# The Sacrum, The Pelvis and Obliquity

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**Summary**
How the sacrum influences the pelvis and spine and the seven patterns of pelvic obliquity identified by Juhl and Dulhunty. Considering the significance of sacral movements in sitting.

**Aims and objectives**
To understand the important yet nuanced effect of the sacrum on seated posture and particularly obliquity.

**Background**
Pelvic assessments are a key part of successful seating, and pelvic orientation is associated with kyphosis, lumbar hyperlordosis and scoliosis. The pelvis itself is made up of six inomminate bones, five fused vertebrae (in adults) forming the sacrum and similarly so the coccyx.

The sacrum itself articulates passively with the inomminate bones of the pelvis at the sacroiliac joint (SIJ), the lumbar spine at the S1 sacrolumbar joint, and the femurs at the acetabulae. The sacrum moves in nutation and counter-nutation; though only small, this is an important action for sitting erect, standing and walking [Vleeming et al (2012)]

Upper-body weight is distributed to the legs or ischial tuberosities (IT) through the SIJ. In normal bone development, the SIJs and the sacral plateau of the S1 joint are aligned to gravity and parallel to the hip joints and ITs. However, abnormal bone development and injury and degeneration may result in a sacral plateau that is misaligned with the innominate bones, and may be observed in those with: spina bifida, cerebral palsy, leg length discrepancy (anisomelia), and injuries to the SIJ resulting in issues such as upslip (the upward translation of one innominate bone). In such instances, the sacral angle and the angle across Its/hips/iliac crests may not be parallel to each other nor to a horizontal seating surface. [Dulhunty (2015), Juhl et al(2004), Hasler et al (2020), Jae et al (2017)]

Sacral obliquity can be regarded as being absolute or relative. Absolute sacral obliquity is the angle at the sacral plateau to gravity at any adopted posture, and can change between sitting and standing. Relative sacral obliquity is the angle of the sacrum relative to associated structures such as line across femoral heads, ITs or Iliac crests and is fixed [(Dulhunty 2015)]

Juhl et al (2004), and further refined by Dulhunty (2015), identified seven different patterns of obliquity; six to the left and six to the right plus an orthogonal or “normal” position and suggests how these could be remedied in seating. Of these seven patterns, Pattern 4 (Dulhunty) could be regarded as the classical representation of pelvic obliquity, with the sacral plateau parallel to the ITs. In Dulhunty's proposed corrections, a build-up under one IT would not be successful. Furthermore, Pattern 7 would require additional raising to the side of the pelvis that would be palpating as being raised already.

Dulhunty also evidenced that palpating the pelvic landmarks of ASIS and PSIS was an unreliable tool to determine the sacral base angle. He also notes that there is little evidence to validate the assumptions that palpation and other physical assessments make in assessing and determining the pathomechanics of the lumbopelvic spine.

**Discussion**

The pelvis is not one but two articulating structures; the innominate bones and the sacrum. It could be considered that the boundary of the upper body and lower limbs is not at the hips, nor at the S1 joint but rather at the SIJs; the innominate bones being concerned with hips and legs and the sacrum with the spine. They are joined with an articulation at the SIJs but are not necessarily parallel to each other nor to gravity; particularly in the presence of scoliosis and/or iliac obliquity. There is a complex interplay of movements between the innominate bones, the sacrum and the lumbar spine when sitting or standing.

In practice, this indicates that we must be careful of the assumptions that we make about the status of the pelvis in obliquity, and that palpating iliac crests to determine an angle can only give us a partial picture of what is happening at the sacrum at best. Without x-rays we may need to apply a more deductive approach.

It is worth noting that of the six patterns of obliquity deformity, three also involve an inclination of the sacral base (absolute and relative) in the same direction. Certain physical assessments may indicate issues at one or both SIJs such as ligament laxity, but will not reveal angular deviation at the sacral plateau.

**References**

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