Hands-on Mechanical Assessment Tool (MAT)- An Introduction

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Objectives:

- Understanding the process of the MAT assessment

- Increase confidence to complete hands-on assessments
  - Bony landmarks and their positions of symmetry
  - Basic manual handling for MAT Ax
  - Common postural abnormalities
  - Basic translation of MAT Ax findings to wheelchair and seating set up

- Explore interventions to support a variety of muscle tone presentations in wheelchair seating.

- Simple wheelchair adjustments to assist with postural changes

- Explore complimentary tools to understand a user's posture and postural changes during the day

Evidence-based Seating Assessments

Why do MAT evaluations?

- To gain a deeper current seating posture and its impact on function
- To understand the client's biomechanical and physical profile
- Development of client-centered goals with meaningful pathways of interventions.
  - Not just equipment related!
- Through the process, we explore:
  - current and previous equipment
  - postural changes, skin integrity, and pressure care management.
  - Sitting balance and impact on function from different surfaces
  - 24hr positioining needs

When to do MAT evaluations?

- As therapists, we should be asking “Why am I not doing a full MAT assessment on this client?”
- It may be because your client is currently mobilising/display good functional movements

- As a “rule of thumb” map everyone's pelvis

What does a Hands-on MAT assessment do?

1. Assess transfer methods (in and out of seating system)

1. Assess body flexibility and identify any fixed or flexible deformities

2. Evaluate posture and pressure management options through simulated sitting scenarios

3. Examine how muscle tone and spasms affect posture and positioning

4. Determine the need for postural support by assessing functional sitting balance

5. Document seating goals and progress throughout trial and final seating system setups

6. Justify seating interventions with clinical reasoning in documentation or reports

7. Skin integrity check

Stages of MAT AX:

Postural assessment in existing seating system

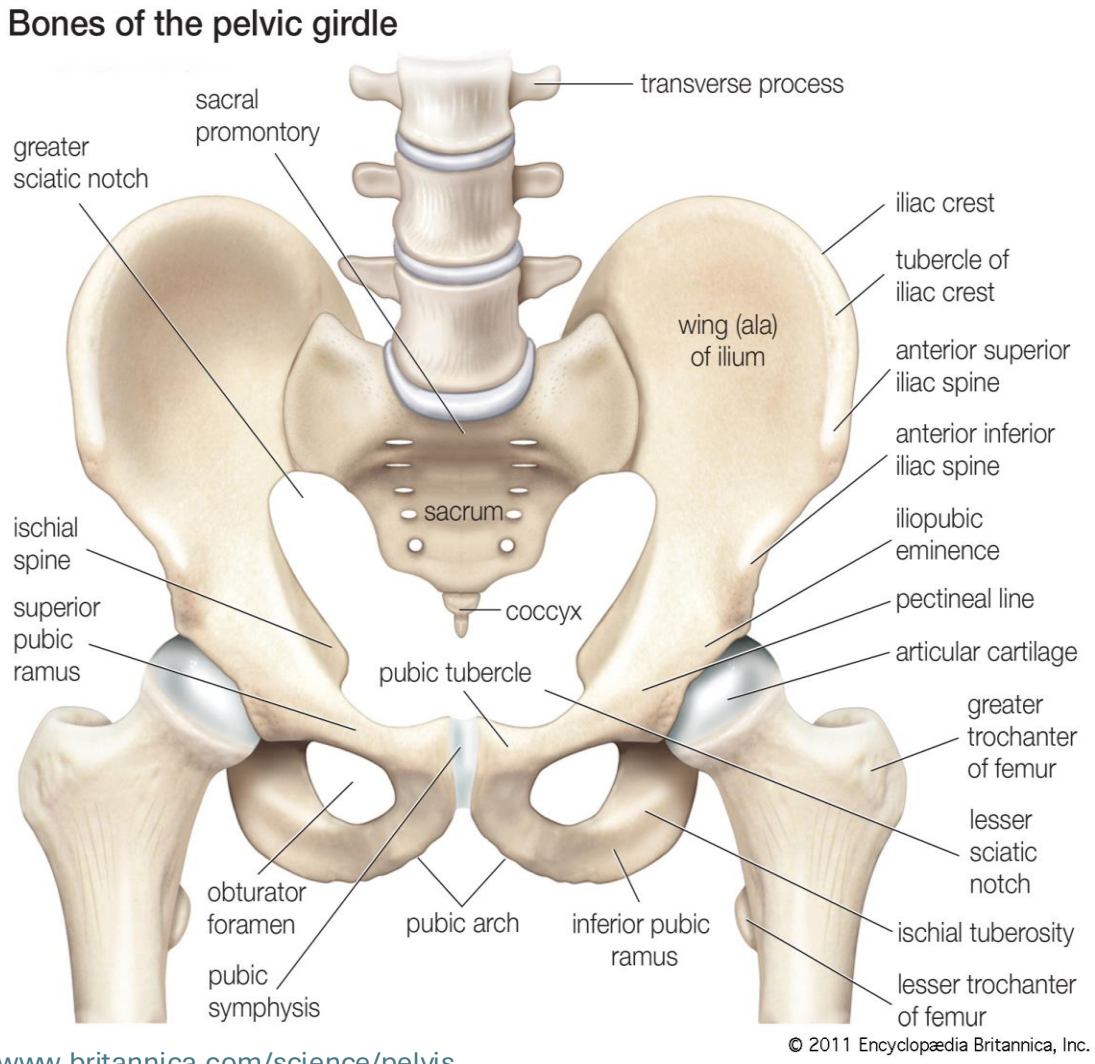
Assessment in supine

Assessment in sitting

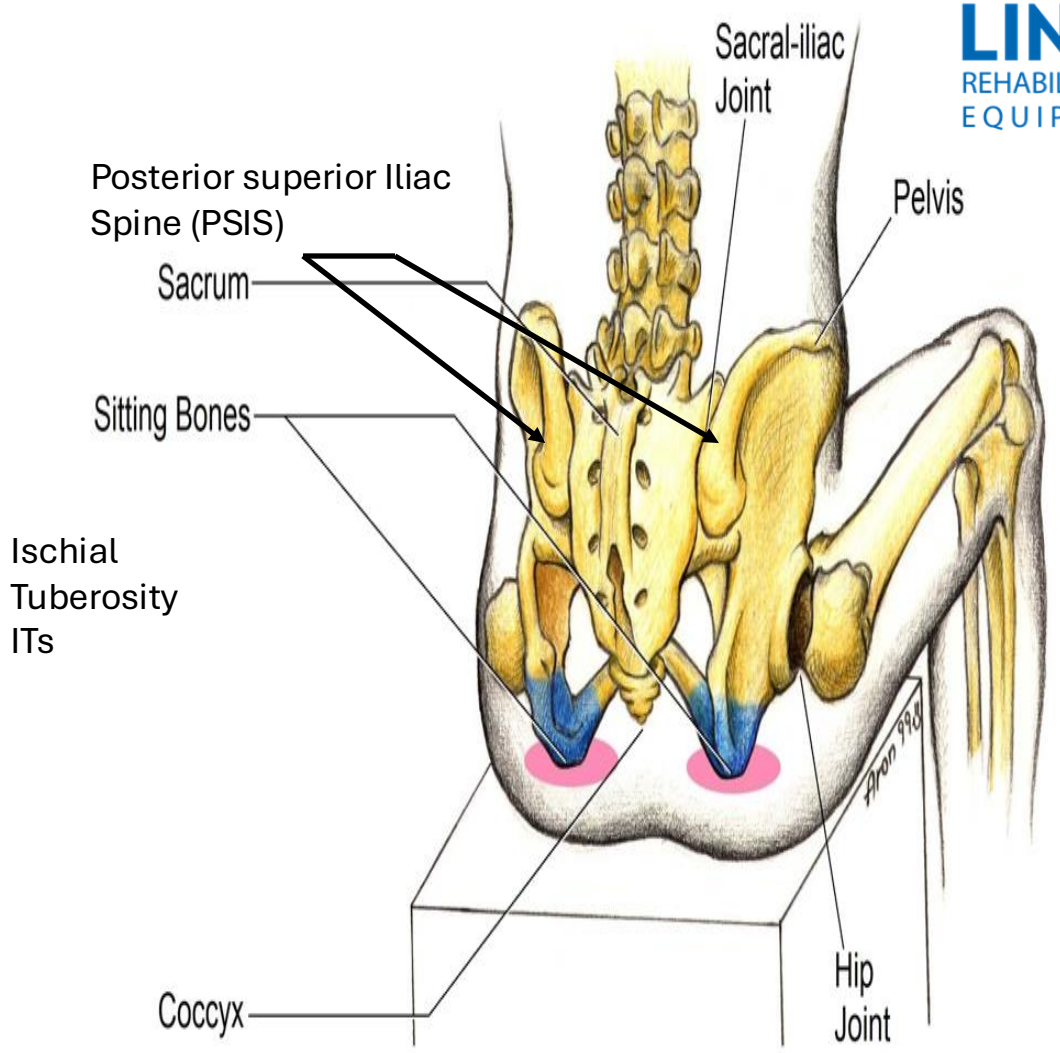
https://aci.health.nsw.gov.au/networks/spinal-cord-injury/spinal-seating/module-3/conducting-the-mat

Get to know the bony landmarks

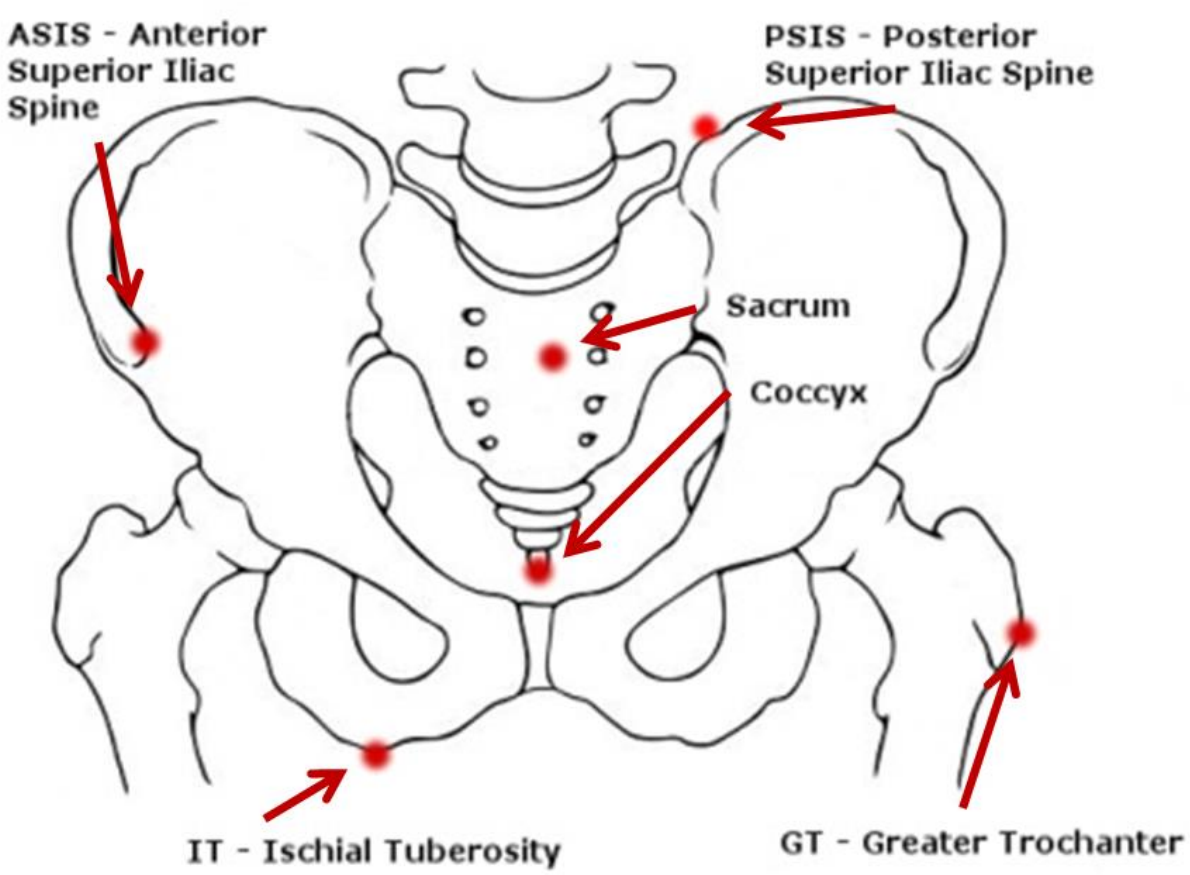
- Pelvis and hips

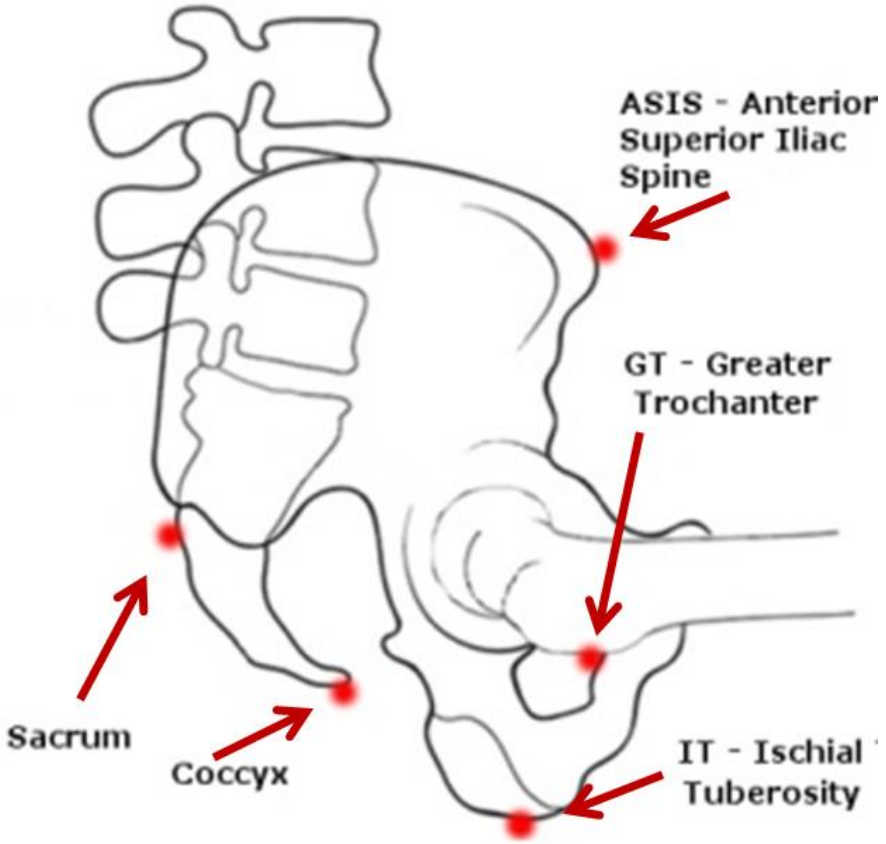


https://www.britannica.com/science/pelvis



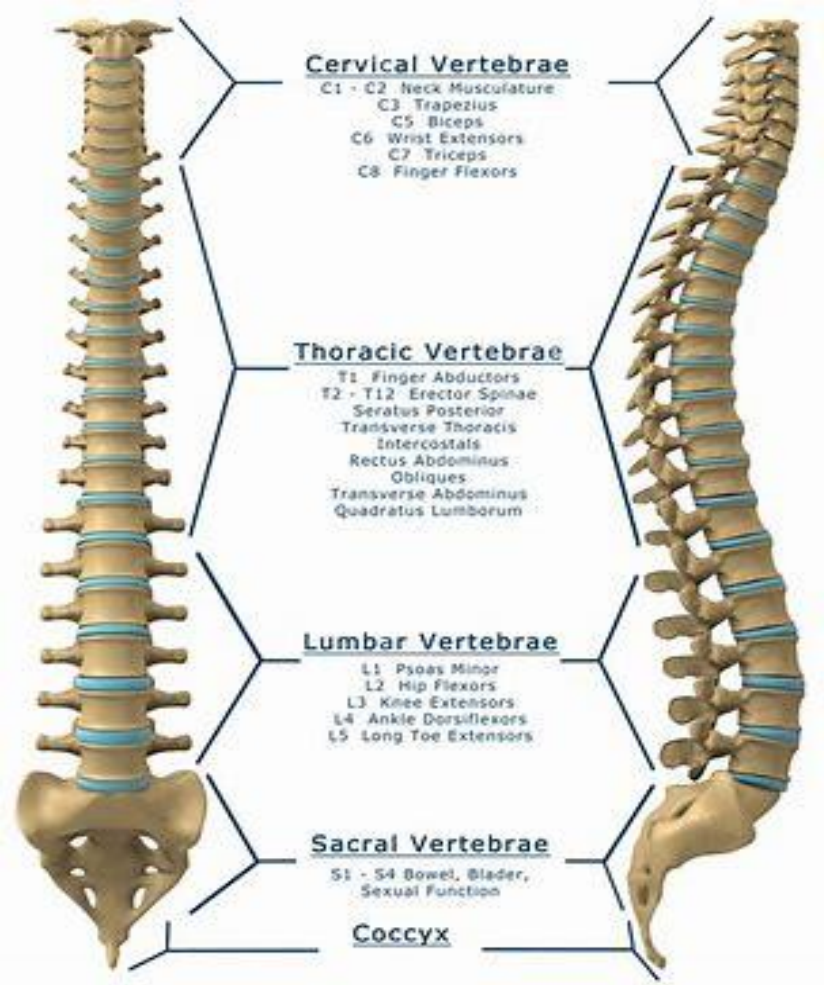
https://alexanderteachingstudio.com/your-bottom-belongs-behind-





https://aci.health.nsw.gov.au/networks/spinal-cord-injury/spinal-seating/module-3/the-mechanical-assessment-tool-mat#:~:text=The%20MAT%20is%20a%20musculoskeletal%20examination%20of%20the,noted%20as%20they%20affect%20posture%20and%20muscle%20length

- Spine

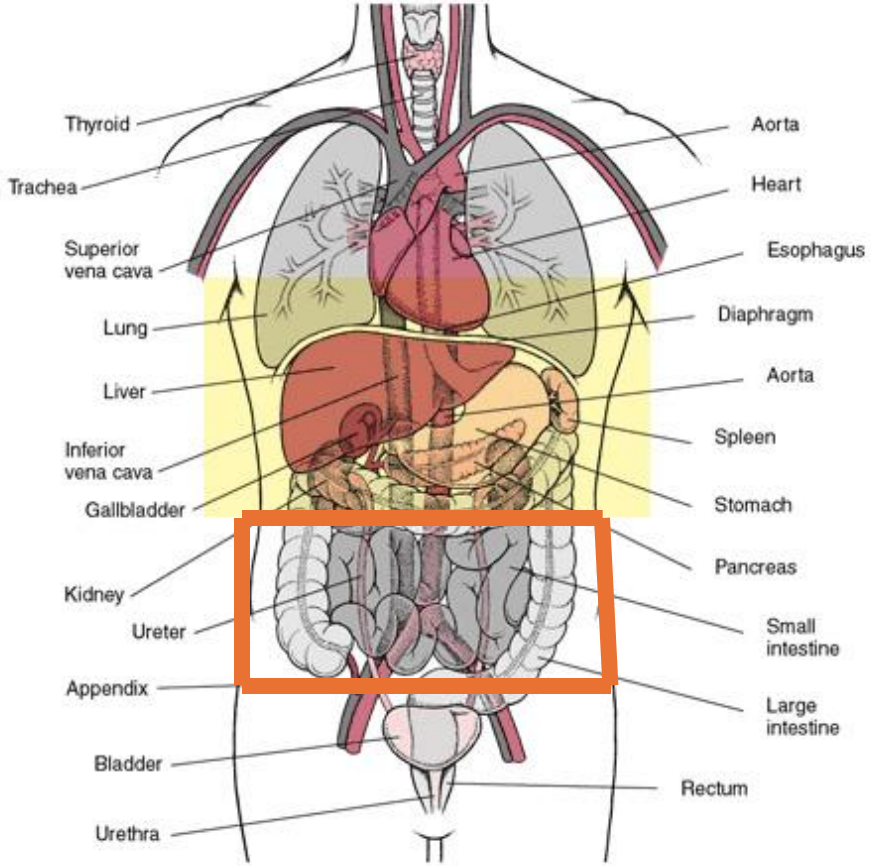


https://anatomy-medicine.com/nervous-system/116-the-spinal-cord.html

http://www.seat-specialists.com/products/knoedler-air-chief-seat-choose-your-options.html

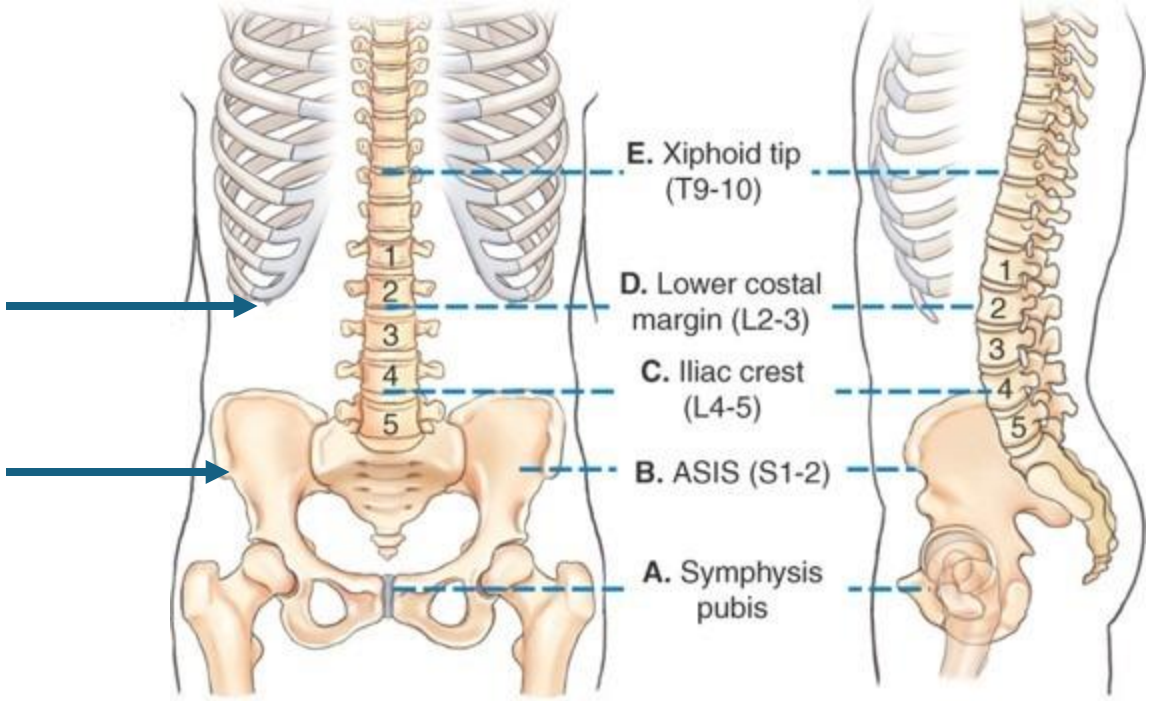
https://karo.co.za/knowledge-center/what-happens-when-you-sit-and-how-it-affects-your-body/

- Life Box



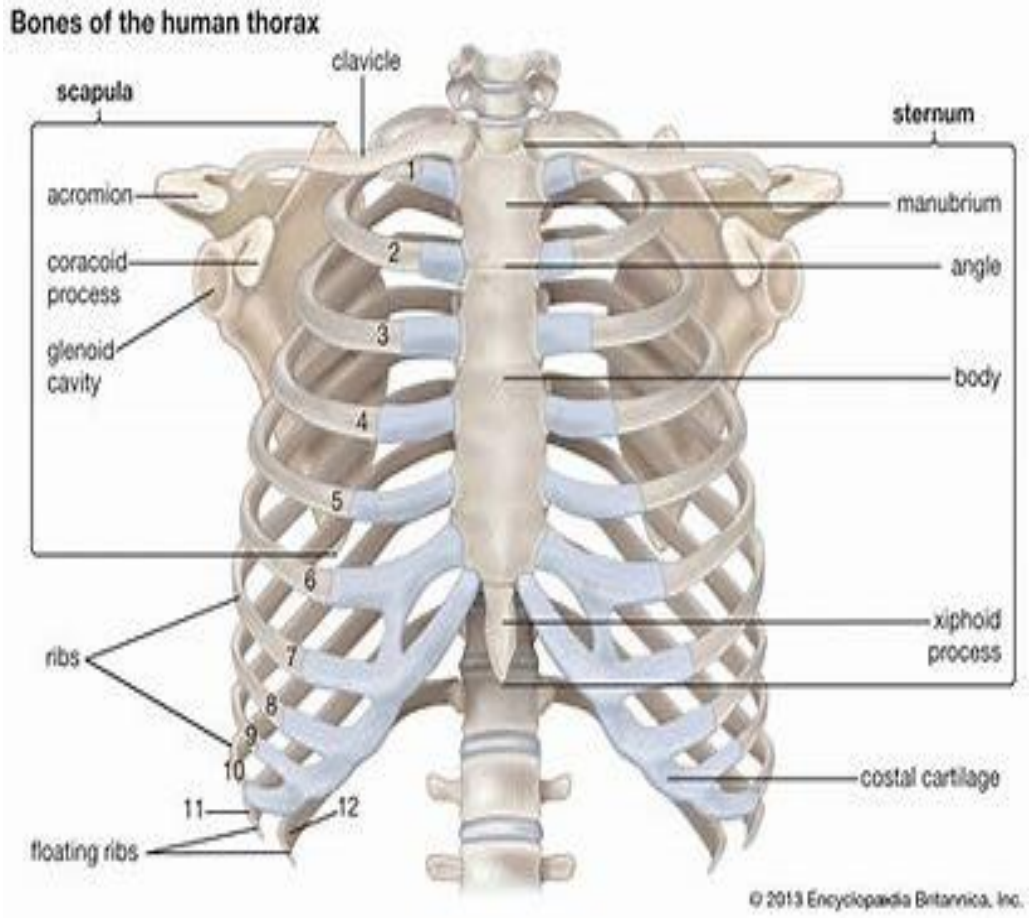
https://889community.com/the-breath-part-one-basic-breath-anatomy/

LIFE BOX

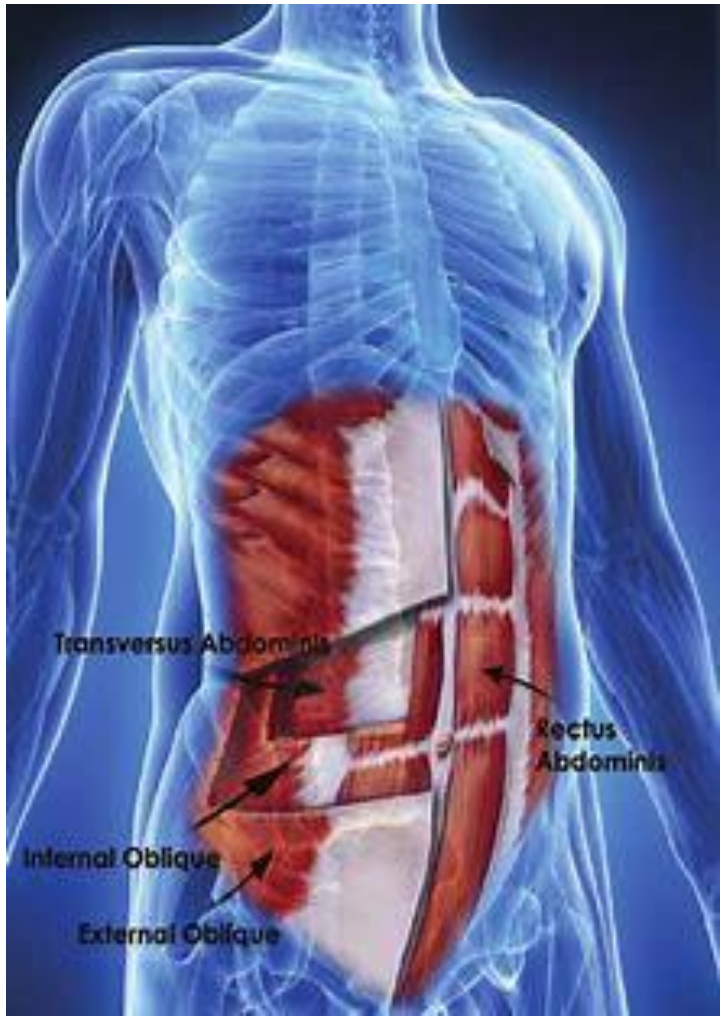


https://quizlet.com/345418418/chapter-9-lumbar-spine-sacrum-coccyx-radiographic-positioning-pathology-flash-cards/

- Thoracic – Apexes
  Abdominal Wall



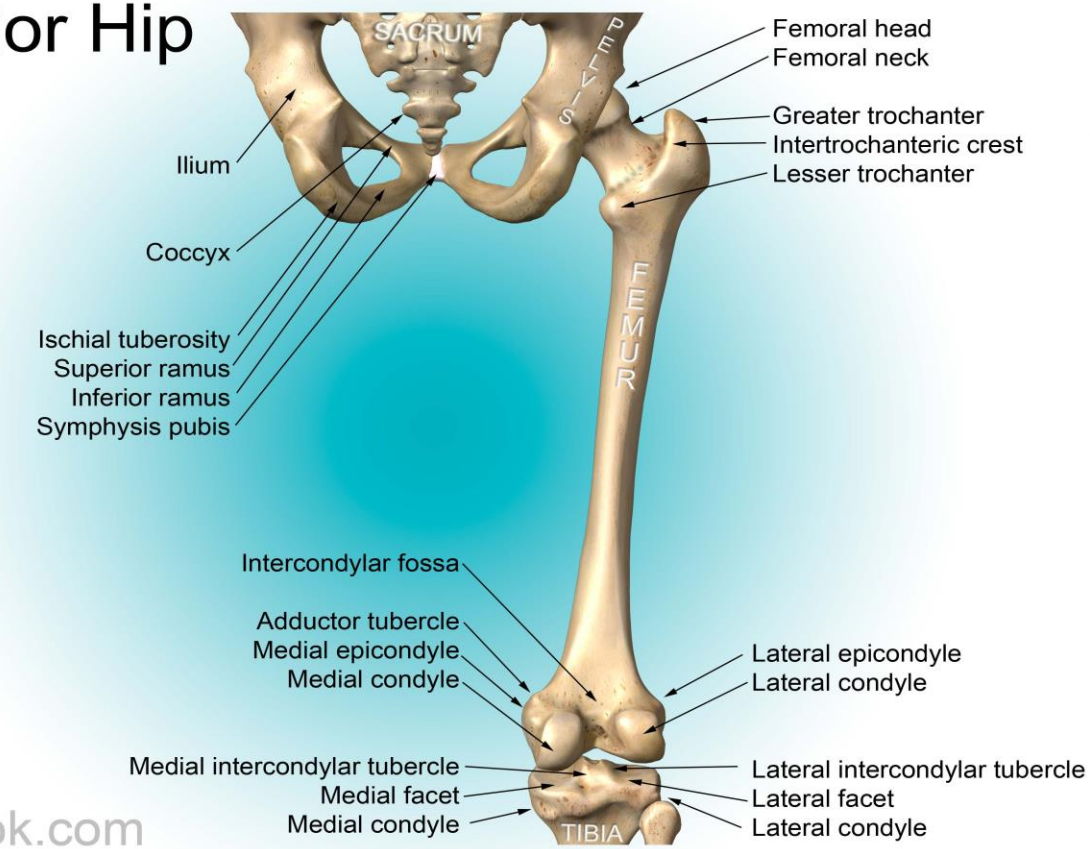
https://www.britannica.com/science/thoracic-cavity



https://www.researchgate.net/figure/The-anatomy-of-the-abdominal-wall_fig1_283209177

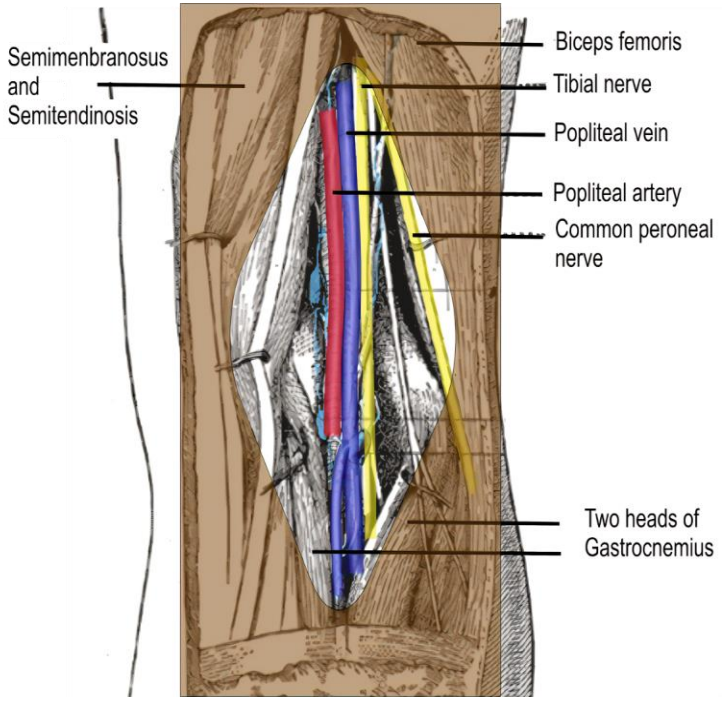
- Femur and Popliteal Fossa

Posterior Hip



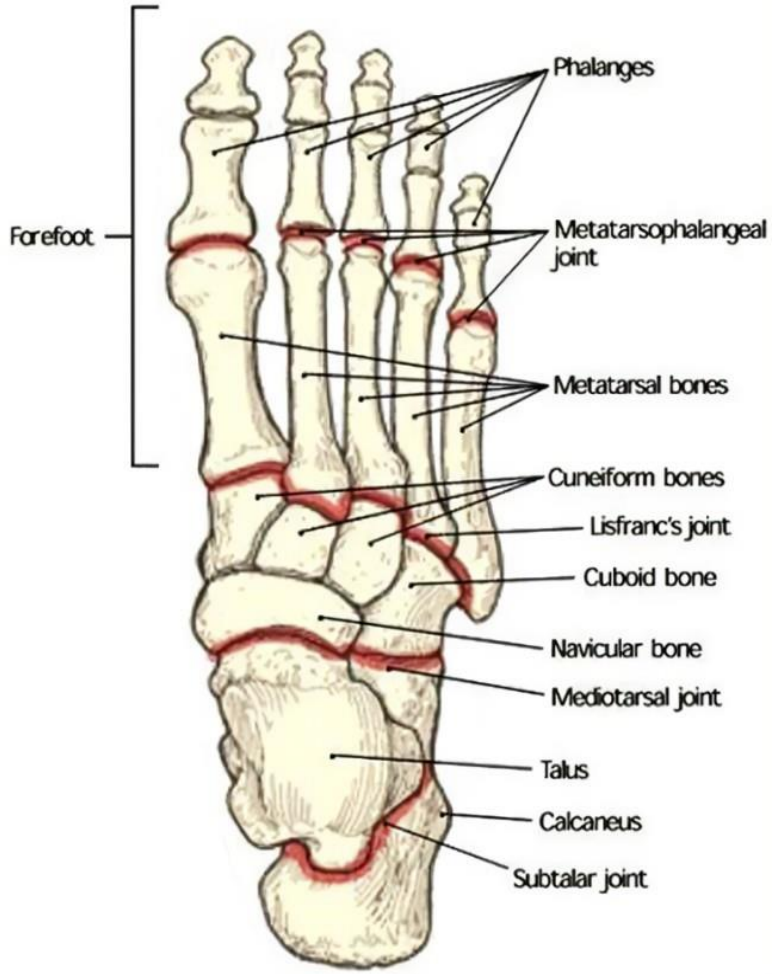
fpnotebook.com

http://www.fpnotebook.com/Ortho/Anatomy/FmrBn.htm

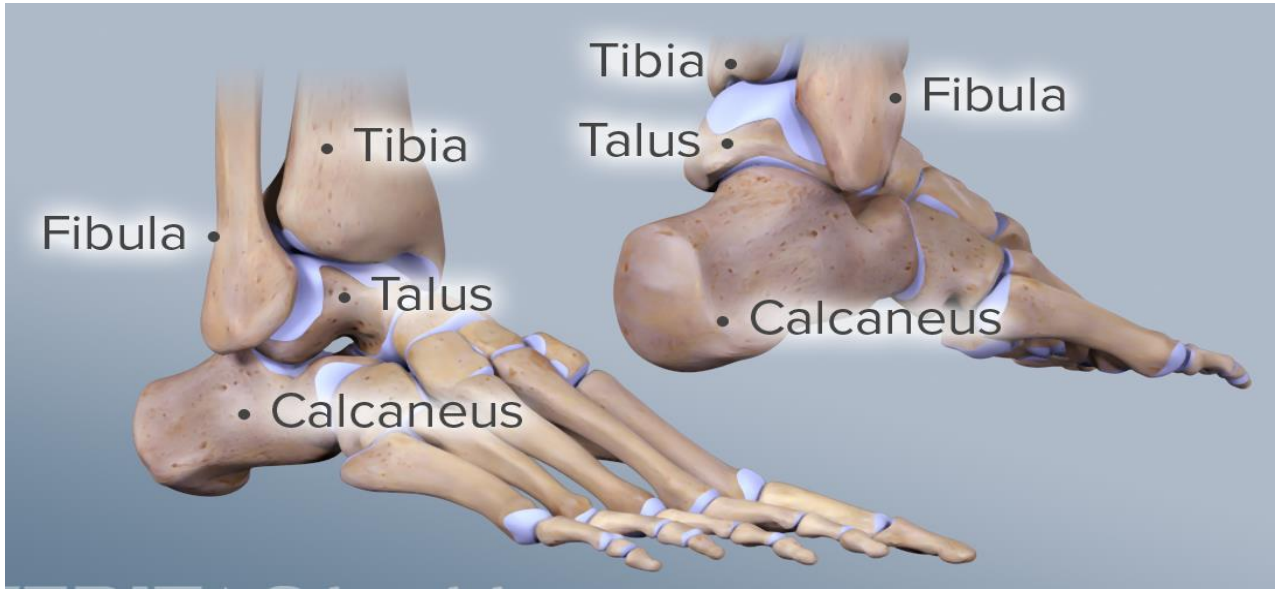


http://www.cambridgeorthopaedics.com/cambridgeanaesthetics/advancednerveblocks/popliteal%20block.htm

- Forefoot and ankle (the lower is controlled by the hip and knee)

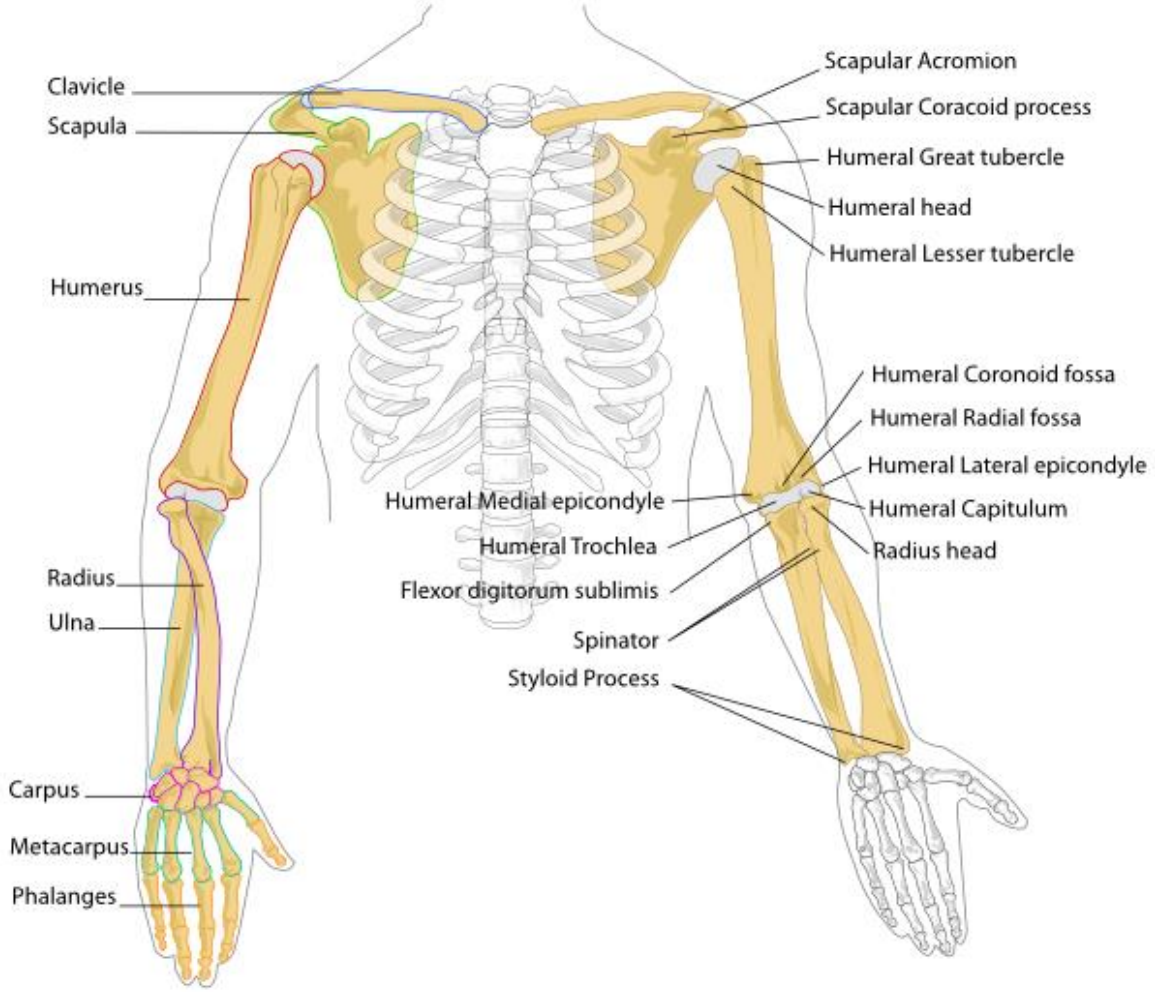


https://www.orthobullets.com/foot-and-ankle/7006/foot-anatomy-and-biomechanics

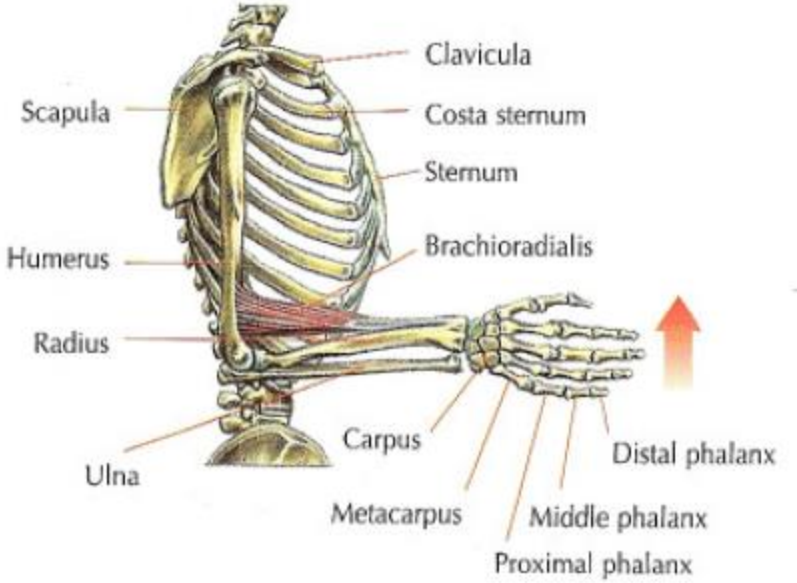


https://www.arthritis-health.com/types/osteoarthritis/ankle-joint-anatomy-and-osteoarthritis

- Upper extremities

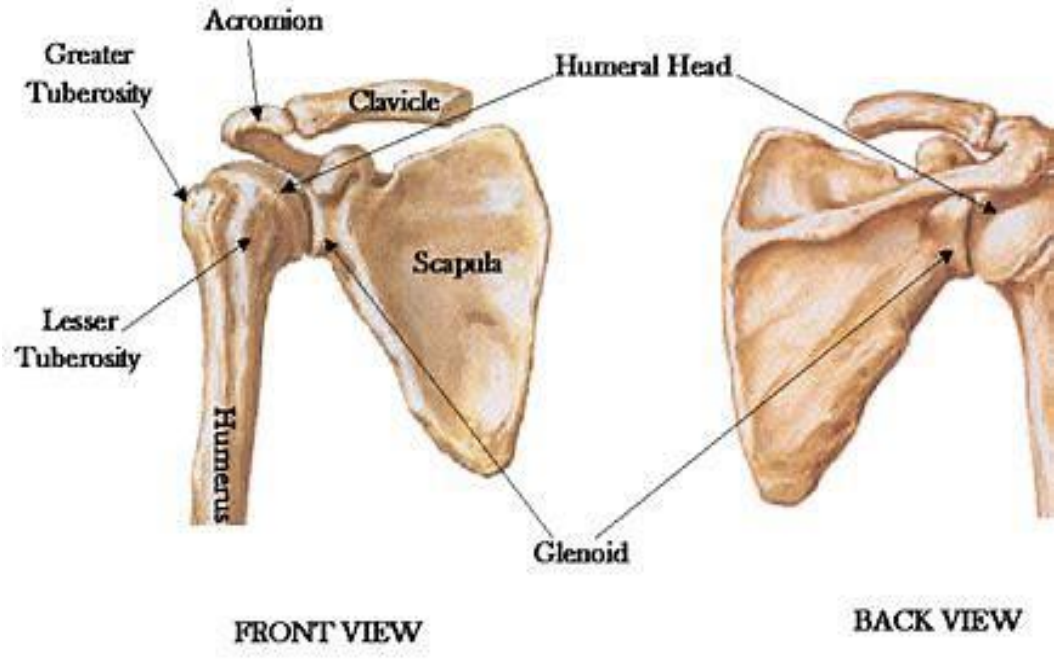


https://study.com/learn/lesson/volar-dorsal-sugar-tong-sprints.html



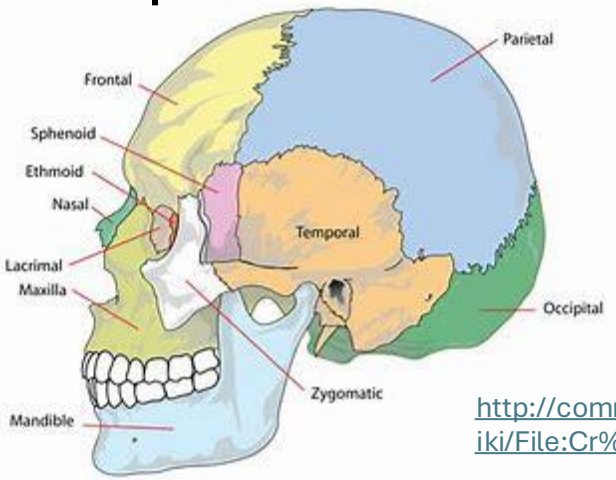
https://www.thestephaneandre.com/hammer-curls/

- Shoulder Girdle

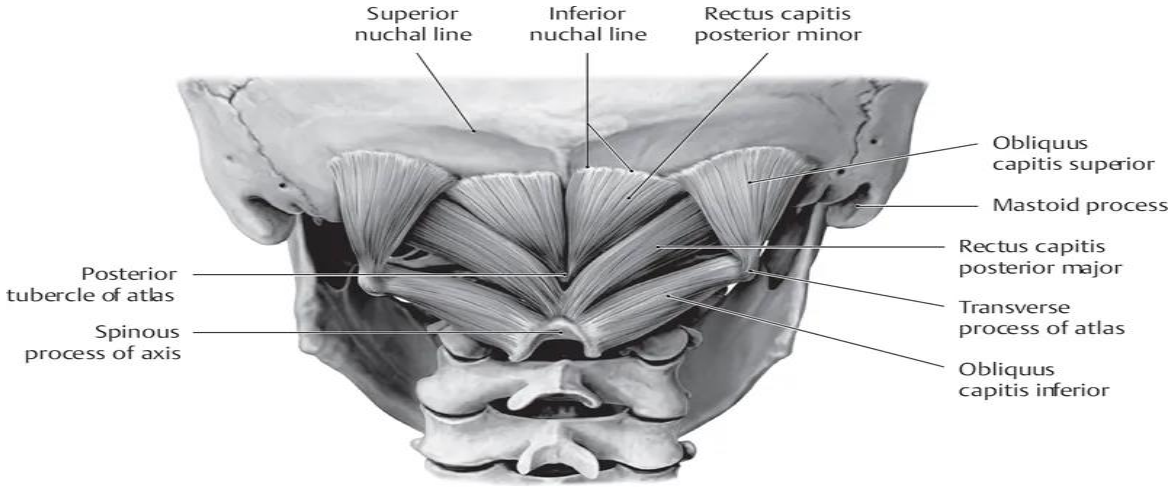


http://rrcmrt.wordpress.com/2012/07/16/shoulder-girdle-anatomy-tutorial/

- Skull – Sub Occipital



http://commons.wikimedia.org/wiki/File:Cr%C3%A2ne_2.svg



http://neupsykey.com/craniovertebral-junction-2/

Review all body planes of symmetry

- Consider what it means to be “Symmetrical”?
- What is a “neutral” sitting posture?
- What is a “position of comfort”?
- How do we use this information to increase our understanding and make sound clinical judgments about our client’s seated postures?

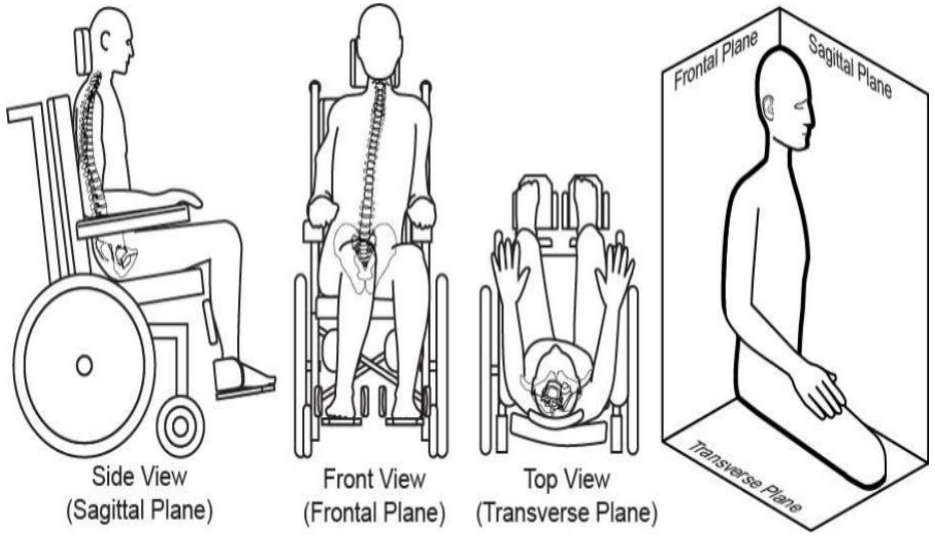


Fig. 1.5: Describing postural deviations in three planes

Waugh, et al., 2013 pg. 10

MAT Ax FORM

LINDS® REHABILITATION EQUIPMENT

Pelvis

Tilt (Side View)

☐ Neutral ☐ Posterior ☐ Anterior

Obliquity (Frontal View)

☐ Neutral ☐ Left ↓ ☐ Right ↓

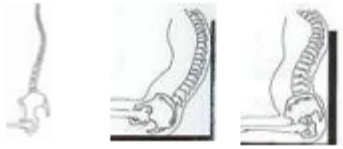
Lowered by:

Rotation (Top View)

☐ Neutral ☐ Left Forward ☐ Right Forward

Trunk

Anterior / Posterior



☐ Neutral ☐ Thoracic Kyphosis ☐ Lumbar Lordosis

☐ Lumbar C-Curve Flattening

Scoliosis (Frontal View)

☐ Neutral ☐ Convex Left ☐ Convex Right

Apex at:

Rotation (Top View)

☐ Neutral ☐ Left Forward ☐ Right Forward

Hips

Thigh to Trunk Angle

Left: **Right:**

_____° _____°

Degrees Degrees

Position (Frontal View)

☐ Neutral ☐ ABduct^{n} L / R ☐ ADduct^{n} L / R

☐ External Rotation: L / R

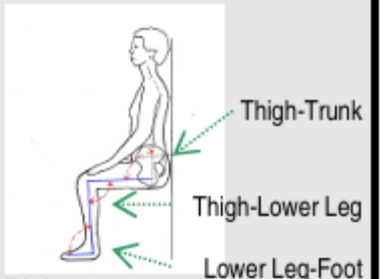
☐ Internal Rotation: L / R

Windswept (Frontal View)

☐ Neutral ☐ Left ☐ Right

Angles

Left:



Right:

MAT Ax FORM

Knees and Feet

Thigh-Lower Leg Angle

Left: _____ ° Degrees

Right: _____ ° Degrees

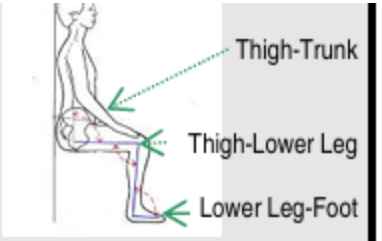
Lower Leg- Foot Angle

Left: _____ ° Degrees
- ☐ Plantar-flex
- ☐ Dorsi-flex

Right: _____ ° Degrees
- ☐ Plantar-flex
- ☐ Dorsi-flex

Foot Position

Left:	Right:
☐ Neutral	☐ Neutral
☐ Inversion	☐ Inversion
☐ Eversion	☐ Eversion



Head and Neck

Cervical Curve (Side View)

- ☐ Neutral
- ☐ Flexion
- ☐ Extension
- ☐ Cervical Hyperextension (Chin poke)

Neck Position (Frontal View)

- ☐ Midline
- ☐ Lateral Flexion: L / R
- ☐ Rotation: L / R

Control

- ☐ Independent Head Control and Full ROM
- ☐ Restricted Head Control
- ☐ Restricted ROM
- ☐ Absent Head Control

Upper Limbs

Shoulder Positioning

☐ Level ☐ Asymmetric

	Left	Right
Elevated	☐	☐
Depressed	☐	☐
Retracted	☐	☐
Subluxed	☐	☐
Ext rotation	☐	☐
Int.rotation	☐	☐

Elbow and Forearm Position

☐ Arm support ☐ No support

Elbow flexion: (0°- 150°)
Left:_____ Right:_____

Supination: (0°-90°)
Left:_____ Right:_____

Pronation: (0°-90°)
Left:_____ Right:_____

Position Description:

Hand grip	Left	Right
Palmer /gross grip	☐	☐
Lateral pinch	☐	☐
Tripot pinch	☐	☐
Nil grip	☐	☐

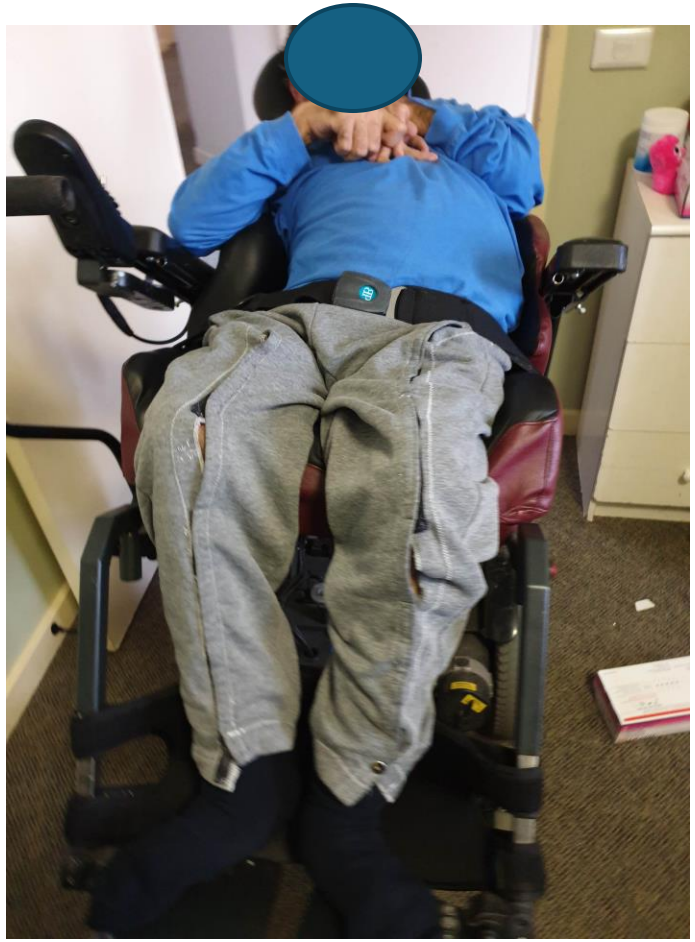
Wrist and Handgrip

Wrist position: L R

Flexion / extension: ☐ ☐

Deviation (ulnar/ radial): ☐ ☐

What are we looking for in photos?



Positioning from transfer

Position before transferring out of the wheelchair

Before MAT / Interventions:

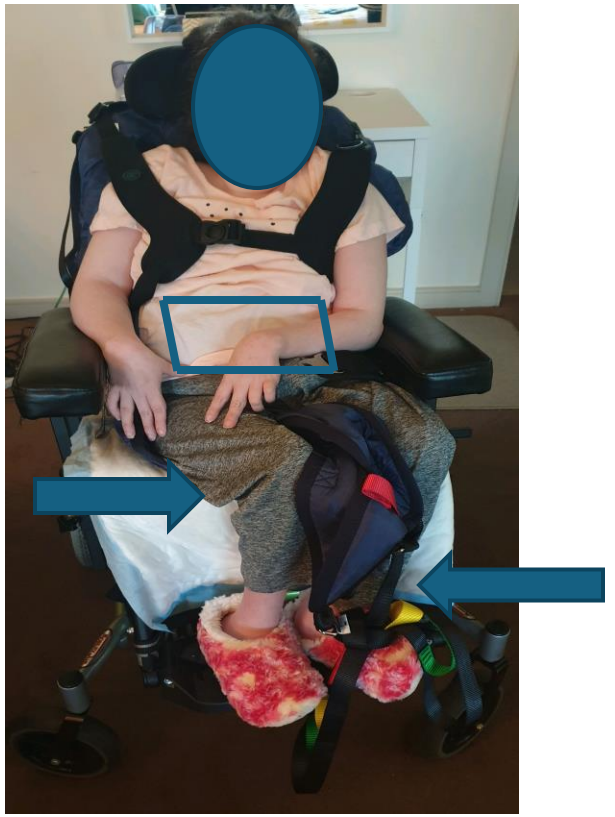
Frontal

LHS Sagittal

RHS Sagittal

Traverse

Phase One: Review of Existing Seated Posture



Visual

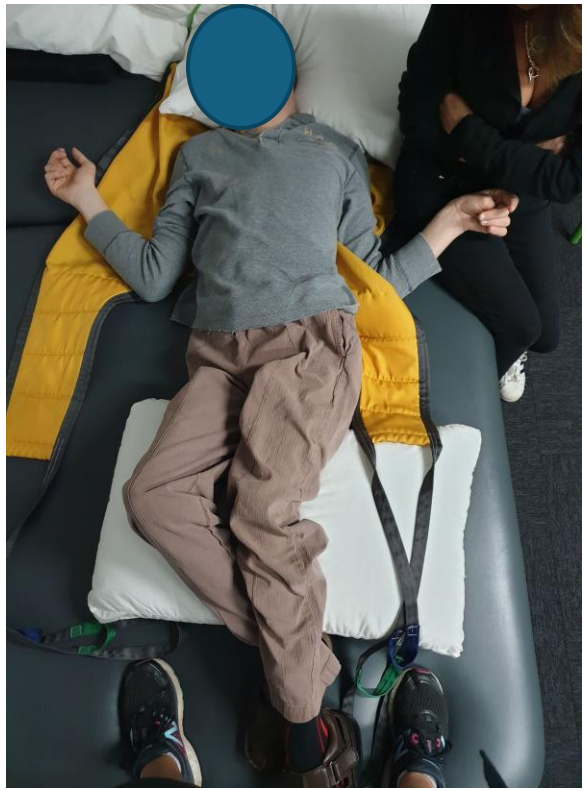
Phase One: Review of Existing Seated Posture

Hands-on, feel and record. Consent for photos. Highlight Landmarks.

Take the opportunity to dig deeper:

- History of current seating
- Transfers – postural changes throughout day
- History of seating patterns (length of time)
- Daily activities completed in chair
- Level of comfort – signs of discomfort
- Map out existing seating support surfaces.

Phase Two: Supine MAT Assessment



https://www.physicaltherapy.com/articles/wheelchair-seating-considerations-for-prop-4785#:~:text=Prop%20sitter%20One%20way%20of%20looking%20at%20wheelchair,sitter%2C%20the%20hands-dependent%20sitter%2C%20and%20the%20prop%20sitter

Visual

Phase Two: Supine MAT Assessment

Hands-on, feel and record findings

Also note direction of force and counteracting force. Consent for photos.

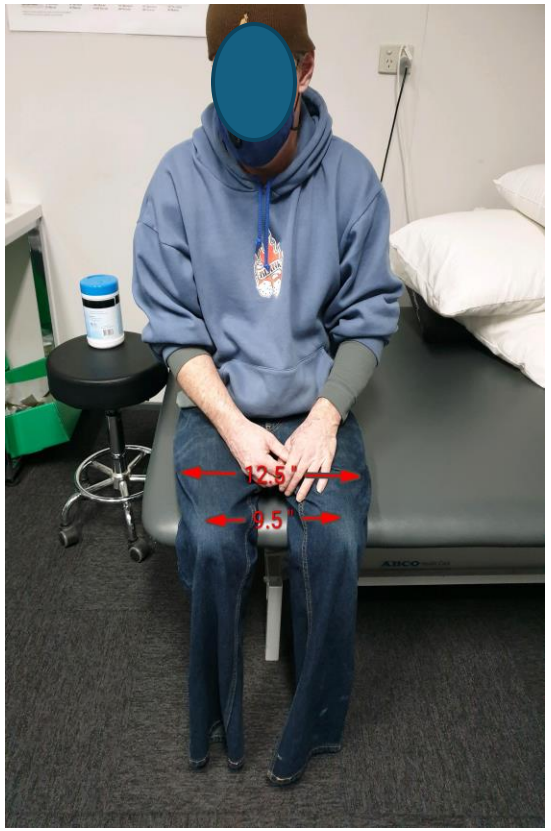
Highlight Landmarks.

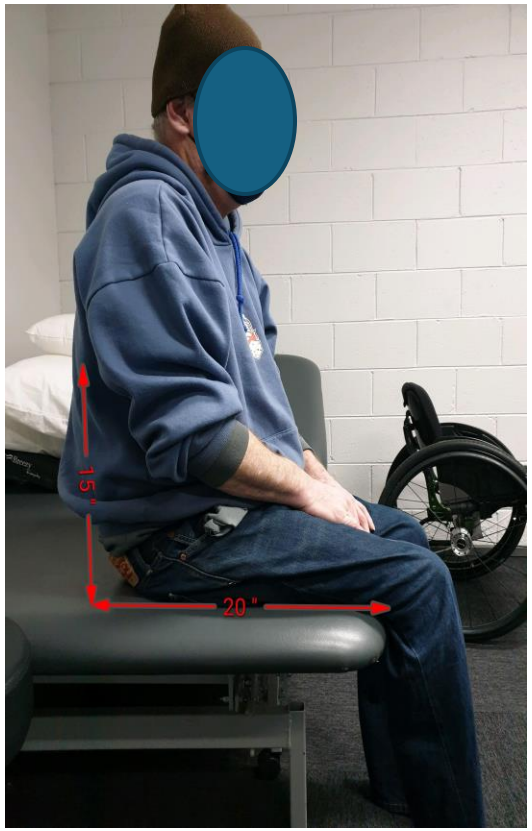
CONTRIDICTIONS: Aspiration risks; behaviors of concern; medically indicated risks; sensory processing disorders (hypersensitive)

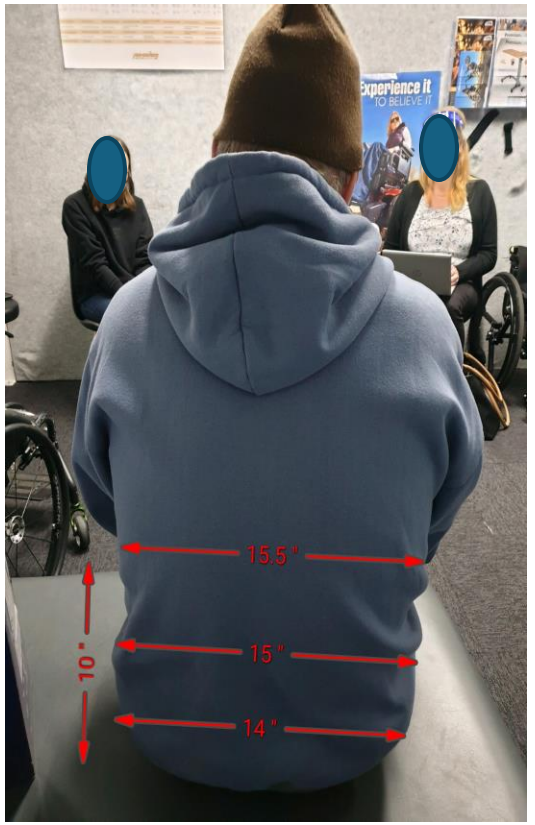
Take the opportunity to dig deeper:

- Transfer methods (standing / slide/ sling)
- Any triggers for tone
- 24hr positioning needs - ? Bed positioning
- Skin integrity
- Review current seating system

Phase Three: Sitting MAT Assessment







Visual

Phase Three: Sitting MAT Assessment

https://www.occupationaltherapy.com/articles/wheelchair-seating-assessment-2845

https://www.physicaltherapy.com/articles/wheelchair-seating-considerations-for-prop-4785#:~:text=Prop%20sitter%20One%20way%20of%20looking%20at%20wheelchair,sitter%2C%20the%20hands-dependent%20sitter%2C%20and%20the%20prop%20sitter

Phase Three: Sitting MAT Assessment

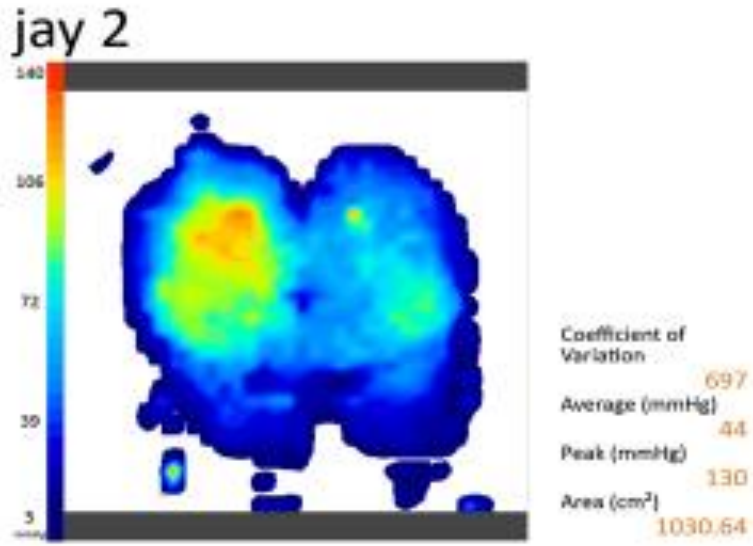
Hands-on, support, and record. Consent for photos.
Highlight Landmarks and where postural support is required.
Take anthropometric measurements.

Take the opportunity to dig deeper:

- Sitting balance
- Impact of posture/ interventions on reach (note compensatory patterns)
- Impact of gravity on tone
- Finding the balance between correction and comfort
- Review head and neck control, and assess visual field.

Complimentary Tools

- Pressure Map Imagery
- Loop+ Activity tracker data reports



Functional Task Analysis

Photos of Measurable Outcomes

Outcomes – identify supports required

Anatomical Area	Existing Relation to neutral on all 3 planes	MAT outcomes	Counteracting forces & location	Outcomes to base of support
Pelvis	(F) Moderate LHS obliquity (S) Mild anterior pelvic tilt (T) Mild Left rotation	(F) Non- reducible (S) Reducible towards N (T) Reducible to N	- LHS P GT - ≥ D thigh support - Leg length discrepancy RHS	- Cushion GT buildup under cushion to maintain envelop and immersion , Lateral R hip support - Posterior slope in cushion from front of cushion, lumber + PSIS back support, pelvis position belt - Custom cut out RHS 1" accommodation of leg length discrepancy, IT well, pelvic positioning belt

Outcomes – identify supports required

Anatomical Area	Existing Relation to neutral on all 3 planes	MAT outcomes	Counteracting forces & location	Outcomes to base of support
Lower Limbs	(F) IR + ADduction RHS, ER + ABduction LHS (S) ≤90° thigh to trunk angle, 90° thigh to shin, N foot PF (T) RHS rotating to Left	(F) Reducible towards N (S) Reducible towards N (T) Reducible towards N	- Reducible allowing RHS thigh discrepancy - ≥ Distal thigh loading - Reducible allowing RHS thigh discrepancy	- Custom cut out RHS 1" accommodation of leg length discrepancy, Thigh trough contouring medial and lateral thigh supports in cushion - Posterior slope in cushion from front of cushion, accommodating FP height - Custom cut out RHS 1" accommodation of leg length discrepancy, IT well, accommodating FP placement

LINDS® REHABILITATION EQUIPMENT

Outcomes – identify supports required

Anatomical Area	Existing Relation to neutral on all 3 planes	MAT outcomes	Counteracting forces & location	Outcomes to seated supports
Trunk	(F) Moderate Convex Scoliosis LHS (S) Mild lumbar lordosis (T) Neutral	Prop sitter (F) Mild Reducible towards N (S) Reducible towards N (T) Reducible towards N with Pelvic rotation correction	- Reducible allowing LHS Obliquity support, - Lateral dispersed force to convex apex LHS - Lateral dispersed force above concave apex RHS angular - P thorax LHS, A thorax RHS de-rotation support	- Off- set lateral back support, broad surface with angle adjustments - Standard contour back support with combined PSIS and Lumber adjustment, firm positioning for RHS thorax support - 90° thigh to trunk back angle

LINDS® REHABILITATION EQUIPMENT

Outcomes – identify supports required

Anatomical Area	Existing Relation to neutral on all 3 planes	MAT outcomes	Counteracting forces & location	Outcomes to seated support
Upper Limbs	(F) Forearms toward midline (S) Mild Shoulder protraction, Elbow F ≤90°, no wrist supports (T) Neutral	Prop Sitter Sustained trunk extension through forearm support ≥ functional output within midline power zone	- Disperse forearm support across power zone	- Tray surface for positioning elbows at 90° with neutral shoulders - Height adjustable wide arm pads water fall when tray not it use with neutral shoulders
Head	(F) Midline (S) Mild Cervical hyperflexion (T) Neutral	Independent head control Cervical stacking toward	- Head support for car transport only	- Maintain PSIS and lumber spine stacking to support cervical spine alignment

Make comment on :
Position of Symmetry
Position of Comfort/Tolerance
Position of Function

LINDS® REHABILITATION EQUIPMENT

Wheelchair setup and Trunk positioning

Flexible

- Ensuring appropriate seat base
- Increasing lateral supports

Fixed

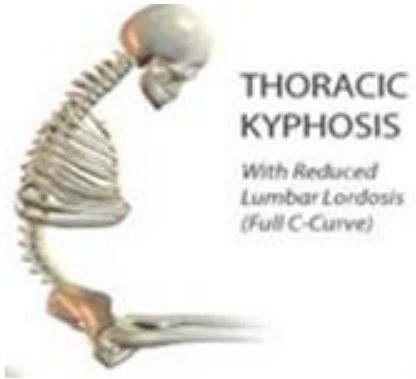
- Accommodating curvature with equipment
  - Ensuring that apex of trunk is well supported
- Use of tilt
- Appropriate head support mounts

Equipment Changes:

- **Seating surface (Width, depth)**
- **Armrest height**
- **Joystick positioning**
- **? Set up of functional activities**

LINDS REHABILITATION EQUIPMENT

Wheelchair setup and Trunk positioning



Flexible

- Increasing posterior pelvic supports
- Change Seat angle

Fixed

- Accommodating curvature with equipment
- Use of tilt
- Chest harness

Equipment Changes:

- **Seat depth**
- **Backrest positioning**
- **Leg rest position too high**
- **Armrest height**
- **Joystick positioning**
- **? Set up of functional activities**

LINDS REHABILITATION EQUIPMENT

Wheelchair setup and Trunk positioning

Flexible

- Increasing posterior pelvic supports
- Change Seat angle

Fixed

- Accommodating curvature with equipment
- Use of tilt
- Chest harness

Equipment Changes:

- **Seat depth**
- **Backrest positioning**
- **Armrest height**
- **Lack of LL support**
- **Joystick positioning**
- **? Set up of functional activities**

LINDS® REHABILITATION EQUIPMENT

Using the data you have collected

- Identify problems you want to fix, and non-negotiable compromises.

- Cover off the key seating principles:
  - Base of support
  - Know the positions of alignment vs comfort vs function
  - Know where supporting forces need to be – match these with equipment features
- Collaborate with your suppliers and share your outcomes.

- Use this data in your outcome measures.
  - Before and after photos
  - Improvement in a person's physical capacity

Take Home Messages:

- Take away confidence from what you have learned today to feel postures and create balance for improved function.

- There is always more to learn!
  - An in-depth understanding of muscle tone and spasticity
  - Specific diagnosis
  - Wheelchair set-ups

- Teamwork makes the dream work!
  - Take a multidisciplinary approach.
  - Know the role of your supplier in the process

- State Spinal Cord Injury Service NSW has developed an online Spinal Seating Education Modules
  - https://aci.health.nsw.gov.au/networks/spinal-cord-injury/spinal-seating

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Please remember to fill out our survey

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