Treating Common Foot Conditions in Teens to Adults with Down Syndrome

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Roberta Nole is owner of Stride®, Inc. Custom Foot Orthotics (an Accredited ABC Orthotic Facility); Stride Physical Therapy & Pedorthic Center; and, Nolaro24™, LLC - Maker of the QuadraSTEP® and littleSTEP® foot orthotics. She is a graduate of the University of Scranton (Biology); the University of Connecticut (Physical Therapy); and is also a ABC Certified Pedorthist. Nole is patented on a unique foot-typing algorithm that identifies 24 variations of the normal human foot (US Patent 7,789,840). Since 1989 she has specialized in biomechanical gait examination and rehabilitation of the foot and ankle. She has developed an educational training program entitled Clinical Analysis of 24 Adult Foot Types that is based on her original technology. She is a member in good standing of the American Physical Therapy Association, and the Pedorthic Footwear Association.

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To understand the Neuro-typical development of the pediatric foot and how that differs in individuals with Down syndrome (intro to 2/17 pediatric webinar)

To understand the typical foot types of those adults affected with Down syndrome

To understand the importance of orthotic therapy to help improve quality of life and prevent future deformities and dysfunction.
Development of the Neuro-Typical Foot

- It is common for neuro-typical baby's feet to look flat. The arch doesn't usually develop until age 3 to 4. By ages 5-6 a “normal” arch should be apparent.

- The arch of a baby’s foot appears flat, largely due to a fat pad that fills the arch.

- Babies are born with skeletally immature foot until about the age of five, when all 26 bones form.

- A neuro-typical toddler should start ambulating around 12 months, but lacks postural stability due to core and lower extremity neuromuscular weakness.
Motor and Foot Development for Individuals with Down Syndrome

“Pattern of motor skill development for kids with Down syndrome is largely one of delay rather than difference…”


“Motor development covers a wide range of important human skills, from sitting, walking and running, to independent drinking, eating and dressing….all movements require fast and complex control by the CNS....”

Kids with Down syndrome usually learn to walk between 16 to 42 months (Ave 24 months), and have increased difficulties due to core and lower extremity neuromuscular weakness.

“Individuals with Down syndrome need more practice than typically developing individuals to improve their performance”.
“Normal” Age Specific Development of the Neuro-Typical Human Foot

- Vertical Bisection Of The Calcaneus In Weight Bearing Is Greatest At Age 1yo, When It Is About 6 valgus.

- Calcaneal Valgus Decreases 1° per Year Until About 6 Yrs of Age.

- At 6y.o. The Heel Should Be Vertical!
DEVELOPMENTAL FLAT FEET

"A poorly functioning, posturally deficient foot that has the potential to cause future deformity and disability“

- Joe D'Amico

LACK OF SYMPTOMS is an UNRELIABLE indicator of foot function in any age group...

TREATMENT GOALS

- Stabilize and Align the Osseous and Soft tissue Structures
- Reduce Pronation
- Optimize Posture, Balance, Coordination & Strength
- Stretch the Heel Cords
- Be Persistent…Practice, Practice, Practice….
Children with Down syndrome (DS) experience delays in reaching motor milestones due to hypermobility, low muscle tone, and poor skeletal alignment.

The goal is to facilitate a lifelong normalcy of activity.

Flat feet are common in DS leading to many quality of life issues and resultant dysfunction or deformity with aging, which can be easily treated or prevented through early orthotic management. The goal is to facilitate a lifelong normalcy of activity.
Due to ligamentous laxity and hypotonicity, many kids with DS have trouble attaining and maintaining good strength throughout their entire bodies. Kids with DS typically have flat feet causing excessive foot and ankle pronation, and an out-toed stance.

Any structure built on a weak foundation will collapse.

Excessive foot pronation compromises muscle function as the body has no foundation to build on. Strength in the limbs and core muscles are equally effected, resulting in postural deficiencies.
Kids Don’t always outgrow flat feet
Despite what Pediatricians tell you – Not All Kids Outgrow Flat Feet!

Kids Feet Evolve into 1 of 6 Functional Adult Foot Types

Kids are patients for life!

61% Adults May Suffer from Symptoms related to Flatfeet.
Research on flat feet & childhood obesity

References

“I don’t want my child to become dependent on the orthotics, I have them walk barefoot to strengthen their ankles.”

Myth...orthotics inhibit strength development.... FALSE!!

Using foot orthoses improves foot and ankle alignment and facilitates function by normalizing alignment and allow muscle recruitment.

The Golgi organ (also called Golgi tendon organ, GTO, tendon organ, neurotendinous organ or neurotendinous spindle) senses changes in muscle tension. It is a proprioceptive sensory receptor organ that is at the origins and insertion\(^{[1]}\) of skeletal muscle fibers into the tendons of skeletal muscle. It provides the sensory component of the Golgi tendon reflex.

Treatment for Developmental Flat Feet

Main Goal...

**Control The Rearfoot!**

Prefabricated Foot Orthotics

**KEY ORTHOTIC FEATURES:**

- 30mm Heel Cup Depth
- Deep Medial and Lateral Flanges
- Medial Rearfoot Posting
- Medial Skive

**Designed to Improve:**
- Coordination
- Pain
- Foot Alignment
- Balance
- Posture
- Strength

Custom Foot Orthoses

For severe cases.

2/17 Webinar!!!
Teen and Adult Foot Types

For when you need more than just rearfoot control!!!
HOW TO SELECT THE FOOT TYPE?

**Easy Foot Typing Tool**

The 4 Steps to selecting a device with the correct features are based on many years of clinical experience and scientifically researched evidence.

Choosing the correct foot type is easy with this simple 4 step process!

**The 4 Steps are:**

1. Assess arch height
2. Use Toe-Sign to assess forefoot alignment
3. Functional gait assessment
4. Check callus pattern

Having trouble choosing a foot type? Send us your video
STEP 1
IDENTIFY MEDIAL ARCH HEIGHT
Left Column Or Right Column?

MEDIUM TO HIGHER ARCHES TO THE LEFT SIDE OF THE CHART

LOW TO FLATTER ARCHES TO THE RIGHT SIDE OF THE CHART
STEP 2
IDENTIFY FOOT & LEG ALIGNMENT
Which Row?

CHOOSE FROM
- Externally rotated tibia / Adducted forefoot
- Normal externally rotated tibia / Straight forefoot
- "Peek-a-boo" Hallux
- False Toe Sign

OR CHOOSE FROM
- Internally rotated tibia / Adducted forefoot Toe-In
- Internally rotated tibia / Straight forefoot Neutral
- Internally rotated tibia / Abducted forefoot Creasing Toe Sign
- Severe internal tibial rotation / Abducted forefoot Splaying Toe Sign

[Images of different foot and leg alignments]
**STEP 3**
Identify gait style

Steps 3 & 4 Offer Confirmation!

**CHOOSE FROM**

- **A** Narrow Gait
  - Propels from 1st MTH

- **C** Toe-Out Gait
  - Propels off Medial Hallux

**OR CHOOSE FROM**

- **B** Toe-In Gait
  - Propels from 1st and 2nd MTH

- **D** Neutral Gait
  - Causes Midtarsal Joint Break-down at Heel Rise

- **E** Abducted Gait
  - Pivots at 5th MTH in Propulsion

- **F** Abducted Gait
  - Causes Pivot at 5th Met Base
STEP 4
Check against callus pattern

Steps 3 & 4 Offer Confirmation!

CHOOSE FROM

A 1\textsuperscript{st} and 5\textsuperscript{th} MTH

C Medial Hallux

OR CHOOSE FROM

B 1\textsuperscript{st} and 2\textsuperscript{nd} MTH

D 2\textsuperscript{nd} MTH

E 2\textsuperscript{nd} and 5\textsuperscript{th} MTH

F Large Central MTH
Understand that your foot type dictates how you walk and leads to particular callous pattern and an array of predictable symptoms.

**A QUAD**
**SEVERE PES CAVUS**
Possible Clinical Symptoms:
- Lateral Ankle Instability
- Peroneal Tendonitis
- Heel Pain
- 5th Metatarsal Base Pressure
- Lower Back Pain
- Sesamoiditis, Hammer Toes
- Knee Recurvatum

**B QUAD**
**MILD PES PLANUS**
Possible Clinical Symptoms:
- Neuromas
- Sesamoiditis
- May occur with leg discrepancies
- 1st Ray Hypermobility

**C QUAD**
**NEUTRAL FOOT**
Possible Clinical Symptoms:
- Retrocalcaneal Bursitis
- Lateral Hip Pain
- Haglund’s Deformity
- Lower Back Pain
- Iliotibial Band Syndrome
- Pinch Callus Medial Hallux

**D QUAD**
**MODERATE PES PLANUS**
Possible Clinical Symptoms:
- Plantar Fasciitis
- Metatarsalgia
- Functional Hallux Limitus
- Patellofemoral Pain Syndrome
- Posterior Tibial Tendonitis

**E QUAD**
**ABDUCTOVARUS FOREFOOT**
Possible Clinical Symptoms:
- Plantar Fasciitis
- Shin Splints
- Tailor’s Bunionette
- Cubiod Syndrome
- Medial Knee Pain

**F QUAD**
**SEVERE PES PLANOVALGUS**
Possible Clinical Symptoms:
- Plantar Fasciitis
- Posterior Tibial Dysfunction
- Tarsal Tunnel Syndrome
- Patellofemoral Pain Syndrome
- Subfibular Impingement
- Hallux Limitus
THE TWO MOST COMMON FOOT TYPES THAT CONCERN TEENS AND ADULTS WITH DS ARE THE D QUAD AND F QUAD
MODERATE PES PLANUS

- Neutral Toe Out
- Pronation through Midstance
- Midtarsal Joint Instability

Propels off 2\textsuperscript{nd} and 3\textsuperscript{rd} Metatarsal (due to Transverse Metatarsal Arch Reversal)

![Vertical Heel Alignment](image)

POSSIBLE CLINICAL SYMPTOMS

- Plantar Fasciitis
- Metatarsalgia
- Functional Hallux Limitus
- Patellofemoral Pain Syndrome
- Posterior Tibial Tendonitis
- Neuromas
- Dorsal Bunions

KEY ORTHOTIC FEATURES

- Deep Heel Cup
- Medial RF Posting
- Moderate Medial Skive
- Medial Flare

Great for Plantar Foot Pain!
It’s like walking barefoot in soft sand all the time!
Common DS Foot Problems:

Digital deformities such as hammer toes
Hallux Abducto Valgus (bunions)
Pes Plano Valgus (flat feet)
Metatarsus primus adductus, hypermobile 1st ray, brachymetatarsia,
Haglund’s deformity (pump bump), syndactaly and Tailors bunion.

Genu valgum (knock knees) and subluxation and/or dislocation of the patella are another concern due to this condition. Hip and spinal issues are often seen as well.
SEVERE PES PLANOVALGUS

- Pronates through Propulsion
- Severe MTJ Instability
- Propels from Central MTH’s

Lateral Column Instability

LARGE INTERNAL TIBIAL/FIBULAR ROTATION

LARGE TOE SIGN

FLAT ARCH

EVERTED HEEL ALIGNMENT

POSSIBLE CLINICAL SYMPTOMS

- Posterior Tibial Dysfunction
- Tarsal Tunnel Syndrome
- Plantar Fasciitis
- Knee Valgus/DJD
- Subfibular Impingement
- HAV/Bunions
- Splayfoot

KEY ORTHOTIC FEATURES

- Depth Orthosis
- Large Medial Skive
- Medial RF & FF Posting
- 1st MTH Cut-Out to Peroneal Function

Great for PTTD!
Flexible Flatfoot vs. Rigid Flatfoot

Early Detection vs. Late Detection
TREATMENT GOALS
STRUCTURE

Prefabricated Orthotics or Custom?

Factors to Consider

The QUADRASTEP SYSTEM® of custom foot type orthotics

STRIDE CUSTOM FOOT ORTHOTICS
1 – Strengthen lower extremity musculature (hips, knees, ankles, and feet) aimed at improving push off and augmenting support of the knee joint.

2 – Heel cord stretching with the heel in neutral alignment when limited passive range of motion exists.

3 – Dynamic balance activities, such as running or descending stairs which encourage the child to shift their weight during late swing phase rather than waiting until heel contact.
Instability of the patella (kneecap) has been estimated to occur in close to 20 percent of people with DS. The majority of cases of instability present only as kneecaps that can be moved further to the outside than the normal kneecap (subluxation); however, some people can have their kneecaps completely move out of position (dislocation).

Genu Valgum (Knock Knees) is commonly associated with overly pronated feet and can lead to patellar subluxation or dislocation.
Five to eight percent of children with DS will develop abnormalities of the hip.

The most common condition is subluxation or dislocation of the hip. In this condition, the head of the thigh bone (the femur) moves out of the socket formed by the pelvis (the acetabulum). This condition may or may not be associated with malformation of the acetabulum.

Some contributing factors include:
- laxity of the connective tissue that normally keeps the hip together
- low muscle tone found in DS
- Flat Feet

Interestingly, hip subluxation in children with Down syndrome is hardly ever found at birth but instead occurs between the ages of 3 and 13 years.

The most common sign is a limp, and pain may or may not be present. Treatment will often start with immobilization of the hip with a cast. Many children with DS will require surgical correction, however... Can this be avoided?
Another condition associated with the spine in Down syndrome is **scoliosis**, which is the curvature of the spine to the side. While it appears to be more common in people with DS, the exact incidence isn't known.

Treatment of scoliosis remains the same as in other children, with bracing being the initial therapy, followed by surgical intervention if necessary.

The Back

Always Consider the Foundation.....
Getting on The Right Track

Proper Exam
Proper Orthotic

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Connecticut-based prefab supplier since 2011

20+ years custom orthotic experience

State of the Art prefab design

littleSTEPS Orthotics for Children Tots to Teens
Covered in your next Webinar 2/17

The Quadrastep System for Teens to Adults

Dispensers and Distributors Worldwide
The Quadrastep System
Teens to Adults

6 Unique Foot Orthotics/Inserts
Biomechanically tailored to each foot type

Easy to Fit
4 step assessment process to identify patient foot type

Immediate Results
No casting/impressions/scans

Affordable
Alternative to customs
Multiple Pairs to complement customs
Find The Right Practitioner To Help You Decide Between Custom Or Functional Prefabs
Prices and Ordering

Varies by Dispenser  $150+

Nolaro Pricing
   1 Pair Quadrasteps $150
   Top Covers $25

Purchase directly by Phone

Purchase Online at www.stepsonlineorthotics.com

Prerequisites for an order:

   Proper Fit Assessment
      DPM, MD, PT, DC, CPED

   Prescription or Referral Form
For More Information

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Nearest location of qualified medical professional for assessment

Train/Qualify your Therapist or Doctor

Medical Referral Form needed for Order

Special NDSS Discount Code
THANK YOU!

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