



# POSNA

## The Core Curriculum

### Torsional problems in children

#### Objectives

1. Describe the normal development of the upper and lower limbs in utero in regard to rotational changes from the limb bud
2. Describe the normal range of hip rotation, and thigh foot angle for the newborn, the toddler, the 6 year old, and the adult; foot progression angle for all ages except the newborn
3. Describe the physical findings associated with tibial torsion and femoral anteversion
4. Describe the natural history of tibial torsion and femoral anteversion
5. Describe indications for treatment of tibial torsion and femoral anteversion

#### Discussion

Torsional problems, real or perceived, are probably the most frequent reason for pediatric orthopaedic consultation. A firm knowledge of normal development of torsional relationships is essential for anyone treating musculoskeletal problems in children. After formation of the limb buds in the 5th week, the upper limb rotates externally so the thumb, originally on the cephalic side of the bud, is lateral in the anatomic position. The lower limb rotates internally, so the great toe, originally on the cephalic side of the limb bud, is medial in the anatomic position.

Staheli has provided a great deal of information about the normal range of lower limb rotation in children. At birth, there is increased external rotation of the hips, averaging about 70 degrees. This slowly subsides during childhood to about 40 degrees, then slowly increases again in adult life. Internal hip rotation is about 40 degrees at birth, rising in early childhood (more in girls) to 45-50 degrees, then decreases from about age 7 throughout the rest of the lifespan. The thigh foot angle, and transmalleolar axis, both assessing tibial torsion are about 0 degrees at birth, and increase throughout childhood to about 15 degrees of external torsion, with a range of about 15-20 degrees of normal either side of the average measurement. The foot progression angle is initially about 10 degrees externally rotated when walking commences, slowly decreases to about 5 degrees at the end of growth, and slowly increases throughout adult life. From about age 7, the natural history for the rest of the lifespan is a slow increase of both femoral and tibial external version. (Version is the anatomic corollary of torsion, referring to the difference in inclination of the femoral neck to the femoral condyles, and the knee axis and transmalleolar axis.

Torsion is assessed clinically by Staheli's "torsional profile", performed by having the child in the prone position with the hips extended and the knees flexed 90 degrees. With the knees flexed, the hips are rotated internally and externally; the tibia forms an angle with the tabletop indicating the degree of rotation. The relationship of the foot to the thigh, judged from above, is the thigh foot angle, and the difference between a line through the malleoli and the knee axis is the transmalleolar

axis. The foot progression angle is assessed by observing the child's gait, and is the angle between the long axis of the foot and the line of progression of gait. This assessment is rapid, simple, and informative.

Femoral anteversion is usually most problematic between ages 3 and 6, when it is physiologically greatest, slightly more in girls. Resolution by age 8 can be expected in the great majority of cases. Severe torsion of more than 90 degrees of internal rotation and less than 10 degrees of external rotation in a child over age 8 may warrant corrective femoral osteotomy, if the child continues to trip during walking or running. There is no effective nonoperative treatment for femoral anteversion. There is no evidence that increased femoral torsion contributes to the development of hip osteoarthritis in adults. Sprinters have slightly more internal rotation during gait than controls.

Medial tibial torsion is most common in toddlers. The natural history is very favorable, and no treatment is necessary. If the family is unable to tolerate the natural progression of spontaneous correction, a night Dennis Browne bar can be used. Osteotomy for correction of medial tibial torsion in an otherwise normal child is basically never necessary.

## References

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