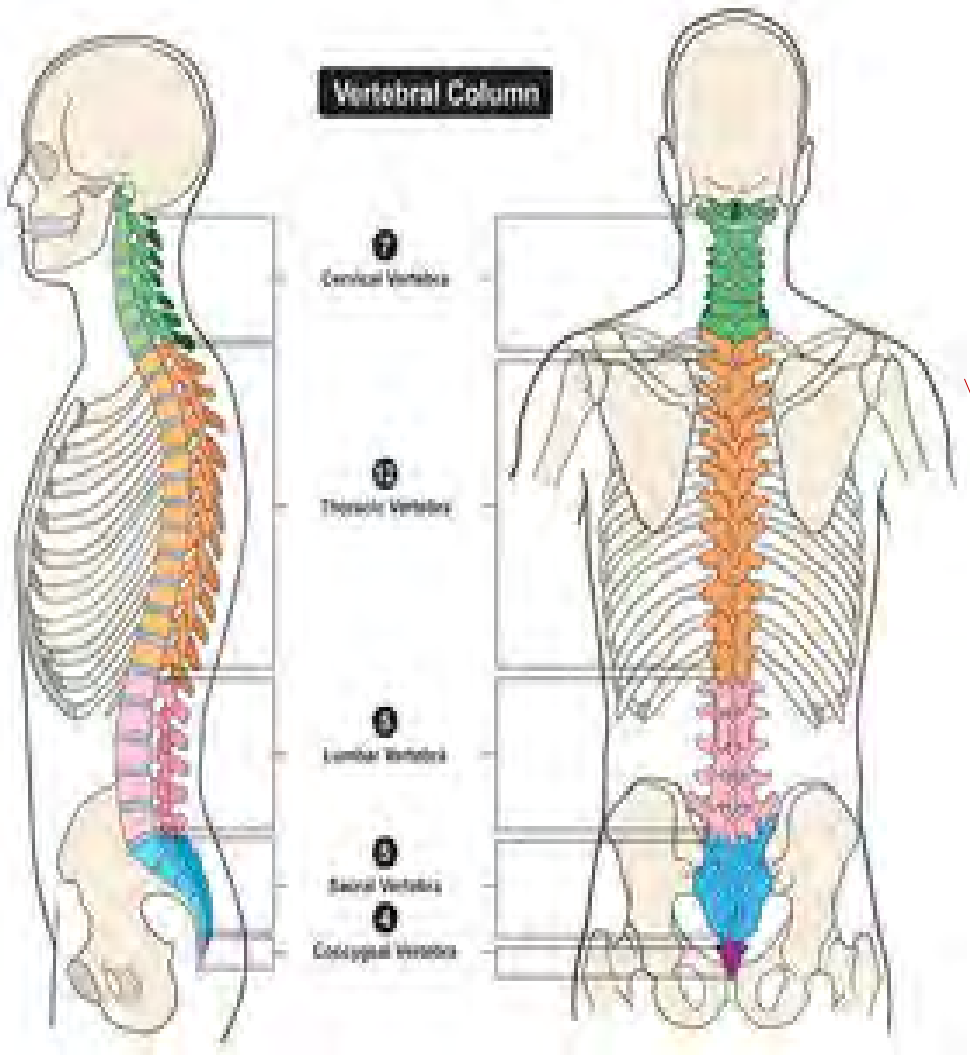
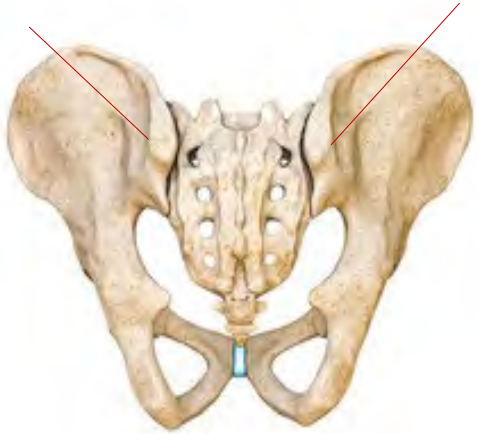


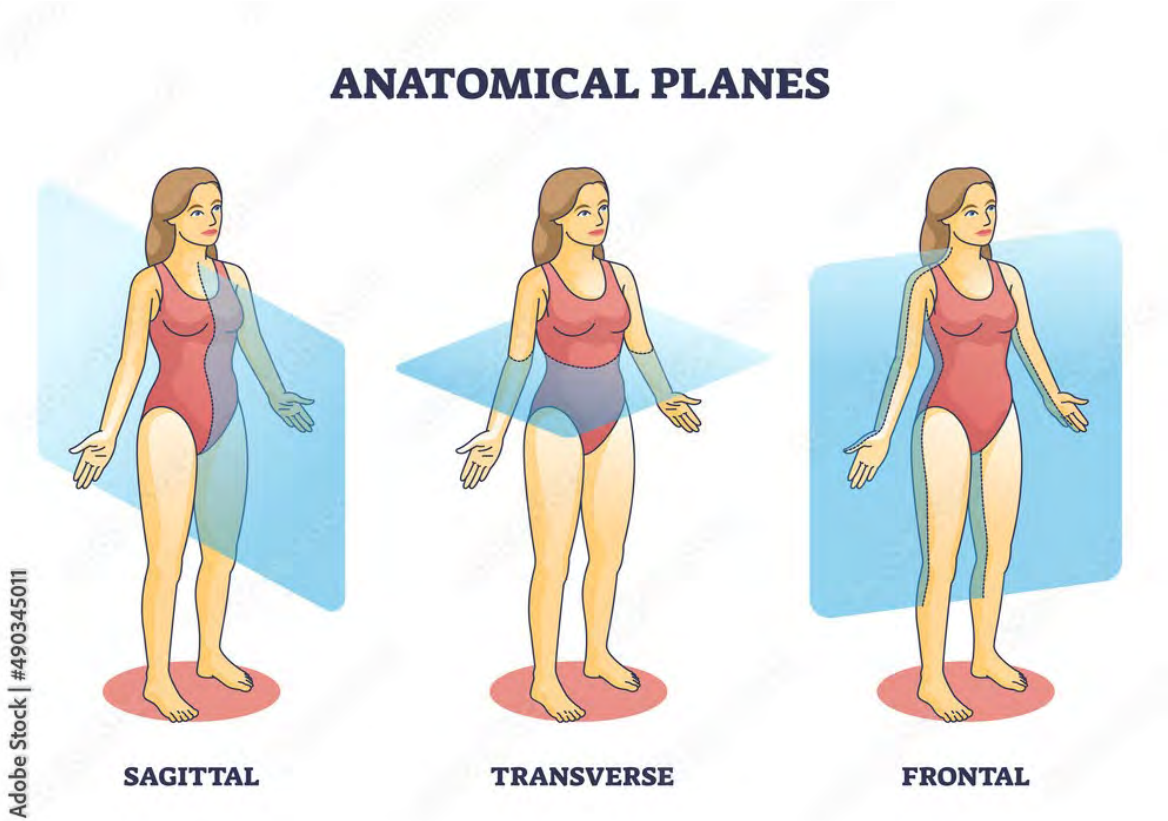
Image: Adobe Stock (Spine Anatomy)

Arrow indicates
ASIS location



Arrow indicates
PSIS location

Image: Adobe Stock (Pelvis Anatomy Photo)

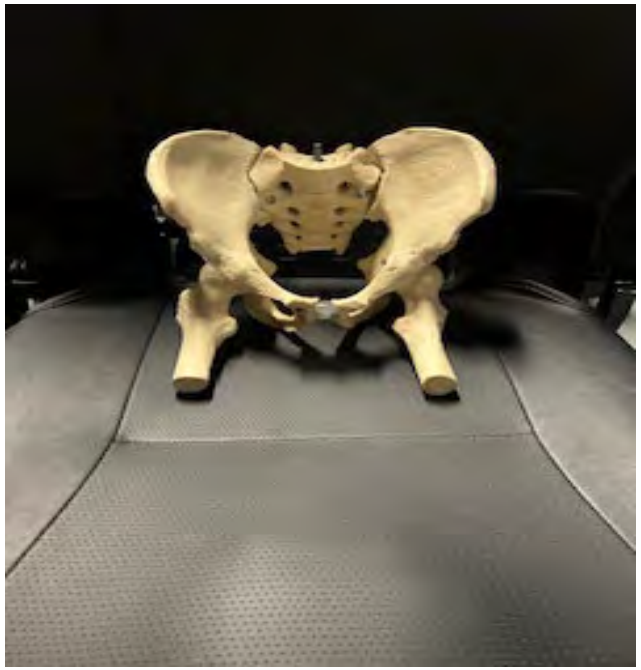


- Sagittal plane (tilt)
- Frontal plane (obliquity)
- Transverse plane (rotation)

Image: Adobe Stock (Anatomical Planes)

Assessment of the pelvis in supine:

The pelvis is the foundation



Anterior/posterior pelvic tilt

-Checking for neutrality in the spine

-Assessing for flexibility in both directions

-We want to know if the pelvis can be positioned in neutral

Anterior/Posterior Tilt: Utilizing ASIS as reference, looking for discrepancies in thumb levels from sagittal plane

Obliquity: Using ASIS as reference, looking for discrepancies in thumb levels from frontal plane: one side is higher than the other.

Rotation: Using ASIS as reference, looking for discrepancies in thumb levels from transverse plane: one side is further forward

Neutral sitting posture

Anterior Pelvic Tilt

Posterior Pelvic Tilt

Causes for Posterior Pelvic Tilt

- Limited hip flexion ROM
- Hamstring tightness
- Seat depth too deep
- Sitting in posterior pelvic tilt may provide stability and balance for patient
- Comfort
- Decreased energy expenditure or fatigue
    - Example of fusion patient

*It is crucial to determine what is causing the posterior pelvic tilt as solutions for seating may be different based on the cause- example if tight hamstrings- increase seat angle

(Lange, 2018)

Causes for Anterior Pelvic Tilt

- Trunk extensor muscles with spasticity/always activated
- Low trunk tone
- Hip flexor muscles are shortened or overly active
- Muscle imbalance in cases such as Muscular dystrophy and Spina Bifida
- Spinal Fusion

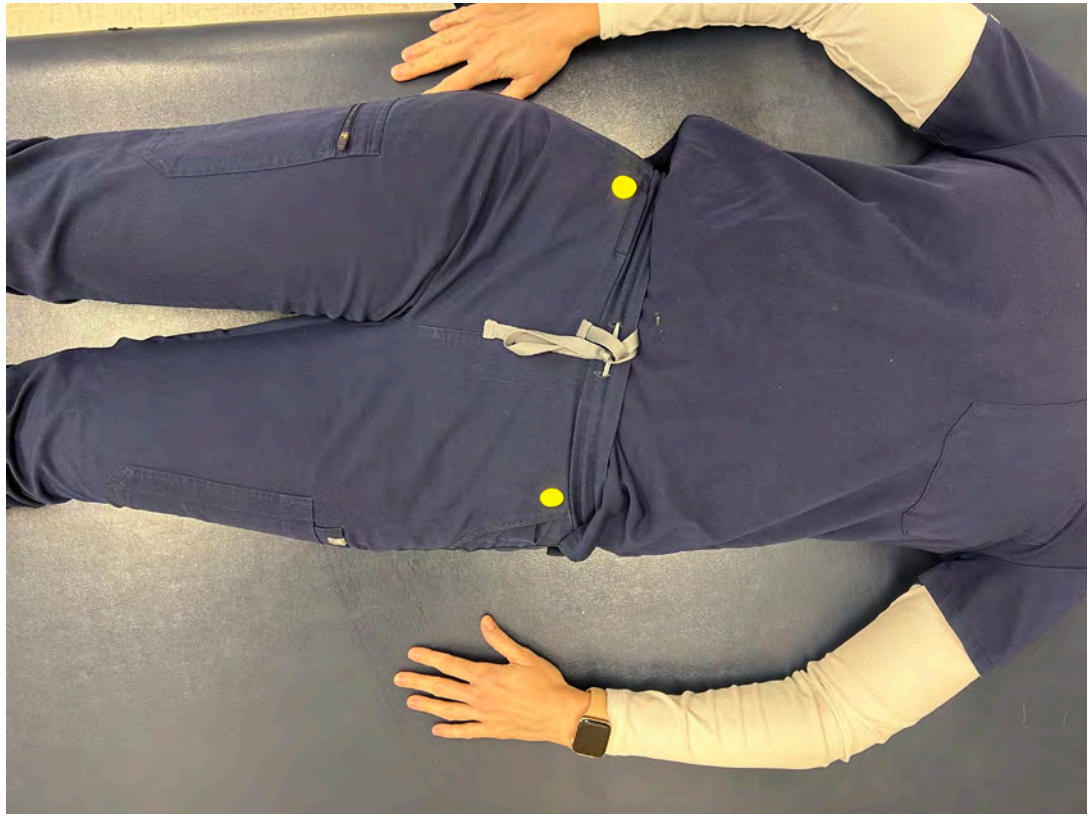
(Lange, 2018)

Causes of Pelvic Rotation

- Spinal curve with rotation
- Hemi-plegia - stronger side may be further back and the weaker side more forward or spasticity may be impacting rotation as well
- Leg length discrepancy
- Limited hip flexion on one side- patient will rotate hip with more limited hip flexion more forward to position themselves with more hip extension
- May be flexible if it reduces with symmetrical positioning

(Lange, 2018)

Causes of Pelvic Obliquity



- Hip subluxed or dislocated
- Muscle imbalance such as spasticity
- Asymmetrical ischial tuberosity
- Scoliosis
- Seat may be too wide or hammocking of seat upholstery

(Lange, 2018)

After determining the position of the pelvis and whether fixed or flexible...

We can position the pelvis in the best position as possible; whether accommodating or supporting

Hips

- Next in supine: Assess available hip ROM
- Stabilize pelvis and passively flex hip
- Stop at the first pelvic movement
- Measure angle with goniometer
- This measurement and angle determines the seat to back angle
- Forcing 90 degree in sitting may cause:
  - Posterior pelvic tilt
  - Sacral sitting
  - Increased shear and pressure
  - Note: keep knees flexed to keep hamstrings as loose as possible to limit movement at the hips

(Lange, 2017)

Hamstring length

The hamstring extends the hip and flexes the knee: acting on 2 joints

In supine:

- Pelvis is stabilized in neutral, →Hip flexed to 90 degrees→contralateral leg extended and stabilized
- Maintain hip flexion while passively extending the knee and stop at the first pelvic movement into posterior tilt → measure this knee angle with goniometer
- If hamstrings are shortened: may increase posterior pelvic tilt and sacral sitting.

(Lange, 2017)

Abduction/adduction of hips and windswept deformity

- Increased tone or spasticity
- Weakness or low tone
- Joint impairment or soft tissue
- Windswept deformity:
- Pelvic rotation or obliquity and one leg is abducted and one leg is adducted.
- Spine is either rotated or scoliotic

Supine Assessment of Head and Neck

- Head
  - Flex/Ext, Lateral flexion and Rotation
  - Assessing if patient can lay flat on mat will

  help determine a fixed vs flexible neck posture
- Trunk
  - Lordosis, kyphosis or any scoliosis
  - Assessing shoulder and rib levels will

  help identify any scoliosis present

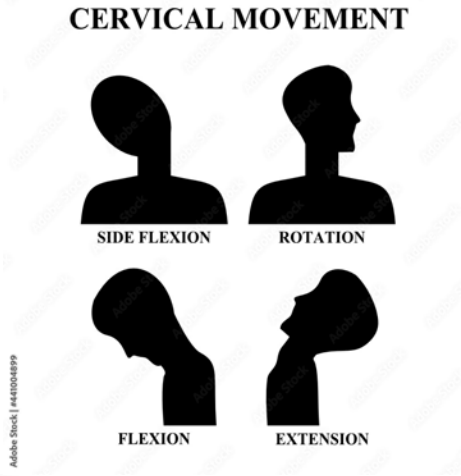


Image: Adobe Stock
(Cervical Movement)

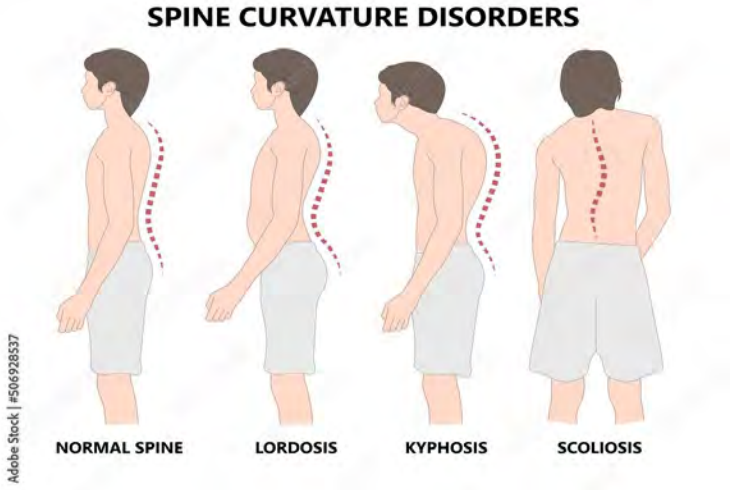


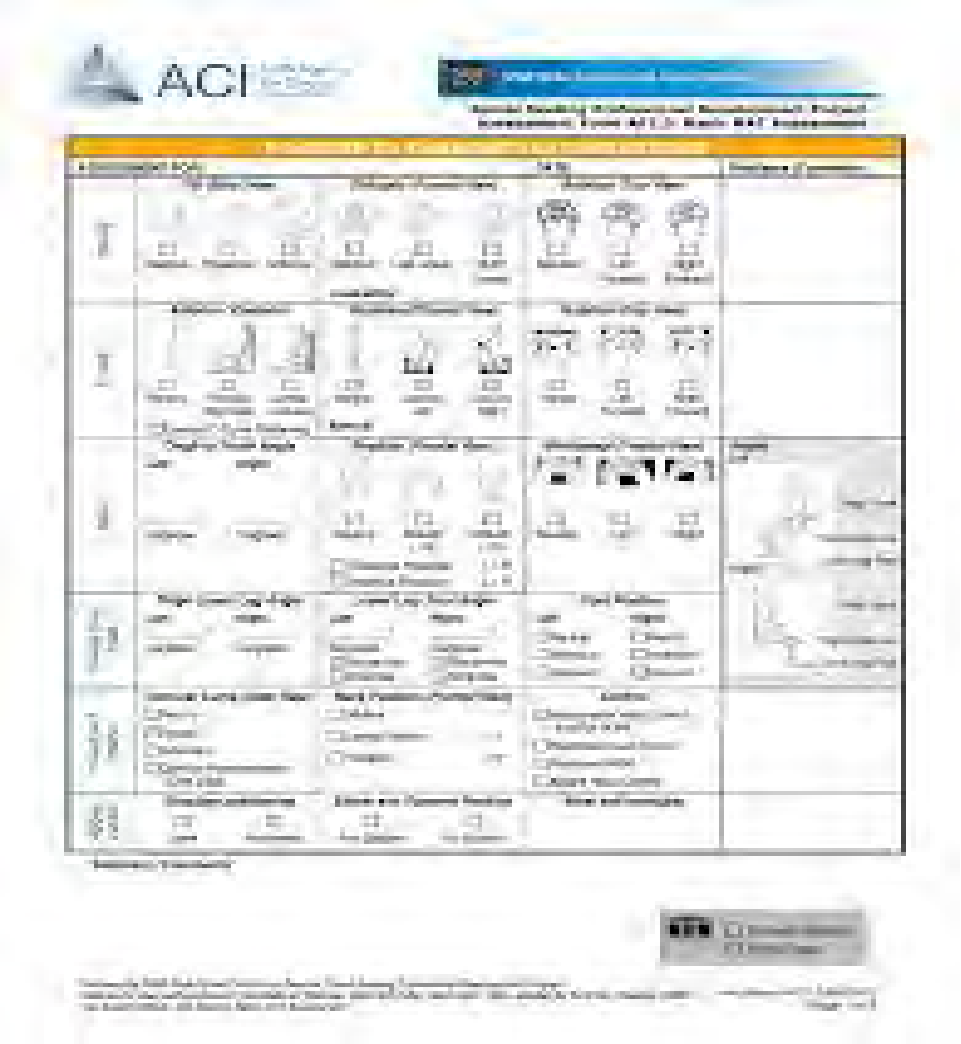
Image: Adobe Stock
(Kyphosis)

Trunk rotation and head rotation example in wheelchair:

The Trunk and head in supine

- Spinal alignment: Is the spine straight or curved? (kyphosis, lordosis, scoliosis)
- Trunk rotation: Does the torso twist left or right?
- Flexibility vs fixed posture: Does trunk move with gentle repositioning?
- Shoulder position: Symmetry? Are shoulders lifted or rotated?
- Head alignment: Neutral or tilted/rotated?

Mat Evaluation: Posture in Sitting



(Image: PDF Filler, n.d.)

Sitting assessment

Supine assessment allows to more accurately measure ROM and **sitting** assessment will more accurately show the effects of gravity/tone/spasticity on their posture.

Assess static balance and dynamic reaching to determine independence levels.

Make sure feet are on flat surface and thighs are properly supported

Assistance may be required depending on patient's ability to maintain an unsupported seated balance.

Sitting assessment continued

Evaluation of the pelvis, lower extremities, upper extremities, trunk, and neck and also noting your hand placement as it correlates to the possibilities the seating system can provide.

Determine the amount of force required to reduce or correct asymmetries- what angles and areas are you supporting with your hands?

This will help guide your decision making when recommending equipment

(Sharpe, 2023)

Posterior Pelvic Tilt in Sitting

- **Flattened lumbar spine** (loss of lordosis)
- **Increased thoracic kyphosis**
- **Rounded shoulders & forward head**
- Hips may appear **adducted/rotated** depending on tone and function
- Seat interaction Weight often shifts toward **sacrum/coccyx** with sliding forward in the seat
- Note: If pelvis is off - you'll see those compensatory instabilities as your body is trying to seek stability

Sit into posterior pelvic tilt:

How does it feel?

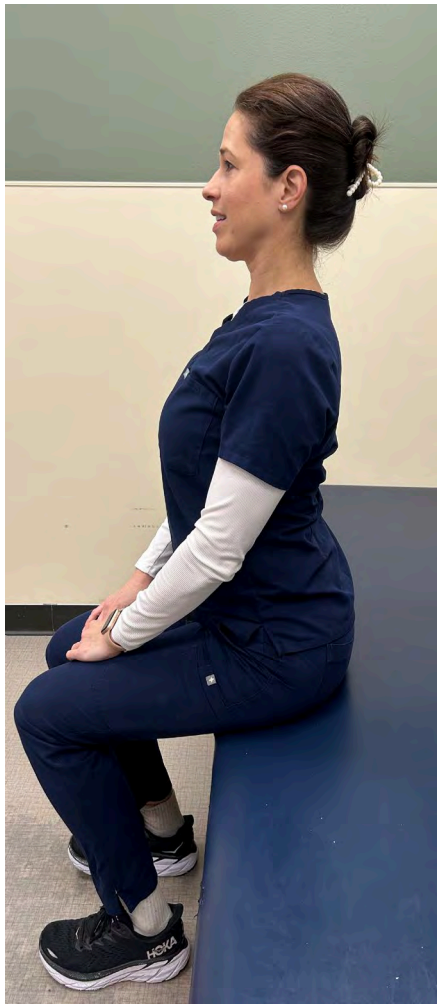
How does it impact breathing?

How does it feel to reach overhead?

Is it easier or harder to swallow?

Anterior Pelvic Tilt in Sitting

- Thoracic spine: may be straighter or slightly extended
- Lumbar spine: increased lordosis (arched lower back)
- Head/Shoulders: may lean back slightly to compensate
- Lower extremities: hips may be slightly abducted or extended
- Seat interaction:
  pelvis tips forward → thighs may not fully contact seat back



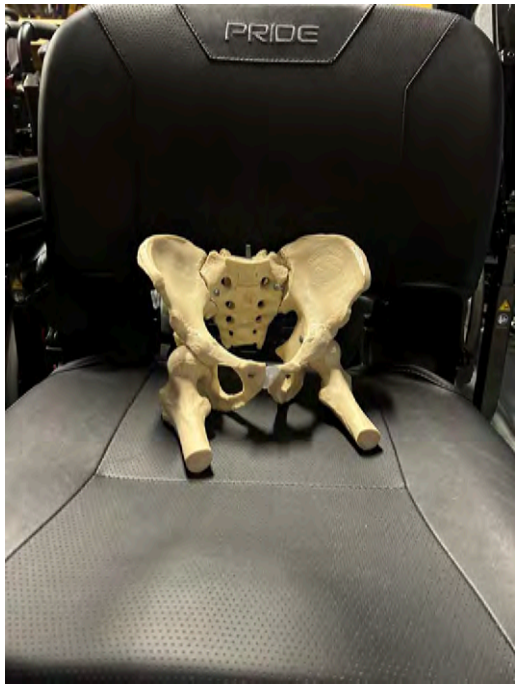
- Assessing sitting posture reveals how the body interacts with gravity and the seating system: allowing us to identify compensations, functional limitations, and equipment needs that are not apparent in supine

Lateral Pelvic Tilt (Obliquity)

As stated above, obliquity is named for the low side	This results in:	Possible causes:
	• C-curve • Risk for pressure injury on the lower side due to increased pressure • Back pain	• ATNR pattern • Scoliosis • Pain • Pressure Injury

(Lange, 2018)

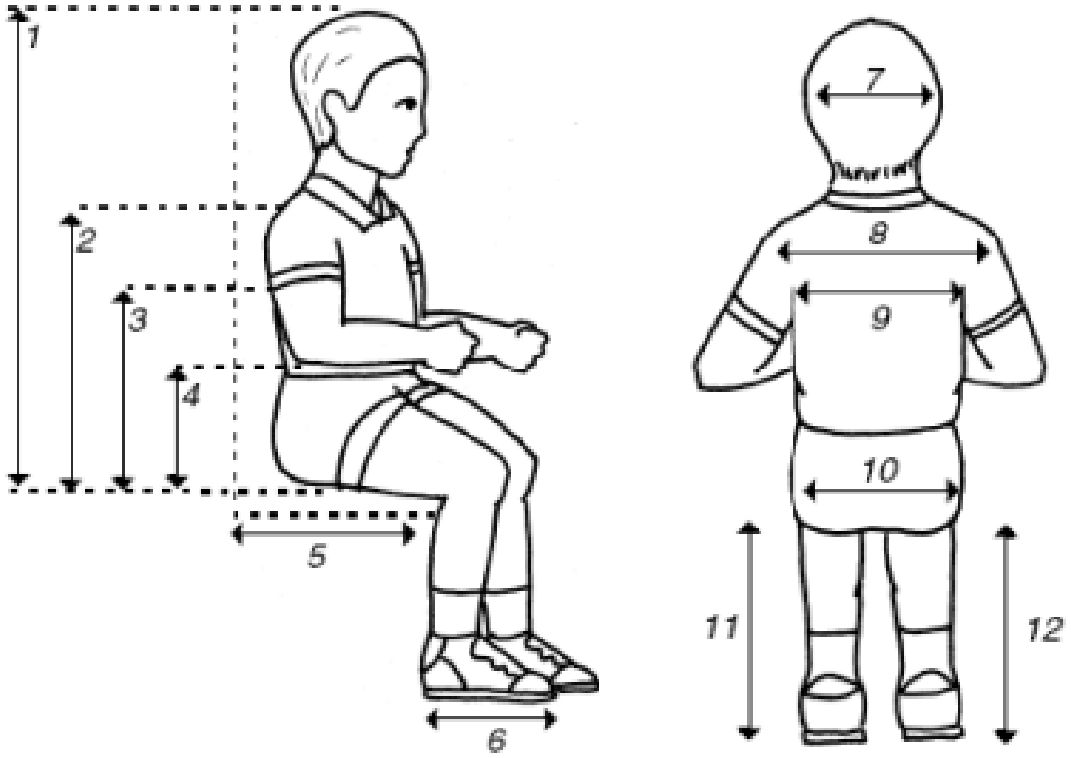
Pelvic Rotation in Sitting



- Spinal curve with rotation
- Hemi-plegia - stronger side may be further back and the weaker side more forward or spasticity may be impacting rotation as well
- Leg length discrepancy
- Limited hip flexion on one side- patient will rotate hip with more limited hip flexion more forward to position themselves with more hip extension

Measurements

1. Top of Head
2. Top of Shoulder
3. Seat to Armpit
4. Seat to Elbow
5. Back of Buttock to Back of Knee
6. Foot
7. Head Width
8. Shoulder Width
9. Chest Width
10. Hip Width
11. Knee to Heel – Left
12. Knee to Heel – Right



(Texas Medicaid & Healthcare Partnership, 2021)

* Yard stick/measuring tape and Calipers

Measurements that Influence Seating Decisions

- Hip Width → helps determine the seat width
  - MWC vs PWC considerations
  - Too wide: not enough stability and support of pelvis and trunk
  - Too narrow: increased pressure and risk for skin issues

  Seat Depth
  - Influences pelvic position and femoral support
  - Too deep→ posterior pelvic tilt, sacral sitting
  - Too shallow →reduced thigh support and increased pressure under ITs

(LaBerge, 2025)

Measurements that Influence Seating Decisions cont.

- Lower Leg Length
  - Determines seat-to-floor height and foot support
  - Poor match → increased pressure under thighs or feet not supported
  - Impacts propulsion efficiency and transfers

- Available Hip Flexion Angle (measured in supine)
  - Drives seat-to-back angle selection
  - Forcing 90 degrees when ROM is limited → posterior pelvic tilt, shear, increases risk for pressure injuries

(LaBerge, 2025)

Measurements: In Sitting

Hip width: 10

Measuring at widest part of thighs

- Make sure you have your patient positioned on the mat, how you envision them in their seating system
- Seat width may be different based on the type of chair rigid vs power chair, but typically 1” -2” wider

Top of Head: 1

→ Considerations for headrest placement

- Pelvis is positioned as intended

- Headrest fit errors often reflect **pelvic or trunk instability**, not head size

Seat Depth: 5

- Back of buttocks to back of knee and and seat depth is set less than 1-2” less than the measurement
- Distance may be adjusted based on excess tissue, lower extremity propulsion, and backrest type
- Consider actual vs effective buttock/thigh depth: ex: rotation of pelvis (if non reducible) may increase seat depth

Lower Leg Length: 11/12

- Utilized to determine leg rest length and seat to floor height
- Measure from back of knee to heel
  - Measure with feet on floor and with shoes they normally wear
- Consider the height of cushion and angle of front rigging

Shoulder Height/Top of Shoulder: 2

- Ensure your ruler is perpendicular to the surface/mat
- Used to determine overall back height
  - Does your patient use their upper extremities to propel
  - Or are they dependent for trunk control
  - Power vs manual wheelchair

Chest width: 9

- Measure from:
  - Widest point of the rib cage
  - Typically measured **just below the axillae**

- Consideration:
  - Measure in sitting if possible to capture trunk collapse or asymmetry

Common Measurement Pitfalls

- Measuring before pelvis is positioned
  - **Seat depth can be over/underestimated**
    - Posterior pelvic tilt shortens effective thigh length
    - Pelvic rotation can increase seat depth on one side if it’s flexible/correctable
  - **Hip Width**
    - Can appear wider due to collapse or rotation
  - **Lower leg length**
    - Feet not supported or knee not positioned functionally
      - Plantarflexion, poor foot contact, or excessive knee flexion/extension can impact the measurement.
  - **Asymmetries measurements**
    - May reflexed compensation vs true fixed deformity; impacting measurement

  - Measurements should be taken after pelvis is positioned as intended for seating.

(LaBerge, 2025)

Key Take Aways

- The pelvis is the foundation of seating
- Supine assessment identifies what is flexible vs fixed / reducible vs non reducible
- Measurements should inform chair configuration
- Sitting confirms how the body responds to gravity
- Mat findings should guide your equipment decisions

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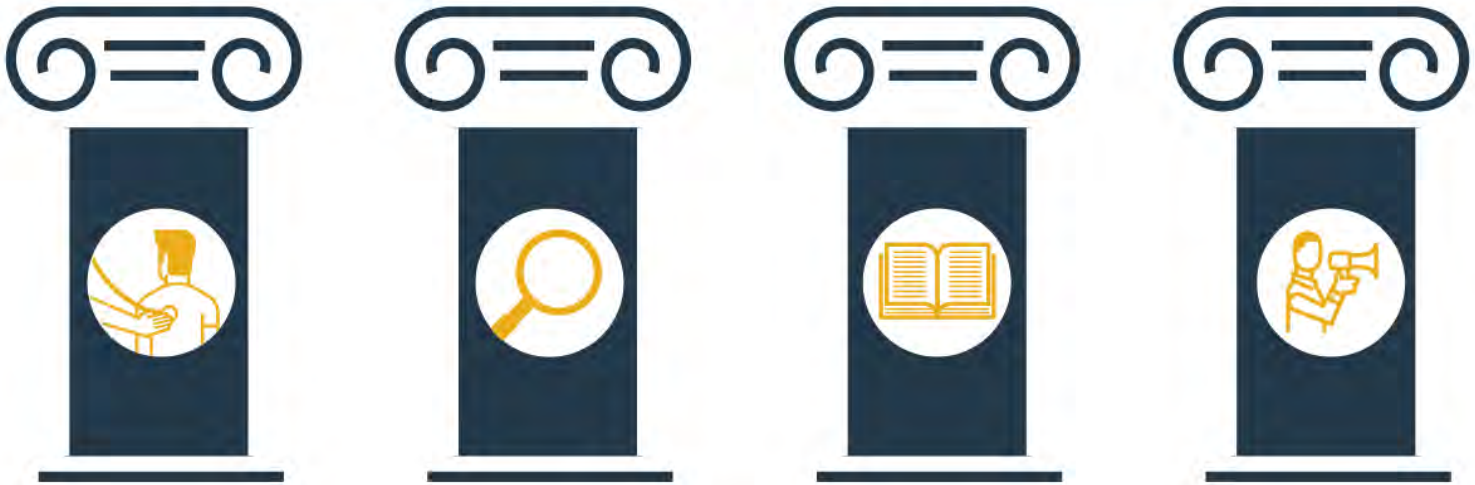

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