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Posture is a composite of all joint positions of the body at any given time. Dynamic postural alignment is best described in terms of various joint positions in relation to the movement of body segments. Joint motion in turn occurs through the different axes and body planes which are at right angles to each other. In-toeing gait (also termed hen toed or pigeon toed)

is a transverse plane deformity, more specifically the caudal (lower) portion. The transverse plane is horizontal and divides the body into the cranial (upper) and caudal (lower) portions. In-toeing is attributed to the transverse plane development of the lower limb. Three areas may be the cause of the in-toed gait: the hip joint, tibia and foot.

The hip joint is the articulation of the acetabulum of the pelvis and the head of the femur. These two segments form a ball and socket joint with three degrees of freedom: flexion/extension, abduction/adduction and medial/lateral rotation in the transverse plane. There are two angulations made by the head and neck of the femur in relation to the shaft, the angle of inclination and the angle of torsion.

The angle of inclination occurs between an axis through the femoral head & neck and the longitudinal axis of the femoral shaft. There are variations among individuals in the angle of inclination of the femur. The angle of inclination is approximately 125° with respect to the femoral shaft. A pathological increase in the angle of inclination is called coxa valga.

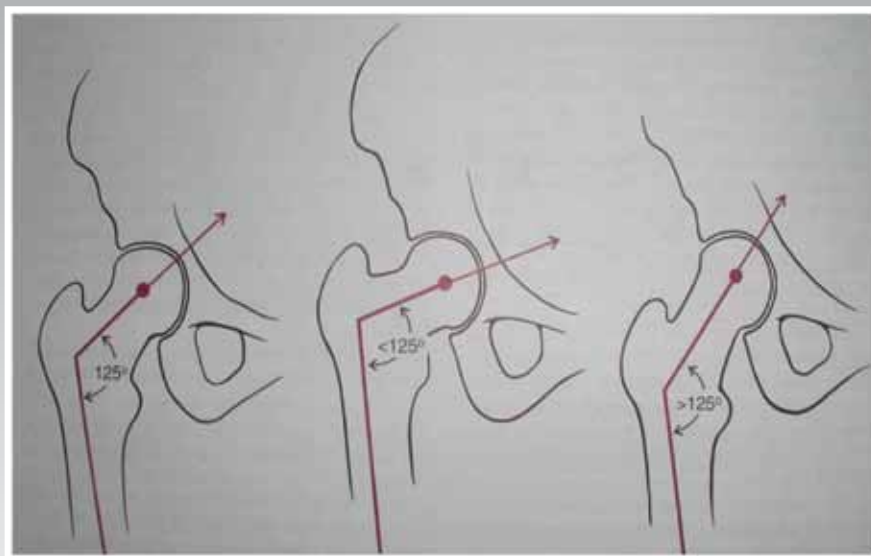


Fig 1: Angle of Inclination in the neck of the femur - (Hamill, 1995 p208)

In-Toeing Gait

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Coxa valga causes the distal end of the femur to be directed away from the midline such that the knees are further apart. (Spencer, 1978 p21). Although coxa valga is not directly related to in-toed gait, it is associated with genu varum which is a deformity of the knee or tibia in which the distal end of the tibia is directed toward the midline (hen toed or pigeon toed).

The angle of torsion can be best viewed by looking down the length of the femur from top to bottom. An axis through the femoral head and neck will lie at an angle to an axis through the femoral condyles with the head and neck twisted forward with regard to an angle through the femoral condyles. Normally the femoral neck is rotated anteriorly (forward) by 12 to 14 degrees with respect to the femur. If this angle increases, a toe-in position is created in the extremity. A pathologic increase in the angle of torsion is called anteversion and a pathologic decrease or reversal of torsion is known as retroversion.

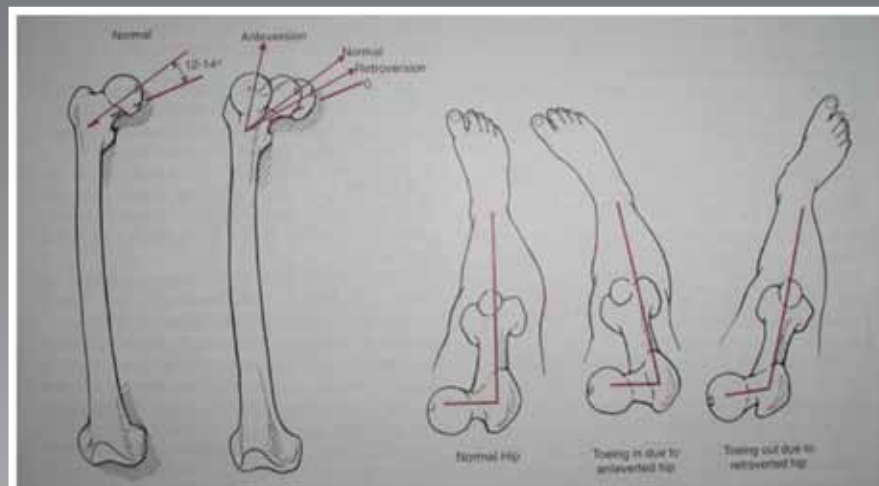


Fig 2: Angle of Anteversion Hamill, 1995 p209



The origin and variability of these angulations are related to the embryonic development of the lower limb. In the early stages of fetal development, the upper and lower extremity limb buds project laterally (side) from the body as if in full abduction (away from the midline). At the end of the eighth week, the "fetal position" has been achieved and the lower limb buds have undergone torsion medially. Although the head and neck of the femur retain the original position of the limb bud, the femoral shaft moves medially and undergoes medial torsion in relation to the head and neck. This is the normal evolutionary process of growth, the development of the angulations of the femur appear to continue after birth and through the early years of development. In-toed gait occurs where normal muscle function is not present to affect the evolutionary corrective process.

In the next article, the focus will be on the knee and foot and how they relate to In-toed Gait 🌈

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