CHILDREN’S ORTHOPAEDICS: THE COMMON NORMAL VARIANTS

P Marshall, Consultant Orthopaedic Surgeon
Royal Lancaster Infirmary

ORTHOPAEDIA: Or, The Art Of Correcting And Preventing Deformities In Children: by such means as may easily be put in practice by parents themselves, and all such as are employed in educating children

Nicholas Andry, Professor of Medicine in the Royal College, and Senior of the Faculty of Physic at Paris

In 1741, at the age of 83 years, Nicholas Andry, a Parisian paediatrician who hated surgeons, wrote the book that founded orthopaedics – Orthopaedia. Andry derived it from two Greek words – orthos meaning straight and paedis meaning child, hence straight child.

In days when diseases such as rickets, polio and tuberculosis were widespread, much of an orthopaedic surgeon’s time was spent in helping children with deformities of their legs to ‘grow straight’. Historically, this often used to involve the use of external devices applied to the body, such as braces, callipers and casts. This is reflected in the symbol of the British Orthopaedic Association which is a bent sapling tree being encouraged to grow straight by being strapped to a stake.

Approximately half of my paediatric orthopaedic referrals relate to normal variants. Mindful of our current efficiency drive in the management of musculoskeletal referrals across the bay, I thought it might be helpful to offer a few guidelines, though please don’t ask me to produce an algorithm!

OUT-TOEING

Children toe out when they start to stand. Standing with the legs externally rotated provides a wider base of support and thus greater stability. Babies and infants tend to have a mild external rotation contracture of their hips secondary to capsular and soft-tissue tightness. It is possible that lying in the prone ‘frog’ position with the lower limbs twisted outwards may be the underlying cause. The problem improves when children walk more and sleep less. By the age of two years most have resolved.

INTOEING

This is the most common paediatric orthopaedic referral. In the newborn, intoeing is usually due to metatarsus adductus; in the toddler, it is usually due to internal fibial torsion; and in the school-age child, it is usually due to internal femoral torsion.

METATARSUS ADDUCTUS

This benign, largely self-resolving condition should be differentiated from congenital talipes equinovarus (club foot). In club foot both the hindfoot and the forefoot are in equinus and varus whereas in metatarsus varus the forefoot is in varus but the hindfoot is in neutral or valgus with normal posterior skin creases (Figure 1).

Figure 1 Clinical photograph showing anterior view of the feet in a patient aged 18 months with metatarsus adductus.

The deformity is often best seen from the sole of the foot and in mild and moderate cases is easily correctable by simple finger pressure on the first metatarsal. The condition may be associated with persistent sleeping in the prone position, in which the forefeet are adducted. X-rays are not usually indicated, but will demonstrate spontaneous improvement of the condition (Figure 2).

At least 80% of feet will correct spontaneously without any treatment. In general, any patient in whom the foot corrects to neutral or beyond will probably correct spontaneously. The child with a very rigid deformity and a deep medial skin crease should be treated, probably initially.
INTERNAL FEMORAL TORSION

There may be as much as 60° of antversion of the femoral neck during foetal development. At birth the femoral neck antversion measures around 40° and this gradually declines to reach an adult value of around 10°. The more the femoral neck is antverted (twisted anteriorly), the more internally rotated is the lower limb when the femoral head rests in the position between maximum internal and external rotation. Thus persistent femoral antversion equates with persistent femoral intorsion.

Between the ages of three and twelve femoral intorsion is the most common cause of in-toeing. It is usually bilateral and symmetrical and affects twice as many females as males. On looking at the legs, it will be obvious that, when the child stands with the feet together, the patellae will point inwards – so called ‘squinting patellae’ (Figure 3).

The condition is diagnosed by the greater range of hip internal rotation than external rotation when the joints are assessed in both flexion and extension.

Although femoral neck antversion is at its maximum at birth, the in-toeing associated with this condition is not usually seen until the age of three years. This is because intorsion of the femur is masked by the fixed external rotation normally found in infants, which is a consequence of capsular and soft-tissue contractures. Standing provides the stimulus to internally rotate the hips.

INTERNAL TIBIAL TORSION

Internal tibial torsion is due to intrauterine position. In the later weeks of pregnancy the feet are in plantar flexion and internally rotated, such that there is medial torsion on the tibia. Prior to this time, the ankles are dorsiflexed and everted. At birth the medial malleolus is usually found to be behind the lateral malleolus. On starting to walk the malleoli are level and later, when walking is fully established, the medial is in front of the lateral.

In the vast majority of children internal tibial torsion will resolve spontaneously. Such children have long been treated unnecessarily with various devices, but there is no evidence that night splintage, shoe modification or the use of insoles alter the outcome.

There seems to be little spontaneous correction beyond the age of eight and after this time surgery in the form of a derotational osteotomy of the tibia is very occasionally undertaken.

---

Figures 2 and 3 reprinted from *Children’s Orthopaedics & Fractures*, Benson MKD, Fissen JA, Macnicol MF (eds), pages 515 and 30, 1994, by permission of the publisher Churchill Livingstone.
The only treatment usually required is observation and reassurance. In the vast majority of cases the deformity corrects by the age of seven or eight years. Beyond this age intoeing can continue to improve, probably due to the development of compensatory tibial extension. Non-operative methods of treatment are not effective in altering the natural history of this condition. Surgery in the form of a derotational osteotomy of the femur is very rarely undertaken. If there is compensatory tibial extension then bilateral femoral and tibial osteotomies may be required if the aim is to have both patellae and feet facing forwards – clearly the risks of such intervention are considerable and are very rarely justified.

**FLAT FEET**

Flat feet are normal in infants, common in children, and within the normal range in adults. Flexible flat foot may be associated with a degree of ligamentous laxity, which may be familial. Clinically, it is important to establish that the flat foot is flexible – this can easily be shown by passive dorsiflexion of the great toe, which will demonstrate normal restoration of the longitudinal arch in flexible flat feet. Alternatively, the child can be asked to stand on his or her toes, which again causes accentuation of the normal arches as the heel moves from slight valgus to slight varus.

The pain-free flexible flat foot does not require treatment. Studies have shown that there is a natural tendency for the longitudinal arch to improve with time and the use of special shoes or insoles does not result in greater improvement than in controls.

Some flexible flat feet may be associated with symptoms of arch discomfort due to mechanical strain. In such cases I would normally suggest to the parents that a trial of simple in-shoe arch supports may be worthwhile, emphasising that the support does not influence the natural history of the condition, which is for spontaneous improvement to occur with time anyway. Occasionally, I will also suggest a trial of arch supports if there are problems of excessive wear on the medial aspect of the sole of the shoes.

A non-flexible and often painful flat foot may be due to a number of conditions: tarsal coalition (an abnormal connection between tarsal bones, such as between the calcaneum and the navicular or between the calcaneum and the talus), congenital vertical talus, juvenile arthritis affecting the subtalar joint, osteomyelitis of the calcaneum or talus, or traumatic avulsion of the tibia's posterior talus. In such cases I would normally investigate first with plain X-rays, proceeding to other imaging studies as appropriate.

Some neuromuscular conditions can be associated with flat feet, particularly cerebral palsy, Duchenne muscular dystrophy, and polio. In most neuromuscular cases there is a tight tendo Achilles with secondary heel valgus.

**FINAL THOUGHTS**

I don't mind seeing children with these 'complaints', checking that there is no serious underlying problem and offering reassurance when appropriate. Such consultations frequently reinforce the reassurance that parents have already received from their family doctor. I always offer to review the child in the future if parents remain concerned, and quite a few do take me up on this.

Why do parents want to be reassured that their children are normal?

'Everyone wants perfect children. Even people with perfect children want them checked - much like taking a car in for a service.'

Mercer Rang, Paediatric Orthopaedic Surgeon