SITTING POSTURE
FOR WHEELCHAIR PRESCRIPTION

ASSESSMENT OF SITTING POSTURE

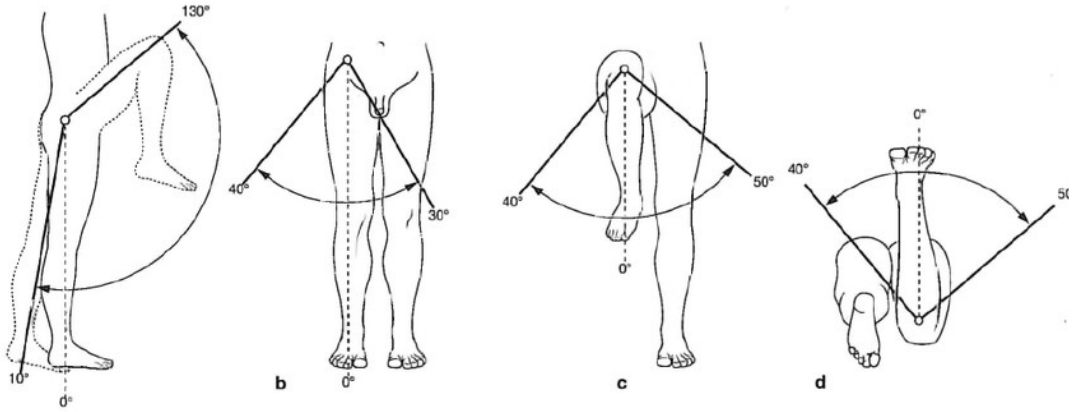
The goal of postural support in sitting is to determine, correct or support postural abnormality.

A physical assessment, often referred to as the Mechanical Assessment Tool (MAT) is commonly used by seating clinicians as part of the seating assessment process. It is a form of biomechanical assessment and physical evaluation.

In most cases the physical assessment will also include a full musculoskeletal examination of the range of motion, joint flexibility, muscle length, and skeletal alignment, with neurological issues such as tone and spasm pattern also noted as they affect posture and muscle length. It also incorporates a postural assessment of the user in their existing wheelchair, in supine, and sitting on a firm surface.

The data should be gathered about the postural alignment at head, shoulder, trunk, pelvis and lower extremities using the visual observation and palpation skills. Assessment of sitting balance is completed to determine any additional postural support devices required through:

- observation of sitting posture without support
- completion of a pelvis and hip posture screen, which will identify how any problems around the pelvis or hips may affect the wheelchair user's sitting posture
- carrying out hand simulation to 'simulate' the support that a wheelchair and additional postural supports may provide the wheelchair user

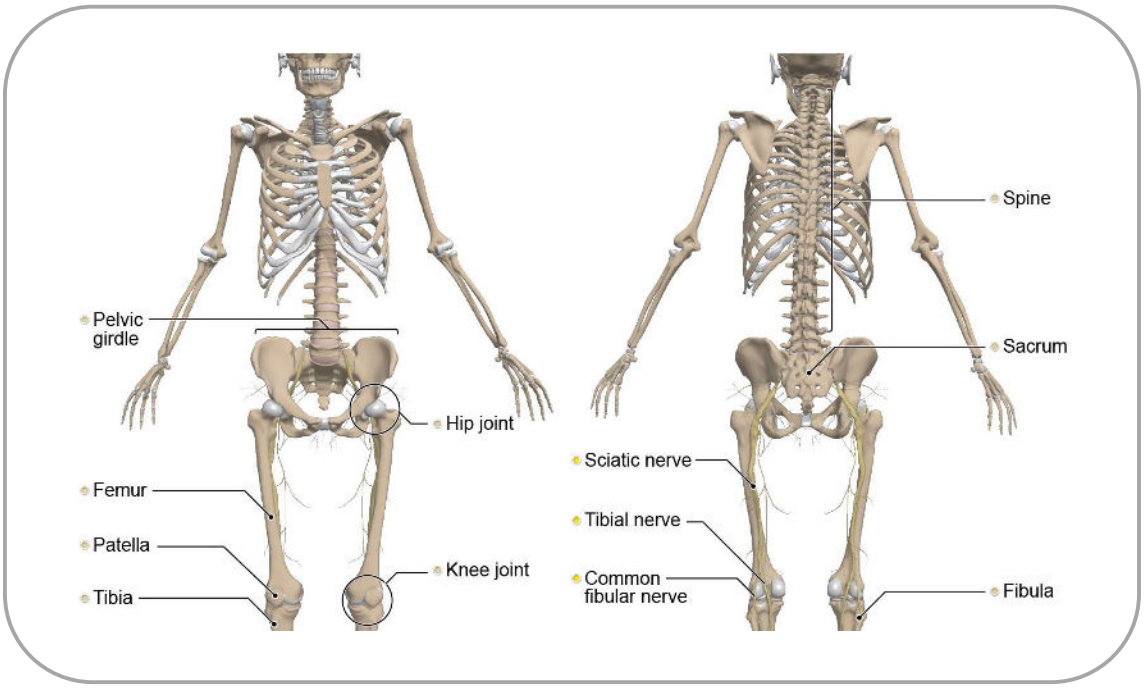


In order to conduct the pelvis and hip posture screen the wheelchair service personnel will need to be able to:

- Locate bony landmarks of the pelvis
- Understand the structure of the skeleton and the influence of the various muscle groups on the articulation of the joints.
- Understand body planes and ranges of movement to identify fixed or flexible abnormalities

HUMAN ANATOMY

Recognising the critical features of the skeletal system ensures that the most informed decisions can be made on how best to correct or support posture. Bony landmarks provide the guidance to current alignment and markers for repositioning and correction.



The Spine

The neck region of the spine is known as the Cervical Spine. This region consists of seven vertebrae, which are abbreviated C1 through C7. These vertebrae protect the brain stem and the spinal cord, support the skull, and allow for a wide range of head movement.

Beneath the last cervical vertebra are the 12 vertebrae of the Thoracic Spine. These are abbreviated T1 through T12. T1 is the smallest and T12 is the largest thoracic vertebra. The thoracic vertebrae are larger than the cervical bones and have longer spinous processes.

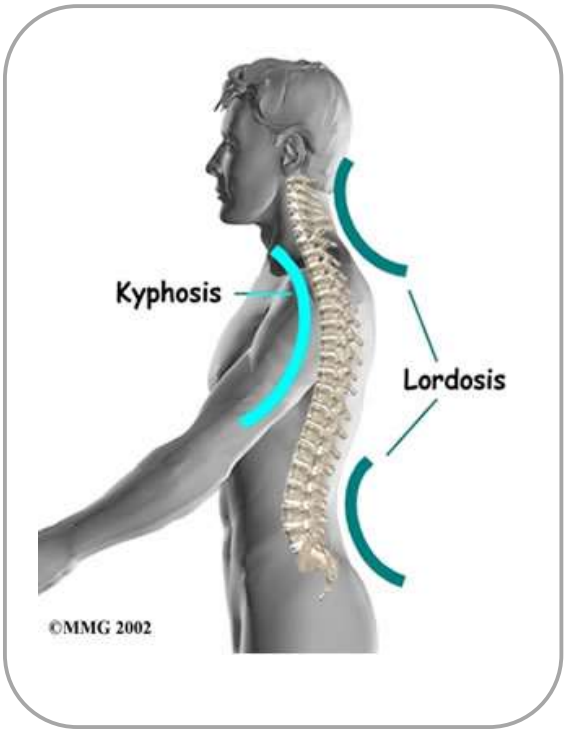
In addition to longer spinous processes, rib attachments add to the thoracic spine's strength. These structures make the thoracic spine more stable than the cervical or lumbar regions. In addition, the rib cage and ligament systems limit the thoracic spine's range of motion and protect many vital organs.

The Lumbar Spine has 5 vertebrae abbreviated L1 through L5. The size and shape of each lumbar vertebra is designed to carry most of the body's weight. Each structural element of a lumbar vertebra is bigger, wider and broader than similar components in the cervical and thoracic regions.

The lumbar spine has more range of motion than the thoracic spine, but less than the cervical spine. The lumbar facet joints allow for significant flexion and extension movement but limit rotation.

The Sacrum is located behind the pelvis. Five bones, S1 through S5, fused into a triangular shape, form the sacrum. The sacrum fits between the two hipbones connecting the spine to the pelvis. The last lumbar vertebra L5 articulates with the sacrum.

Immediately below the sacrum are five additional bones, fused together to form the Coccyx.



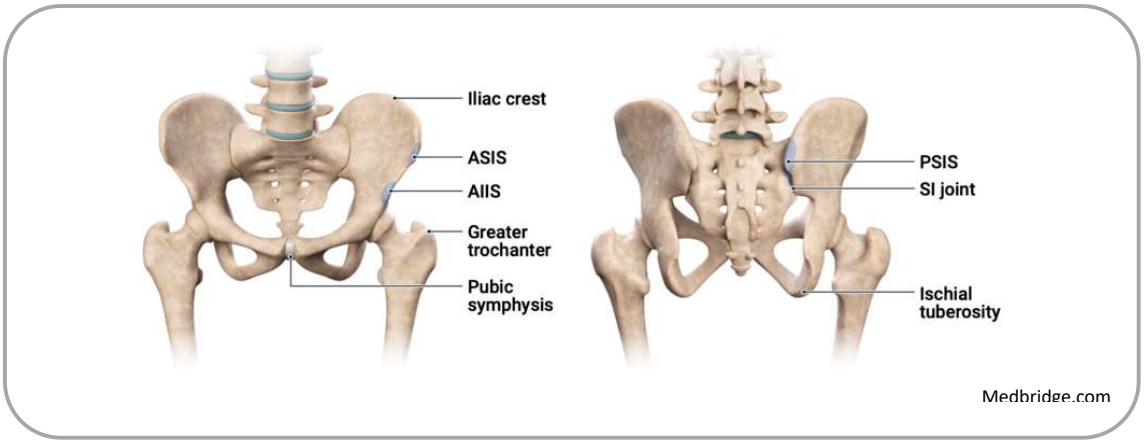
When viewed from the front (coronal plane) the healthy spine is straight. When viewed from the side, sagittal plane, the mature spine has four distinct curves. These curves are described as being either kyphotic or lordotic.

A kyphotic curve is a convex curve in the spine (i.e. convexity towards the back of the spine). The curves in the thoracic and sacral spine are kyphotic.

A lordotic curve is concave (i.e. concavity towards the back of the spine), and is found in the cervical and lumbar levels of the spine

The Pelvis

The bony pelvis is comprised of the sacrum and the two innominate bones (separated into the ilium, pubic bones, and ischium). The anterior superior iliac spine (ASIS), posterior superior iliac spine (PSIS), the iliac crest, pubic symphysis and Ischial Tuberosities (ITs) are important landmarks for locating and assessing pelvic asymmetries.



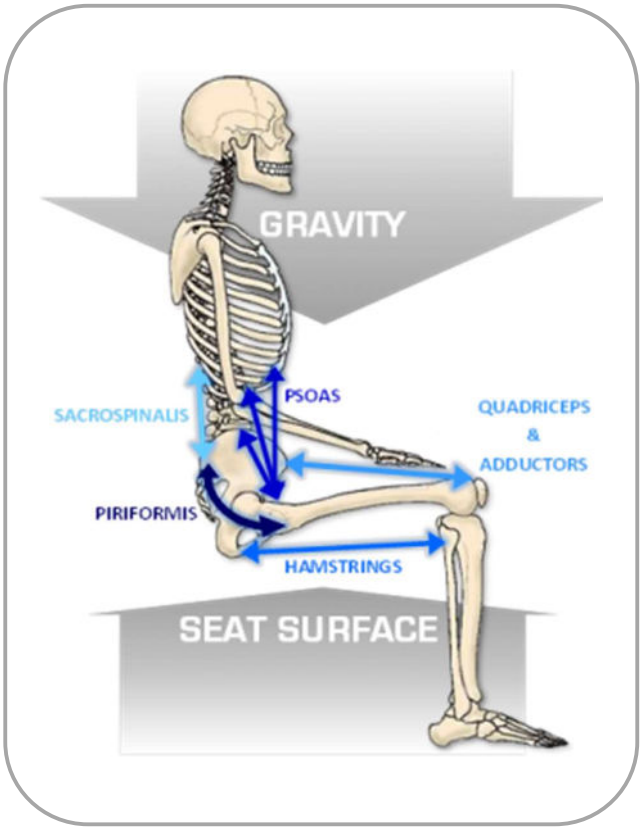
SITTING POSTURE

In sitting, the position where the least intra-discal pressure on the spine, the position least affected by gravity, requires the least effort to maintain & ensures better internal organ function is an upright, straight, symmetrical sitting position. Although the optimum sitting position is determined on an individual basis through the comprehensive seating assessment the principles remain the same.

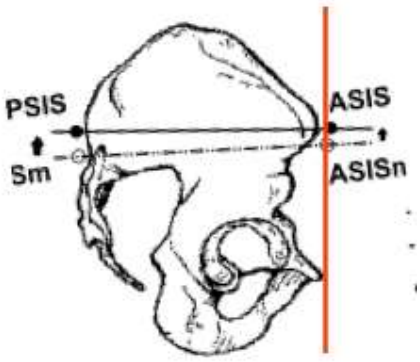
Benefits of neutral sitting posture are multifaceted:

- Systemic health: the internal systems are orientated to function most effectively when in a position of normal posture. Such as digestion and respiration
- Stability: an upright posture is more stable for dynamic balance and function
- Weight distribution: when sitting upright body weight is evenly distributed especially over the ITs. This has benefits for reduction of risk associated with pressure injury.
- Comfort: when body weight is distributed evenly, it is more comfortable
- Preventing consequent problems with posture: sitting neutrally will help to reduce the chance of developing abnormalities of the pelvis and spine
- Self-Esteem and Confidence: sitting upright can help wheelchair users feel better about themselves

The pelvis is the foundation of a seated postural alignment. The aim is to create a neutral alignment of the pelvic musculoskeletal structures then the structures stemming from it.



Pelvic alignment is often quantified using the angle between the horizontal and a line connecting the anterior superior iliac spine (ASIS) and the posterior superior iliac spine (PSIS). This angle is determined by the balance of muscular and ligamentous forces acting between the pelvis and adjacent segments. Bony abnormalities can also alter these measurements away from normal.



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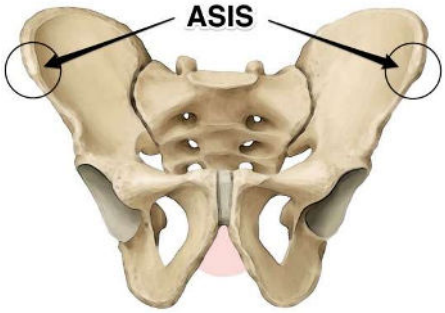
In an ideal situation, the pelvis will sit in midline, the ASIS and PSIS would be level horizontally, with a possible minimal anterior pelvic tilt. The ISIS and pubic symphysis should be in close alignment vertically, with a possible slight forward orientation of the pubic symphysis.



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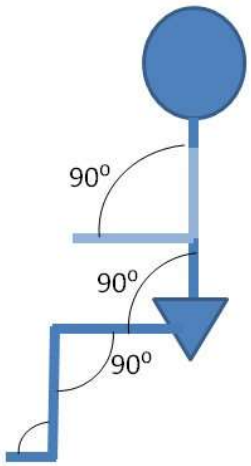
The ASIS and PSIS should be at equal height and depth to one another, with weight evenly balanced over the ITs

The traditional 90-90-90 rule forms a foundation for ideal sitting posture although caution needs to be given to the enforcement of this posture which may not be individualised for longer duration sitting.



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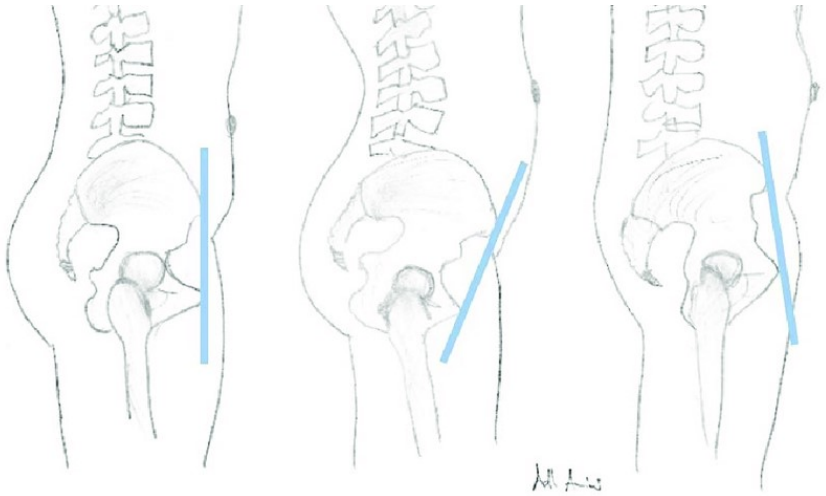
DEVIATED SITTING POSTURES

Sitting postures can be broadly classified into several common alignments. Knowing these postures assists in appropriate correction when supporting the seated posture.

PELVIS



Anterior Pelvic Tilt

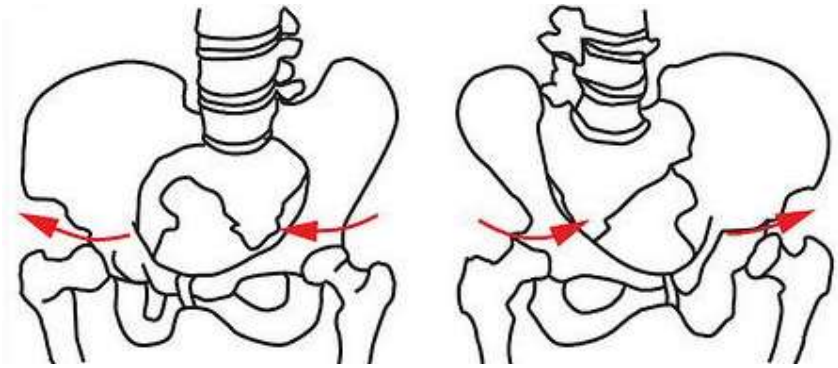
The pelvis is tilted forwards, with the PSIS higher than the ASIS. An exaggerated lumbar lordosis, the face may be orientated upwards due to a compensatory cervical hyperextension.

Posterior Pelvic Tilt

On assessment the PSIS is lower than the ASIS, the pelvis is tilted backwards. Visually the person will be sitting orientated in a C shape sitting on the sacrum caused by excessive thoracic kyphosis. This is known as 'sacral sitting'. A resultant forward neck flexion and possible downward face orientation.

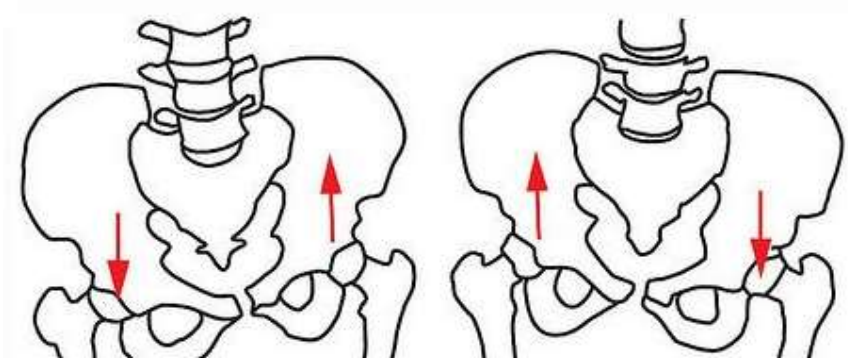
Pelvic Rotation

One ASIS is further forward than the other demonstrating the pelvis is in rotation. The spine will follow this orientation and be rotated left or right along with the pelvis. The head and neck may move into a compensatory lateral flexion.



Pelvic Obliquity

The pelvis is tilted with one ASIS sitting higher than the other, can be known as lateral pelvic tilt. As such the ITs will be positioned one higher than the other. On assessment one hip will be raised. As a consequence, a thoracis scoliosis will occur where the spine curves away from the elevated side and the cervical spine will bring the neck into lateral flexion toward the high hip side



LOWER LIMB

Leg Adduction or Abduction

When sitting, the legs are not in a midline position. This relates to the femoral position at the acetabulum of the pelvis. Abduction is the alignment of the femur away from the midline, an external rotation or lateral position outwards. Adduction is the alignment further towards the midline, an internal rotation or more medial orientation.

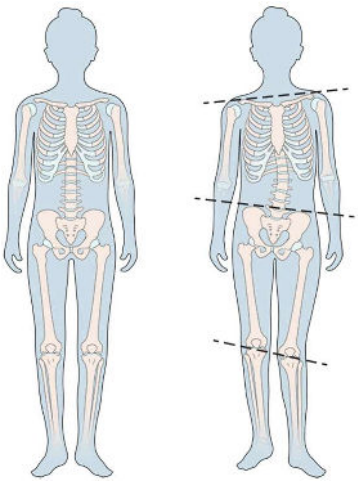
Hip adduction and hip abduction

Windswept Abnormality

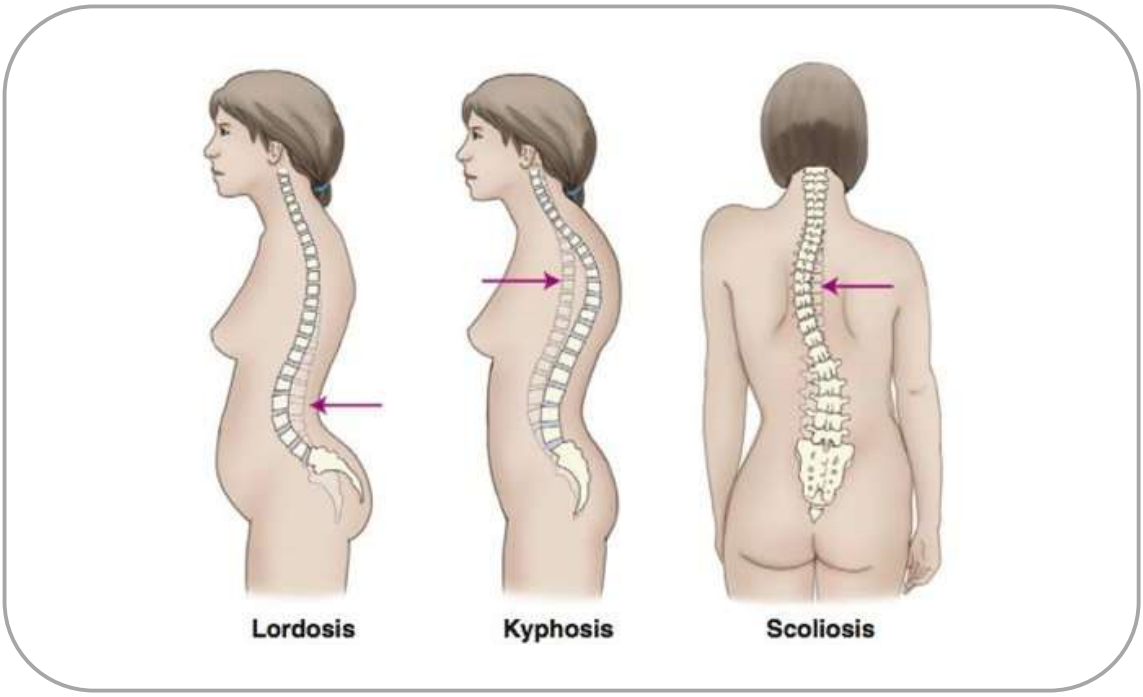
Usually occurs with a pelvic rotation and/or obliquity with potential spinal rotation and scoliosis, creasing a visual representation that the legs have been swept to one side of the chair. It causes each leg to adopt a resultant compensatory position. One leg is adducted and internally rotated, the other abducted and externally rotated.

Leg length discrepancy

One leg longer than the other, can be caused at any or all of the leg bones. Causes resultant dissymmetry in standing which can have consequent affects in posture in sitting.



SPINE



Spinal Lordosis

A change in spinal curvature where the lumber lordosis is accentuated. The kyphotic angles are generally increased in response. This results in a very erect spinal posture and can be associated with an anterior pelvic tilt.

Spinal Kyphosis

A change in spinal curvature where the standard lordosis angles are flattened and the kyphosis is accentuated. This results in a C shaped spine with consequent sacral sitting in a common posterior pelvic tilt.

Spinal Scoliosis

This is a sideways curve or rotation of the spine, moving it away from the normal anatomical alignment.

MUSCULOLIGAMENTOUS

Contractures

Contractures in the muscles, ligaments and soft tissues change the alignment of joints. Reduction in length of these tissues pull bone structures away from normal alignment. These can be caused by postural abnormalities or can be the causation of the misalignment.

ABNORMALITIES

Postural abnormalities can be classified according to their ability to respond to corrective actions.

A Fixed, or non-reducible posture is one that does not deviate from the abnormal posture when corrected. A flexible, or reducible posture responds to correction and can be guided into a normal or nearer normal alignment.

In the case of a flexible abnormality, correction of the posture to as close to physiologically normal is essential in minimising risk of further abnormality and supporting the best possible alignment to minimise adverse effects of poor positioning and maximise function. The aim here is postural correction.

For those with a fixed abnormality, providing individualised support in maintaining posture is critical to preventing further accentuation of the posture, minimising fatigue, alleviating pain and reducing the adverse effects of the alignment changes. The aim here is postural accommodation.

SEATING PERSCRIPTION

By analysing the static and dynamic positioning of the body in sitting an objective assessment of the seating requirements can be made.

Consideration to the chair type, chair dimensions, seat cushion, backrest, headrest and postural supports need to be made.

An individualised seating system is then able to be trialled, aimed at supporting the body against gravity, minimising adverse effects of sitting, facilitating maximum function and improving quality of life.