# **Spino-pelvic angulation**

Spino-pelvic angulation refers to the relationship between the spine and pelvis, which plays a crucial role in maintaining posture, balance, and load distribution across the spine. It is particularly important in spinal surgery, especially for conditions such as spinal deformity, degenerative disc disease, and spinal fusion planning.

Spine biomechanics, particularly sagittal balance and spino-pelvic angulation are determinant factors in the understanding of lumbar degenerative disease. These concepts translated into objective measurements are progressively being integrated into clinical practice.

## **Key Spino-Pelvic Parameters**

Several radiographic angles and measurements describe the spino-pelvic alignment:

#### Pelvic Incidence (PI)

The most fundamental parameter, as it remains constant for an individual.

A higher PI is associated with a more lordotic lumbar spine, while a lower PI correlates with a flatter lumbar curvature.

#### Pelvic Tilt (PT)

Measures the rotation of the pelvis in relation to the femur.

Defined as the angle between the vertical axis and a line connecting the center of the femoral head to the midpoint of the sacral endplate.

Increased PT (>20°) is often seen in compensatory mechanisms for sagittal imbalance.

#### Sacral Slope (SS)

The angle between the sacral endplate and a horizontal line.

Directly related to PI, as PI = PT + SS.

A high sacral slope suggests a lordotic lumbar spine, whereas a low sacral slope is associated with a kyphotic or hypolordotic lumbar alignment.

### Lumbar Lordosis (LL)

The curvature of the lumbar spine, measured as the Cobb angle from L1 to S1. There is an ideal relationship between PI and LL:  $LL \approx PI \pm 9^{\circ}$ . A mismatch (PI-LL mismatch) can contribute to spinal malalignment and pain.

### Sagittal Vertical Axis (SVA)

Measures the global sagittal balance by assessing the horizontal distance between the C7 plumb line and the posterior superior corner of S1. An SVA >5 cm is considered indicative of sagittal imbalance, often requiring surgical correction.

# **Clinical Implications**

Low Back Pain & Degeneration: Poor spino-pelvic alignment contributes to chronic mechanical back pain and degenerative changes.

Spinal Fusion Planning: Understanding spino-pelvic parameters helps in determining the optimal alignment to reduce adjacent segment disease post-fusion.

Sagittal Imbalance: Severe cases of mismatch (e.g., high PI-LL mismatch) lead to compensatory mechanisms such as pelvic retroversion, knee flexion, and increased thoracic kyphosis, which can cause disability.

Surgical Correction Strategies: Osteotomies (e.g., Smith-Petersen, pedicle subtraction) may be required to restore sagittal alignment in severe deformities.

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