

## Spinal Seating MAT Assessment Guide

### *Clinical knowledge for conducting MAT*

This booklet contains information that is relevant to conducting all seating assessment. It is part of the web-based Spinal Seating Module 3: 'Hands on assessment'.

Whilst the information it contains may not be new knowledge to post graduated clinicians, revision of the material prior to attending the Spinal Seating Professional Development Program seating workshops will maximize skill acquisition during these workshops.

The material was developed by Pamela Reeves in 2006 and was reviewed by Charisse Turnbull for the online Spinal Seating online modules in 2008.

The SSCIS Seating Professional Development Program is funded by the Agency for Clinical Innovation (ACI)<sup>1</sup> in NSW Australia and has been developed in collaboration with the seating service in Prince of Wales Hospital and Northern Sydney Central Coast Assistive Technology and Seating.

Content:	Pages
<b>The Pelvis</b>	2 -5
<b>The Hips</b>	6 -9
<b>The Spine &amp; Trunk</b>	10-13
<b>The Shoulder Girdle and Upper Limbs</b>	13-17
<b>The Head and Neck</b>	18-19

*Permission to use graphic illustrations used in this booklet:*

- Jean Anne Zollar, 1996
- Smith & Nephew®
- Sunrise Medical®
- BodyPoint®

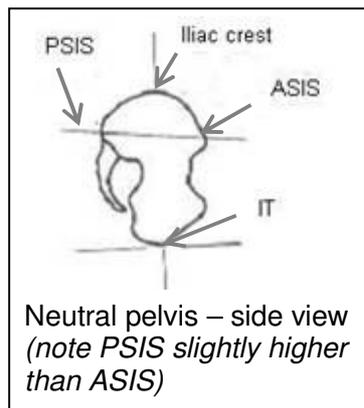
*Consent obtained from individuals for the usage of pictorial illustrations*

<sup>1</sup> Previous known as the Greater Metropolitan Clinical Taskforce (GMCT)



## The Pelvis

- Key landmarks
  - Anterior Superior Iliac Spine (ASIS)
  - Posterior superior Iliac Spine (PSIS)
  - Iliac Crest
  - Ischial Tuberosity (IT)
- Planes of movement
  - Tilt
  - Obliquity
  - Rotation
  - Combinations of these
- Finding landmarks and feeling movement



ASIS  
Base of rib  
cage  
Iliac crest



PSIS

**Spinal Seating Professional Development Project  
Reference Document RD5.2: Seating Reference Guide**

**Movements of the Pelvis**

**Pelvic Tilt** - Pelvic tilt is a movement coming from the joints between the pelvis and lower spine. The pelvis is considered to be in a neutral position (tilt) when the ASIS are just slightly lower approximately 5 degrees, than the PSIS.



- You can see the positions of the ASIS and PSIS in these pictures, indicating anterior and posterior tilt. Look also at the spine.
- When the pelvis is in anterior tilt the spine tends to become lordotic – curve away from the supporting surface whereas in posterior tilt it tends to be more kyphotic – pushed towards the supporting surface.
- The posture of the spine can also be an indicator of what is happening at the pelvis.



**Moving the pelvis through the range of tilt:**

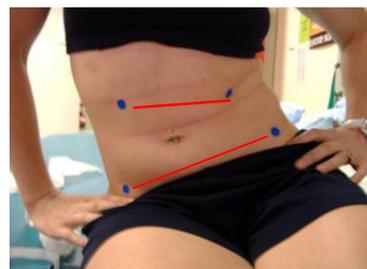
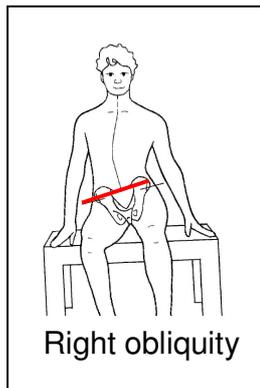
A person may be able to actively move their pelvis from neutral tilt to anterior and/or posterior tilt particularly if you are able to demonstrate the movement you are looking for. Passive movement can be done in sitting or supine. Place your hands on the ASIS and PSIS (or if you can't reach the PSIS, the back part of the iliac crest) and move the pelvis anteriorly and posteriorly. If this is difficult you can also put a rolled towel or similar, behind the lumbar spine and lift up (supine) or pull forward (sitting).





**Spinal Seating Professional Development Project  
Reference Document RD5.2: Seating Reference Guide**

**Pelvic Obliquity** – Pelvic obliquity is a “lifting” of one side of the pelvis – left or right. If the pelvis is in a neutral position, the left and right ASIS will be at the same height, if one ASIS is lower the person has an obliquity. The lower side defines this, that is, if the left side of the pelvis is lower you are said to have a left obliquity. If you sit with an oblique pelvis you will notice that your spine starts to curve in the opposite direction to the obliquity and this becomes more pronounced the closer you are to the point where you lose balance. This obviously impacts on clients and especially if they have poor balance. You will also note that when the pelvis is oblique, there is more weight distributed through one buttock than the other.



Moving the pelvis through the obliquity range:

Again a person may be able to actively move in and out of an oblique posture. To passively move the pelvis in supine, grasp the pelvis in the same way as previously and move it towards neutral pelvic alignment. Alternately, move the pelvis using the lower legs as leverage, providing that the client has intact hip joints and skeletal structures. Refer to videos for conducting MAT in supine and in sitting.

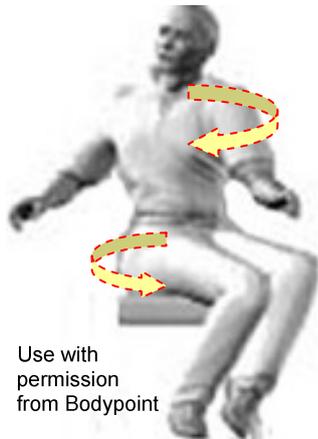
Take note of the trunk and shoulder position. Moving fixed pelvic obliquity to neutral may result in the shifting trunk position whilst moving a flexible pelvic obliquity to neutral should have no impact on the spine.





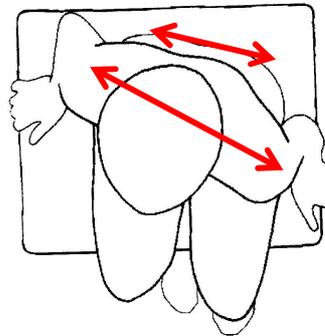
**Spinal Seating Professional Development Project  
Reference Document RD5.2: Seating Reference Guide**

**Pelvic Rotation** – pelvic rotation is the turning of the pelvis around the centre point of the body. When the pelvis is rotated, one ASIS is further forward than the other. The most forward side describes the rotation; if the left ASIS is further forward you have left pelvic rotation. Pelvic rotation may also appear as one knee being further forward than the other or one leg longer than the other, although there other factors can cause both of these things so you would need to confirm it was pelvic rotation by palpating the bony landmarks. Pelvic rotation may co-present with lower limb windswept positioning or with trunk rotation / counter rotation.



Use with permission from Bodypoint

Right pelvic rotation with left trunk rotation and lower limbs wind swept position to the left.



Left pelvic rotation with left trunk rotation

Moving the pelvis in a rotational plane:

A person may be able to actively rotate the pelvis. In supine, you can assess pelvic rotation by grasping the pelvis to move it in the required direction, bringing one side towards anterior and the other posterior simultaneously.

To passively move the pelvis in sitting, get client's weight off the side of the pelvis you wish to "de-rotate" by leaning to the opposite side, grasp the pelvis in the same way as previously and move it in the required direction.



## The Hips

- Key bony landmark – Greater Trochanter (GT)
- Planes of movement
  - flexion/extension
  - abduction/adduction
  - internal/external rotation
  - combinations of above movements
- Finding landmarks and feeling movement

- The hip joint is a **ball and socket** joint that enable movement to occur in several plains.
- It is a large, strong joint designed for weight bearing.
- The acetabulum on the pelvis is like a bowl designed to hold the head of the femur.
- When the head of the femur is correctly aligned with the centre of the acetabulum, the joint is strongest.
- The integrity of the joint can be compromised by poor alignment or a shallow acetabulum.

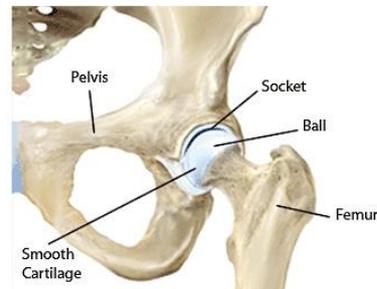
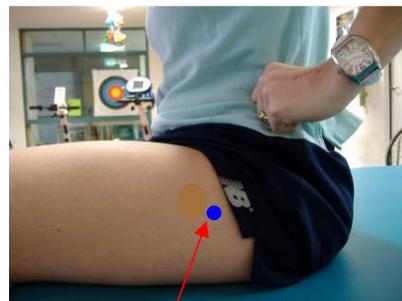


Photo used with permission from Smith & Nephew



Greater trochanter

### Movements of the Hip

When measuring joint range for seating, this can be done in the traditional way, measuring over the joint axis or by measuring the outside surface of the body, where the body will contact the seating system. To use the alternative method, lay the measuring device over the joint and then read measure off device or trace the surface that was against the body onto a page, and measure from the page.



Spinal Seating Professional Development Project Reference Document RD5.2: Seating Reference Guide

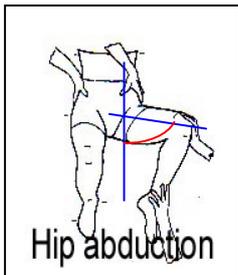
**Hip Flexion & Extension**



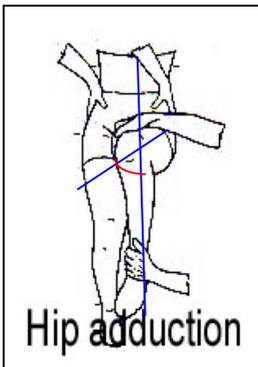
To measure hip flexion, the client should be in supine or side lying. First flex the hip and knee on the side that is not being measured to reduce tension. Locate the ASIS and keep finger on this

With the knee flexed to less than 90 degrees, bend the hip and leg up until the pelvis starts to move. When the pelvis starts to move, stop and measure.

**Hip Abduction & Adduction**



Hip abduction



Hip adduction

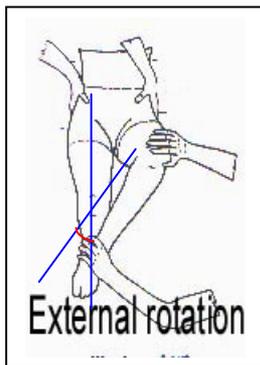
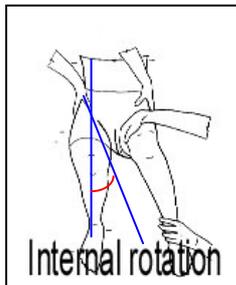
Assessing for abduction and adduction:

- First note the resting position. If the leg rests in line with the pelvis or can be moved into line without the pelvis moving, then it is flexible and you don't need to measure anything.
- If the hip rests in abduction or adduction and it can't be moved to neutral, measure how far the thigh moves from the midline, this will be described as x° of abduction or adduction.



**Spinal Seating Professional Development Project  
Reference Document RD5.2: Seating Reference Guide**

**Internal & External Rotation**



When measuring rotation, it is easiest to measure in sitting. The neutral position is when the thigh and lower leg are in line with the pelvis. If this is the resting position or this can be comfortably achieved, the hip is flexible. If this cannot be achieved, measure the degrees of internal or external rotation can be achieved. The angle is measured between where neutral should be and where the client can reach.



**Influence of the Hamstrings**

The hamstrings are a two joint muscle, crossing both the hip and knee joint, therefore if the hamstrings are shortened or have increased tone they may limit movement at either joint. As the majority of this muscle group originates from the ischial tuberosity and inserts into the tibia, a shortened hamstring will reduce the thigh to knee angle (limitation in extending the knee joint) or pull the pelvis into posterior pelvis tilt (limitation in bending the hip to sit upright).

Most hospital style wheelchair has a configuration composed of a 90-100 degree seat to back angle and footplate mounting that requires the knees to be extended out to a minimum of knee 70 degree flexion. Hamstring shortening has been one of the factors of common compliments: client “sliding down the wheelchair” or foot slipped off rearward and hit the caster.

**Spinal Seating Professional Development Project  
Reference Document RD5.2: Seating Reference Guide**

Hamstring restrictions should be taken into consideration when assessing and recording hip and knee range for seating assessment. Please see below:

*(NB. Assessor should stand beside the client on the side they are assessing.)*



Client should be in supine or side lying with the knee on the side not being assessed, in a flexed position



Locate the ASIS and keep finger on this



Flex knee on side to be assessed and then flex hip until reach 90° OR ASIS moves. If pelvis starts to move you know hamstrings have exceeded maximum stretch.

**RECORD: *TRUNK to THIGH ANGLE***



Gently extend knee until ASIS moves or full extension achieved



**Spinal Seating Professional Development Project  
Reference Document RD5.2: Seating Reference Guide**

Hamstrings are at maximum length just before  
pelvis moves. Record:

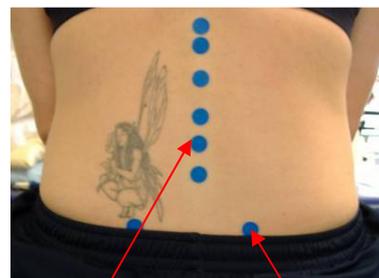
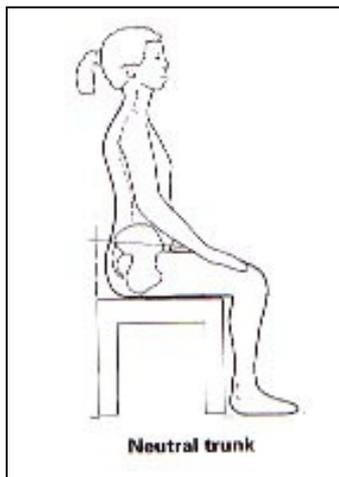
RECORD: ***THIGH to LOWER LEG ANGLE***





## The Spine & Trunk

- o Key bony landmarks
  - o spinous processes
  - o rib cage
  - o sternum
- o Planes of movement
  - o flexion
  - o extension
  - o laterally to the left or right
  - o in a small way combinations of these, thus giving potential for movement in many directions
- o Spine connected to the pelvis and shoulder girdle so what happens at each of these locations effects the spine and vice versa. Therefore, one should take into consideration of the relative pelvis and shoulder positions when assessing the trunk
- o In neutral posture bones are aligned, with curves designed to maximize function
- o (Curves change as grow so children's spines will appear flatter with the curves developing as the child grows and develops)
- o Spine is a common site for surgery so important to have a good history



Spinous  
processes

PSIS



Sternum

Base of  
ribcage

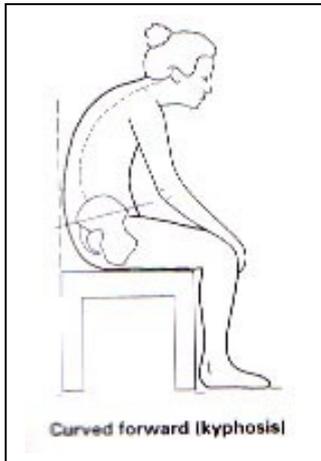


Spinal Seating Professional Development Project Reference Document RD5.2: Seating Reference Guide

Posture of the Spine & Trunk

Neutral spine and trunk posture is shown above, alignment occurs in sagittal plane (anterior/posterior) and frontal plane (lateral). Likewise deviations from the neutral posture occur in these planes.

Kyphosis, Lordosis and Scoliosis



An anterior curve (bent forwards) is described as a **kyphosis**. The kyphosis is further defined by the level at which it occurs eg. a thoracic kyphosis. It is extremely difficult to measure the size of kyphosis so you will often hear people describe it as mild, moderate or severe. Kyphosis is often accompanied with cervical hyperextension.

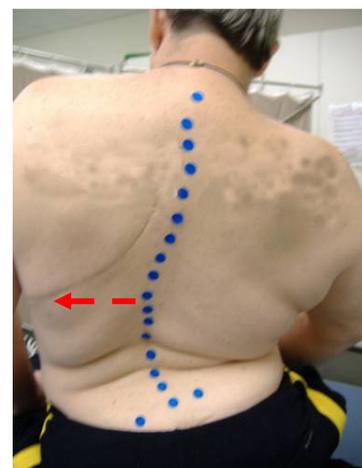


Used with permission from Sunrise Medical

A posterior curve (bent backwards) is described as a **Lordosis**. Lordosis is also described by the level at which it occurs and the severity. It is most commonly seen in people who have low proximal muscle tone; the pelvis rolls forward into anterior tilt and the spine hyperextends to try to achieve stability.



A lateral curvature of the spine is defined as a **scoliosis**. Scoliosis has been described as concave or convex or apex at the left or right. For example in these illustrations, you can see a left scoliosis apex at the lower thoracic spine.



## **Assessing and Recording the Posture of the Spine & Trunk for Wheelchair and Seating Interventions**

To record the posture of the spine and trunk, an easy and reliable method is to take photographs. For a photograph to provide a useful record, however, there are a few steps you should follow:

- Gain informed consent
- Choose a private, warm place to work
- Ask client to remove their shirt – explaining that this is necessary in order for you to accurately assess what is happening at their spine
- Find the spinal processes and inferior borders of the scapulae and mark these –you can use stick on dots or a whiteboard marker which will easily wash off or wipe off with an alcohol wipe
- Find the PSIS and mark these
- Take the photograph – back view
- You may wish to photograph the client in their normal sitting posture and then a corrected posture if this is relevant. You will need to relocate and re-mark the bony prominences when you change the posture
- On some occasions, it may be relevant to take a photograph of a front view. If this is to be done, you would mark the ASIS, the base of the rib cage and the top and bottom of the sternum; you can also mark the shoulders
- If using photographs record relevant information with photograph, including name, date taken and what the photograph is showing

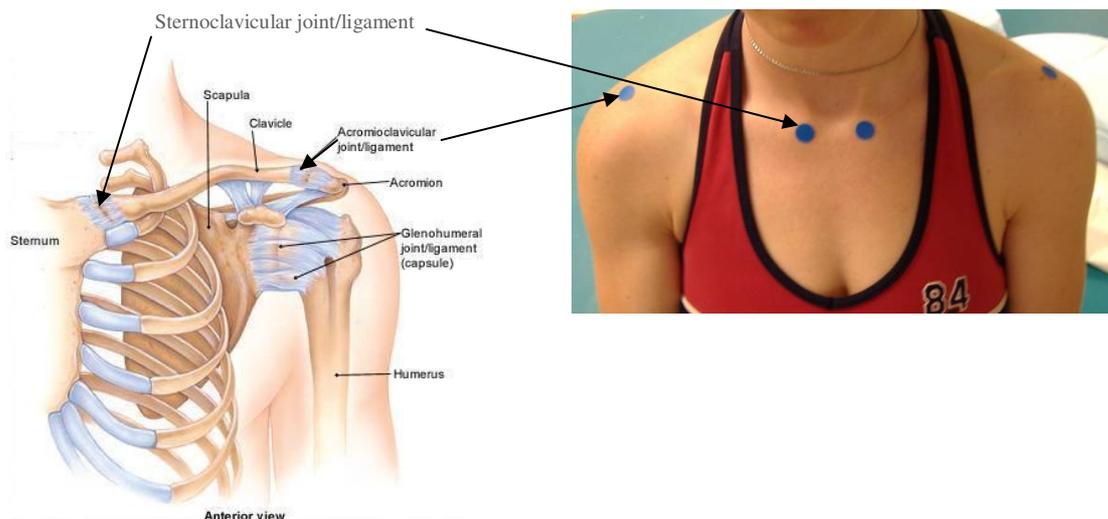
### **Considerations for People with a Spinal Cord Injury**

After a spinal cord injury acute treatment of the spine will either involve surgery or conservative management. Surgical treatment involves fusion of the spine at the level of the injury. The extent of the fusion will depend on the injury. Following spinal fusion a client will have no movement at the level of the fusion. Whether the spine is treated surgically or conservatively there is an increased likelihood of spinal deformity and pain.



## The Shoulder Girdle & Upper limbs

- o Shoulder girdle consists of
  - head of humerus (shoulders)
  - scapulae (shoulder blades)
  - clavicles (collar bones)
- o Shoulder girdle connected to and influenced by
  - Arms
  - Head
  - spine
  - sternum (rib cage)
- o Key bony landmarks of shoulder girdle
  - acromioclavicular joint
  - spine of scapula
  - inferior angle of scapula
  - sternoclavicular joint
- o Upper limb consists of
  - upper arm (humerus)
  - forearm (radius & ulna)
  - wrist (carpal bones)
  - hand (metacarpals & phalanges)
- o Key bony landmarks of arm
  - lateral and medial epicondyles (elbow)





Spinal Seating Professional Development Project Reference Document RD5.2: Seating Reference Guide

**Movements of the Shoulder Girdle**

**Elevation & Depression** – Elevation is the upward movement of the shoulder towards the ear. Depression is the downward movement of the shoulder.



Neutral shoulders



Shoulder elevation

**Protraction & Retraction** – Protraction of the shoulder girdle is where the shoulder girdle is pulled forward (anteriorly). If you observe this movement from the back, the distance between the two scapulae will increase as the shoulders are protracted. Retraction is the opposite movement. During retraction, the distance between the scapulae will decrease as the shoulder girdle is drawn backwards (posteriorly).



Neutral shoulders



Shoulder protraction



Neutral shoulders

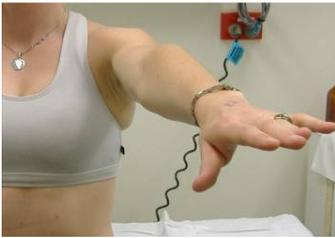


Shoulder retraction



## Movements of the Shoulder Joint

**Flexion & Extension** – These movements occur in the sagittal plane (anterior/posterior). Flexion is the forward (anterior) movement of the arm and extension is the backward (posterior) movement of the arm.



Shoulder flexion

**Abduction & Adduction** – Abduction and adduction occur in the frontal plane (lateral/medial). Abduction is the movement of the arm away from the midline and adduction is the movement towards the midline.



Shoulder abduction



Shoulder neutral



Shoulder  
adduction

**Internal & External Rotation** – This is the rotational movement of the humerus. It is easiest to see this movement with the elbow flexed. Flex the elbow and move your arm towards your body, this is internal rotation. External rotation is the opposite movement.



Shoulder external rotation



Shoulder internal rotation



### Movements of the Elbow & Forearm

**Flexion & Extension** – Movement at the elbow only occurs in the sagittal plane : flexion (bending of the arm) and extension (straightening of the arm).

**Supination & Pronation** – A rotational movement occurs in the forearm, where the radius and ulna rotate around each other. The neutral position is with the elbow extended and the thumb pointed forwards (anteriorly). Rotation of the thumb away from the midline is supination and rotation of the thumb towards the midline is pronation.



Forearm supination



Forearm pronation

### Movements of the Wrist & Hand

**Wrist Flexion & Extension** – In the neutral position the forearm is in a neutral posture and the thumb is aligned with the forearm. Bending of the wrist backwards, away from the midline is extension and bending of the wrist towards the midline is flexion.

**Wrist Radial & Ulna Deviation** – With the forearm pronated, bending of the wrist towards the midline is radial deviation and away from the midline is ulna deviation.

**Finger Flexion & Extension** – Bending of the fingers towards the palm of the hand is flexion and straightening of the fingers is extension.

**Finger Abduction & Adduction** – Movement of the fingers away from the midline of the hand is abduction and movement towards the midline is adduction.

**Thumb Flexion, Extension, Abduction, Adduction & Opposition** – With the forearm supinated and the elbow extended movement of the thumb anteriorly (forward) is flexion and posteriorly (backward) is extension. Movement of the thumb towards the midline of the hand is adduction and away from the midline of the hand is abduction. Opposition uses adduction and flexion and a rotational movement to create a movement whereby the end of the thumb touches each finger.



## Assessing and Recording Shoulder Girdle & Upper Limb Movements for Wheelchair and Seating Interventions

- Record the resting posture both in supine and sitting.
  - ***if not neutral***
- Ask the client if they can move into the neutral posture independently
  - ***if not able***
- Can neutral posture be achieved passively?
  - Support the scapula and ensure it moves with the arm. If the scapula is not moving stop the movement.
  - Record assistance and force required to move the joints into a neutral position. Record fixed postures and the position in which they are fixed.
- ***if fixed deformity***
- Photograph posture with bony landmarks marked – **Optional & only with consent**
- Record the exact ranges of motion if there are restrictions and the client is planning to self-propel a manual wheelchair.

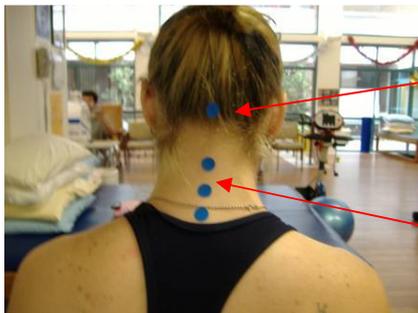
## Considerations for People with a Spinal Cord Injury

- It is not unusual for clients with a spinal cord injury to have pain in the shoulder, forearm or wrist, do not force movement that is causing pain.
- A client with tetraplegia may use a tenodesis grasp to achieve hand function. This grasp depends upon shortening of the long finger flexors (FDP & FDS) and the thumb flexor (FP) and stiffening of the interphalangeal joint of the thumb into extension. If this grasp is used, you should be careful not to passively range the fingers or thumb into positions that are opposite to those described ie. No finger extension when wrist extended.



## The Head & Neck

- o Movement comes from the cervical spine
- o Movement occurs in multiple planes
- o Available range of movement will influence participation in functional tasks
  - o Vision
  - o Hearing
  - o Eating
  - o Breathing
- o Key bony landmarks; spinous processes, occiput



Occiput

Spinous



Neutral head & neck

### Movements of the Head & Neck

Because our head moves through such a range of positions it is not possible to easily measure movement and for seating it is not necessary. What we do need to be able to do is describe positions.

#### **Flexion, Extension & Hyperextension**

When the head is in its neutral posture, this is described as neck extension; further backward movement of the head is neck (cervical) hyperextension. Movement of the head anteriorly – chin toward chest – is flexion.

**Rotation** is the turning of the head to the left or right, described as left or right rotation.

**Lateral flexion** is bending of the head to the side (lateral direction), that is movement of the ear towards the shoulder. It is described as left or right lateral flexion.



**Spinal Seating Professional Development Project  
Reference Document RD5.2: Seating Reference Guide**

**Protraction & retraction** is a sliding movement of the head anteriorly or posteriorly, this is sometimes described as a turkey or emu movement or the anterior position may be described as chin poke. The anterior movement is protraction and the posterior movement retraction.

NB. Combinations of these positions may also be present

**Assessing & Recording Head & Neck Posture For Wheelchair & Seating Intervention**

- Describe resting posture. If the resting posture is not neutral, can the person actively move into a neutral posture?
- If active movement into neutral is not possible, determine if this can be achieved passively and if so, how much force is required. If neutral cannot be achieved, describe the fixed posture.
- If someone's resting posture is neutral, make a note of whether or not they have a full range of active movement, just to ensure you do not reduce their movement and thus function with your seating system.