

# Paediatric Gait & Foot Development

## Normal Developmental Milestones, Variants, and Clinical Decision Making

Paediatric foot and gait assessment requires an understanding of normal developmental trajectories before pathology can be identified. Most common presentations in childhood (flat feet, in-toeing, toe walking) are physiological variants that self-resolve. The clinical challenge is distinguishing those that warrant monitoring from those requiring intervention.

### 1 Normal Developmental Milestones

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| Age         | Foot Development                                                                         | Gait Development                                                                          | Clinical Notes                                                                                            |
|-------------|------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|
| Birth–12 mo | Feet flat; fat pad fills arch space; navicular not yet ossified                          | Pre-walking: cruising, crawling. First steps with wide base, high guard arm position      | Arch appearance is normal finding. No clinical concern unless rigid.                                      |
| 1–2 years   | Fat pad still prominent; arch begins to form. Feet often externally rotated              | Wide base of gait; short step length; lack of heel strike; minimal arm swing              | Expect flat-footed appearance. External foot progression normal. Falls are expected.                      |
| 2–3 years   | Arch becomes more visible in non-weight bearing. Metatarsus adductus may persist         | Heel strike emerges. Base of gait narrows. Cadence high (140–180 steps/min)               | Persistent metatarsus adductus: refer if not passively correctable by age 18 months.                      |
| 3–4 years   | Arch evident in most children. Physiological flat foot still common and normal           | Reciprocal arm swing established. Trunk rotation improving. Step length increases         | Tibial torsion and femoral anteversion still prominent — reassess at 6–7 years.                           |
| 4–6 years   | Arch development largely complete. Some children remain physiologically flat-footed      | Adult gait pattern mostly established. In-toeing reduces as femoral anteversion decreases | Age-appropriate intervention: orthoses if symptomatic or functional. Not for cosmesis.                    |
| 7–12 years  | Near-adult foot anatomy. Accessory navicular may become symptomatic during growth spurts | Adult mechanics. Sever's disease risk peak 8–12 years                                     | Growth-related heel pain: exclude Sever's. Assess calcaneal apophysitis clinically.                       |
| Adolescence | Adult structure. Hallux valgus risk increases, especially girls. Flat foot may persist   | Osgood-Schlatter and patellofemoral pain risk elevated                                    | Sesamoiditis and stress fractures emerging in active adolescents — screen for relative energy deficiency. |

## 2 Common Paediatric Variants: Observe or Intervene?

| Presentation                                                         | Typical Course                                                                         | Intervene if...                                                                                                                                         | Intervention Options                                                                                                                                           |
|----------------------------------------------------------------------|----------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Physiological flat foot (flexible)                                   | Self-resolves in most children by age 6–8. Arch forms progressively                    | Symptomatic (pain, fatigue, avoidance of activity); family Hx of adult flat foot with symptoms; excessive subtalar pronation with downstream effects    | Activity modification; footwear advice; prefabricated or bespoke orthoses if symptomatic. Avoid over-prescribing asymptomatic flat foot.                       |
| In-toeing (metatarsus adductus, tibial torsion, femoral anteversion) | The vast majority self-resolve by age 7–8 as femoral anteversion decreases with growth | Persistent, severe, and functionally limiting beyond age 9; associated tripping; unilateral presentation (asymmetry warrants investigation)             | Parental reassurance and observation for most. Gait orthoses rarely indicated. Referral for paediatric orthopaedic opinion if unilateral or severe past age 9. |
| Idiopathic toe walking                                               | Resolves in most children by age 3–4. Idiopathic — no neurological cause               | Persisting beyond age 3; tight Achilles on assessment; family does not respond to observation; concern re neurological cause (cerebral palsy screening) | Passive stretching programme; serial casting in some cases; AFO if equinus fixed. Rule out neurological cause before labelling idiopathic.                     |
| Genu valgum (knock knees)                                            | Physiological peak at age 3–4. Typically resolves by age 6–7                           | Persisting past age 8; progressive; asymmetric; associated pain or difficulty walking                                                                   | Observation and reassurance for physiological. Orthotic management for subtalar component if flat foot driving valgus position. Referral if structural.        |

## 3

## Paediatric Clinical Assessment Framework

| Assessment Domain            | What to Assess and Document                                                                                                                                                                                                                                        |
|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| History                      | Age of onset; pain vs. cosmetic concern vs. parental worry; functional impact (activity avoidance, fatigue, keeping up with peers); previous treatment; family history of foot problems; birth/developmental history for neurological red flags.                   |
| Footwear assessment          | Current footwear: heel counter rigidity, width, fit. Age-appropriate footwear guidance: flexible sole in toddlers; stable heel counter and longitudinal support by school age. Frequent replacement essential — children's feet grow rapidly.                      |
| Static lower limb assessment | Femoral version (Craig's test or clinical estimate); tibial torsion (thigh-foot angle, normal +10 to +20 degrees); knee alignment (valgus/varus); subtalar position (RCSP); arch index (Chippaux-Smirak or visual); ankle dorsiflexion (knee extended and flexed). |
| Dynamic assessment / gait    | Foot progression angle (normal 0–15 degrees external rotation); base of gait; heel strike presence; midstance pronation; toe-off; arm swing symmetry; observe barefoot and in footwear. Consider video gait analysis for paediatric review.                        |
| Neurological screening       | Reflexes (patellar, Achilles); muscle tone; coordination; developmental milestones met. Any neurological concern: refer to paediatrics before proceeding with orthotic management.                                                                                 |
| Pain assessment              | Use Wong-Baker FACES scale or NRS adapted for age. Document location precisely: arch, heel, forefoot, ankle. Night pain, pain at rest, and progressive pain are red flags requiring further investigation.                                                         |

## 4

## Orthotic Prescribing in Children

| Principle                                  | Guidance                                                                                                                                                                                                                                                                   |
|--------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Prescribe for symptoms, not appearance     | There is insufficient evidence to support prescribing orthotics for asymptomatic paediatric flat foot on the basis of cosmesis or parental concern alone. Intervene when there is pain, functional limitation, or a clear biomechanical driver for a downstream condition. |
| Prefabricated first for flexible flat foot | Prefabricated orthotics are appropriate first-line intervention for symptomatic flexible flat foot. Bespoke devices are indicated when prefabricated options fail, when the foot is semi-rigid, or when there is a complex biomechanical presentation.                     |
| Review frequency                           | Children grow rapidly — orthotic review every 6–12 months minimum. Document shoe size at every appointment; replace devices when foot has grown by 1 full size or device shows compression/wear.                                                                           |
| Casting and fitting considerations         | Neutral suspension casting is appropriate where achievable. For young children, semi-weight-bearing foam impression or 3D scan may be more practical. Heel cup depth must accommodate growing heel pad.                                                                    |
| Parental communication                     | Explain the expected trajectory: most variants are self-limiting. Set realistic goals — symptom management, not correction of anatomical variant. Avoid language that pathologises normal development and causes unnecessary parental anxiety.                             |
| When to refer                              | Neurological concerns; unilateral presentation without clear cause; rigid flat foot at any age; persistent toe walking beyond age 4; significant bony deformity; failure to respond to conservative management within 3–6 months.                                          |

The single most important principle in paediatric podiatry: distinguish normal development from pathology before intervening. Over-prescribing in asymptomatic children has no evidence base and creates unnecessary medicalisation of normal childhood foot variation.