Toe-Walking

Benign Variant
or
Scourge of Bipedal
Locomotion?

Definition

Absent Heel Strike
+/- Equinus Throughout Gait Cycle
+/- Knee Hyperextension
+/- Hip Flexion

Physical Exam

+/- Equinus Contracture
Some Can Walk “Normally” at Will
(Only 17% Normal on Gait Analysis)
## History

- Walk on Toes, Usually from First Steps
- Male Predominance
- Many Have Positive Family History

## Etiology

- Normal Variant in Young (< 3yo)
- Idiopathic (Habitual)
- Congenital Short Achilles Tendon (Hall)
- Sensory Issues / Autism
- CNS Issues / Hypertonia
- Muscle Issues / Weakness

## Differential Diagnosis

### CNS Issues

- Cerebral Palsy
- Diplegia
- Hemiplegia
- Tethered Cord
Differential Diagnosis
Muscular Issues

Duchenne Muscular Dystrophy
Charcot-Marie-Tooth

Differential Diagnosis
Toe-Walking Tool

When the child was born, was their birth weight over 2500g?
When the child was born were they over 37 weeks of gestation?
Was the child admitted to special needs nursery/neonatal intensive care after birth?
Did the child independently walk prior to 20 months of age?
Does the child have a family member that toe walks with no other medical condition?
Does the child toe walk on one foot only?
Is the child toe walking in response to pain?
Did the child previously walk flat footed and only recently start to toe walk?
When you ask the child to walk on their heels are they able to?
On testing the ankle or hamstring range of motion is there a clonus and/or catch?
When asking the child to get up from the floor is there a positive Gower's sign?
Is there a normal knee jerk reflex?
Is there a normal Babinski reflex?
a. Are the hip flexors tight for the child's age (Thomas test)?
b. Are the hamstring tight for the child's age (Sujian Angle)?
c. Is the gastrocnemius and soleus tight for the child's age (Sujian Test)?
Does the child have more than 2 significant delayed developmental milestones?
Does the child have limited eye contact, have rigid rituals or ritual related behaviors, i.e., lining up toys, rocking or spinning

Differential Diagnosis
Toe-Walking Tool

The Subtle

Significant Assymetry?
Tight Hip Flexors, Hamstrings?
Limited Eye Contact, Ritual Behaviors?
Differential Diagnosis

Toe-Walking Tool


More Obvious

Did They Originally Walk Normally?

Are They in Pain?

Does Child Have Muscular Dystrophy?

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Natural History of Idiopathic Toe Walking

What Are the Risks of

Contracture

Pain

Tripping

Foot Deformity

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Differential Diagnosis

Toe-Walking Tool


When the child was born, was their birth weight over 2500g?
When the child was born were they ever 37 weeks of gestation?
Was the child admitted to special needs nursery/neonatal intensive care after birth?
Did the child independently walk prior to 20 months of age?
Does the child have a family history of toe/walks with no other medical conditions?
Does the child toe walk on one foot only?
Is the child toe walking in response to pain?
Did the child previously walk flat footed and only recently start to toe walk?
When you ask the child to walk on their hands do they hold on?
On testing the ankle or hamstring range of motion is there a clonus and/or catch?
When asking the child to get up from the floor is there a positive Gower’s sign?
Is there a normal Babinski reflex?
Are the Babinski reflexes right for the child’s age (Thomas test)?
Are the hamstring tight for the child’s age (Popliteal Angle)?
Is the plantar flexion and soleus tight for the child’s age (Lunge Test)?
Does the child have more than 2 significant delayed developmental milestones?
Does the child have limited eye contact, have strict rituals or ritual related behaviors, i.e., lining up toys, rocking or spinning

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Treatment of Toe Walking

- Look Other Way
- Nagging
- Stretching
- AFOs Day vs Night
- Serial Casting
- Surgery

Natural History of Idiopathic Toe Walking

- No Randomized Controlled Studies
- No Level 1 Evidence

Natural History

Eastwood DM et al.

- 49 Pts (27M, 22F)
- Age 1.5-10 (avg 4)
- Observed 2-12 years (avg 3.2)
- No Treatment Given
- Assessment by Parents
- Assessment by Physician
Natural History
Eastwood et al.

Parental Assessment
49 Pts (27M, 22F)
Observed 2-12 years (avg 3.2)
6% Normal Gait
45% Improved
0% Worsened

Natural History
Eastwood et al.

Physician Assessment
49 Pts (27M, 22F)
Observed 2-12 years (avg 3.2)
12% Normal Gait
88% Toe-Walking

Comparative Results
Observation vs Therapy/Casting vs Surgery

Cast Treatment Results Similar to Observation (FU 3.7y vs 3.2y)

Surgical Treatment Better (FU 7.9y)
Lengthening of Gastrocnemius
Comparative Results

Eastwood et al.

**Physician Assessment**

<table>
<thead>
<tr>
<th></th>
<th>Observed</th>
<th>Casted</th>
<th>Surgery</th>
</tr>
</thead>
<tbody>
<tr>
<td># of Pts</td>
<td>49</td>
<td>41</td>
<td>46</td>
</tr>
<tr>
<td>Avg Age</td>
<td>4y</td>
<td>3.5y</td>
<td>6.9y</td>
</tr>
<tr>
<td>Duration FU</td>
<td>3.2y</td>
<td>3.7y</td>
<td>7.9y</td>
</tr>
<tr>
<td>NI Gait</td>
<td>12%</td>
<td>22%</td>
<td>37%</td>
</tr>
<tr>
<td>Toe-Walking</td>
<td>88%</td>
<td>78%</td>
<td>63%</td>
</tr>
</tbody>
</table>

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Hirsch G & Wagner B:
The **natural history** of idiopathic toe-walking: a long-term follow-up of fourteen conservatively treated children


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14 (or is it 16?) Pts

2 Excluded for Achilles Lengthening

11 Actually examined at follow-up

All had Physiotherapy

5 Children Casted (3/5 braced)

Followed avg 14.5 years (7-21)
Hirsch G & Wagner B:
The natural history of idiopathic toe-walking: a long-term follow-up of fourteen conservatively treated children

14 Pts

Followed avg 14.5 years (7-21)

3/14 Still Toe-Walked

No Consistent Change in ROM

Complaints of Foot or Leg Pain Less Common than at Presentation

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**Comparative Results**

**Observation vs Casting vs Surgery**


<table>
<thead>
<tr>
<th></th>
<th>Group 1</th>
<th>Group 2</th>
<th>Group 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Median age at presentation (yrs)</strong></td>
<td>4.2</td>
<td>4.2</td>
<td>5.0</td>
</tr>
<tr>
<td><strong>Male patients (%)</strong></td>
<td>53.1</td>
<td>66.6</td>
<td>50.0</td>
</tr>
<tr>
<td><strong>Family history of ITW (%)</strong></td>
<td>30.6</td>
<td>22.4</td>
<td>33.3</td>
</tr>
<tr>
<td><strong>Initial foot posture (%)</strong></td>
<td>31.3</td>
<td>22.8</td>
<td>20.0</td>
</tr>
<tr>
<td><strong>Initial foot pain (%)</strong></td>
<td>16.5</td>
<td>17.9</td>
<td>10.0</td>
</tr>
<tr>
<td><strong>Change in range of motion (deg)</strong></td>
<td>15.0</td>
<td>15.7</td>
<td>11.0</td>
</tr>
</tbody>
</table>

Percentage of time walking onampion dorsiflexion of patients:

- **0%**: 7
- **50%**: 6
- **100%**: 10

<table>
<thead>
<tr>
<th></th>
<th>(n = 40)</th>
<th>(n = 37)</th>
<th>(n = 10)</th>
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**Comparative Results**

**Observation vs Casting vs Surgery**


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<tr>
<td><strong>Median pretreatment ankle DF</strong></td>
<td>10°</td>
<td>5°</td>
<td>-10°</td>
</tr>
<tr>
<td><strong>Median ankle DF at final follow-up</strong></td>
<td>10°</td>
<td>5°</td>
<td>10°</td>
</tr>
<tr>
<td><strong>Mean follow-up (m/o)</strong></td>
<td>36.0</td>
<td>34.6</td>
<td>32.0</td>
</tr>
<tr>
<td><strong>Outcome</strong></td>
<td>Satisfied (%)</td>
<td>23.0</td>
<td>23.5</td>
</tr>
<tr>
<td><strong>Neutral (%)</strong></td>
<td>54.2</td>
<td>64.7</td>
<td>26.6</td>
</tr>
<tr>
<td><strong>Dissatisfied (%)</strong></td>
<td>20.8</td>
<td>11.8</td>
<td>6.7</td>
</tr>
</tbody>
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Conclusions

Toe-walking Can be a Normal Developmental Variant in Young Children

Care Must Be Taken to Rule Out Neuromuscular Disease in Toe Walkers

Observation Alone is Appropriate in the Absence of Equinus Contractures

Tendo Achilles Lengthening or Gastrocnemius Lengthening Appears to be the Most Effective Treatment for Toe-Walkers with Equinus Contractures