In-toeing and Out-toeing

What is all the fuss about?

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• I do not intend to discuss an unapproved/investigative use of a commercial product/device in my presentation.
Practice Gap

- Many primary care physicians lack training in the diagnosis and management of common lower extremity rotation variations in children
Objectives

• Review the musculoskeletal exam when evaluating for rotational variations

• Discuss the diagnosis, natural history and treatment of common lower extremity rotational variations
Embryology/Development

- Limb bud development
- Medial rotation
- Intrauterine positioning
  - Increased relative external rotation of hip
  - Relative internal rotation of tibia
  - Variable positioning of feet
Development

• External rotation of the lower extremity
  – Femur ~25°
  – Tibia ~15°

• Adult alignment ~ 8-10 years of age
Evaluation

- Identify the concerns
  - Current appearance of the feet?
  - Function?
  - Persistence of the appearance?
Evaluation

• History – Onset, Function, Progression/Improvement
• Past Medical History
  – Birth history, Developmental milestones
• Family History
  – Rotational variations in family members
## Differential Diagnosis

<table>
<thead>
<tr>
<th>Intoeing</th>
<th>Out toeing</th>
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<tbody>
<tr>
<td>Metatarsus Adductus</td>
<td>External tibial torsion</td>
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<tr>
<td>Internal tibial torsion</td>
<td>Femoral retroversion</td>
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<tr>
<td>Femoral anteversion</td>
<td>Pes plano valgus</td>
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<tr>
<td>Clubfoot (Talipes equinovarus)</td>
<td>Slipped capital femoral epiphysis</td>
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<tr>
<td>Skew foot</td>
<td>Painful limb</td>
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<td>Spastic Hemiparesis</td>
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</tbody>
</table>
• Dynamic (Gait)
• Static
  – Heel bisector
  – Hip rotation
  – Thigh foot angle

<table>
<thead>
<tr>
<th>Rotational Profile</th>
<th>FPA</th>
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<tbody>
<tr>
<td></td>
<td>R: +10°</td>
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<td></td>
<td>L: +10°</td>
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<table>
<thead>
<tr>
<th>Heel Bisector</th>
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<tbody>
<tr>
<td>R: 2nd webspace</td>
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<td>L: 2nd webspace</td>
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<table>
<thead>
<tr>
<th>TFA</th>
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<tr>
<td>R: +10°</td>
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<td>L: +10°</td>
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<thead>
<tr>
<th>Hip Rotation</th>
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<tbody>
<tr>
<td>Internal Rotation</td>
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<tr>
<td>R: 50°</td>
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<td>L: 50°</td>
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<tr>
<td>External Rotation</td>
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<tr>
<td>R: 50°</td>
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<td>L: 50°</td>
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</tbody>
</table>
Exam - Dynamic

• Feet
• Knees
• Hips
• Other
  – Symmetry
  – Posturing with running
  – Hip/Knee flexion
Exam - Static

• General appearance
  – Facial features, asymmetry, maturity/development

• Lower extremities
  – Range of motion, Asymmetry

• Spine
Exam - Static

- Heel bisector
  - Line intersecting the midline of the hindfoot and forefoot
  - Neutral should pass through the 2nd metatarsal

- Shape of the foot
  - Convex border
Exam - Static

• Thigh foot axis
  – Angle created between:
    • Long axis of the thigh and Axis of the tibia/hindfoot
      – Infant ~ -5° (-30 - +20°)
      – Child ~ +10° (-5° to +30°)
Exam - Static

• Hip rotation
  – Internal rotation
    • Infant ~ 40° (10-60°)
    • Child ~ 50° (25-65°)
  – External rotation
    • Infant ~ 70° (45-90°)
    • Child ~ 45° (25-65°)
Metatarsus Adductus

• Common congenital foot deformity
  – Medial forefoot deviation relative to the hindfoot
  – First year of life

• Etiology – Unknown

• More common:
  – Males, Twin births, Premature births
Metatarsus Adductus

• Convex border of the lateral foot
  – Medial crease

• Normal ankle range of motion

• Classification
  – Flexibility
  – Severity
Metatarsus Adductus

• Treatment
  – Observation
    • Flexible
    • Stretching*
  – Casts
    • Rigid metatarsus adductus
    • Residual deformity
Internal Tibial Torsion

• Common Intoeing etiology in toddlers
• 2/3 bilateral
• Parents report frequent tripping, clumsy
Internal Tibial Torsion

• **Treatment**
  – Observation/Education
    • Tibia continues to externally rotate with growth
  – Bracing/Splints are NOT effective
  – Surgical intervention – Rare
Internal Tibial Torsion

• 100 high school students
  – 50 sprinters, 50 controls
• Mean thigh-foot angle was lower in the sprinters relative to the controls
• More sprinters intoed during sprinting

Femoral Anteversion

• Common intoeing etiology of childhood

• Refers to angle between the axis of femoral feck and the condyles (M/L) knee

• Natural history
  – Infant ~40°
  – Adult ~ 15°

• Symmetric
Femoral Anteversion

- Report of “W” sitting
- “Eggbeater” running motion
- Knee caps point medially
- Excessive internal rotation relative to external rotation
Femoral Anteversion

• Treatment
  – Observation/Education
  – Surgical
    • Severe anteversion
    • Functional limitations
Out-toeing

• Positive foot progression angle
  – Unilateral or bilateral
  – Progressive vs. Static

• Differential diagnosis
  – External tibial torsion, femoral retroversion, pes plano valgus
  – Slipped femoral capital epiphysis
Out-toeing

- Exam
  - Positive foot progression angle
  - Hip range of motion
    - External rotation > Internal rotation (femoral retroversion)
    - Red flags (limp, decreased flexion, abduction, internal rotation)
  - Thigh foot angle
  - Foot/Ankle
    - Achilles contracture
Out toeing

• Identify the cause
  – Hip/Acute injury
  – External tibial torsion/Femoral retroversion
  – Pes plano valgus

• External tibial torsion may progress with age
Practice Gap

• Many primary care physicians lack training in the diagnosis and management of common lower extremity rotation variations in children
Practice Change

• The learner will possess the skills and knowledge to diagnose and manage common cases of intoeing and out-toeing which do not require a need for an orthopaedic referral


