How Early Intervention in Pediatric Foot Care can improve Quality of Life in Children (tots to teens) with Down syndrome

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Goal

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.
Objectives

- To understand the normal development of the pediatric foot and how that differs in individuals with Down syndrome.
- 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.
Normal Development of the Foot

It is normal for a 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 toddler should start ambulating around 12 months but lacks postural stability due to core and lower extremity neuromuscular weakness.

“There is a tendency for the child's flatfoot to be ignored or treated with benign neglect”.

Foot Development in Down Syndrome

Down syndrome motor development is slow and instead of walking by 12 to 14 months as other children do, children with Down syndrome usually learn to walk between 15 to 36 months and have increased difficulties due to core and lower extremity neuromuscular weakness.
Normal Age Specific Development of the 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!

1 to 5

Ages 6-8

Ages 9-12

Normal Adult
Development in Down Syndrome Individuals

Almost all of the conditions that effect the bones and joints of people with Down syndrome arise from the abnormal collagen found in DS.

Collagen is the major protein that makes up ligaments, tendons, cartilage, bone and the support structure of the skin.

The resulting effect in people with DS is increased laxity, or looseness, of the ligaments that attach bone to bone. The combination of this ligamentous laxity and low muscle tone contribute to orthopedic problems in people with Down syndrome.
Up to 6 years of age, skeletal alignment and development of the foot are dictated by nature and severity of the deforming forces directed through it as well as by its ability to resist these forces. When allowed to continue, these compensatory deforming forces delay ideal development while at the same time encouraging the retention of neonatal deficiencies. According to Wolf’s law of bone adaptation, structure will occur in direct response to function, i.e. form follows function. The consequence of poor function is that development will be impaired.

"Correction is a poor substitute for prevention"

Those who say that only children with symptomatic flatfeet should be treated, fail to recognize the relationship between developmental deficiencies and foot dysfunction that can lead to deformity later in life.
Due to ligamentous laxity and hypotonicity, many kids with DS have trouble attaining and maintaining good strength throughout their entire bodies. DS kids typically have flat feet causing excessive foot and ankle pronation, and an out-toed stance.

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.
“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 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

For severe cases.

Custom Foot Orthoses

Supramalleolar Orthotics (SMO’s)
Levels Of Support

No Support

littleSTEPS OTC

UCBL

SMO
Preteen and Adolescent Flat Feet

THE TWO MOST COMMON FOOT TYPES THAT CONCERN CHILDREN WITH DS ARE THE D QUAD AND F QUAD
Kids 9-19 years
Evolution of adult foot types

For when you need more than just rearfoot control!!!
MODERATE PES PLANUS

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

Propels off 2nd and 3rd Metatarsal (due to Transverse Metatarsal Arch Reversal)

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!
SEVERE PES PLANOVALGUS

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

Lateral Column Instability

- 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
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,
Haglunds’ 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.
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), and some may even have a hard time getting it back into the right position. Mild subluxation of the kneecap is not associated with pain, but dislocation may be painful. While people with instability of the patella are able to walk, there is often a decreased range of motion of the knee, with an accompanying change in gait. The longer that nothing is done for the instability, the worse the condition will get over time. Orthoses (special braces) may be useful for mild cases, but severe cases require surgical correction.
Five to eight percent of children with DS will develop abnormalities of the hip. The most common condition is dislocation of the hip, which is also called **subluxation**. In this condition, the head of the thigh bone (the femur) moves out of the socket formed by the pelvis (the acetabulum). This dislocation may or may not be associated with malformation of the acetabulum. The dislocation appears to be due to a combination of laxity of the connective tissue that normally keeps the hip together along with the low muscle tone found in DS. Interestingly, hip subluxation in children with Down syndrome is **hardly ever found at birth** but instead is most common 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.

**Avoid?**
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.

Consider the Foundation.....
Physical Therapy Tips

Specific physical therapy recommendations to consider with inserts/orthotics/SMO’s include:

1 – Strengthening of 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
Individuals with Down syndrome are living twice as long as they were 25 years ago. It’s not uncommon now for DS individuals to live to 50. In fact, studies have shown that those with Down syndrome live longer when they have developed good self-help skills. What better way to encourage self-help than to enable a patient to walk, run and be physically active over the course of a lifetime?
Quality of life factors for Down syndrome patients

When a person has limited ability for movement, there is bound to be some restriction in exposure to learning opportunities and social stimulation, and this privation tends to be reflected in depressed intellectual ability. In other words, by allowing the patient to be more mobile, the patient’s overall well being will be increased.

Obesity is also common in Down syndrome patients, partially due to inactivity. Other diseases common with DS is hypertension, diabetes and high cholesterol. By correcting the biomechanics and optimizing lower extremity alignment, the DS individual can avoid the problems that lead to inactivity. By maintaining an active lifestyle, quality of life may be increased.
Early detection of podiatric anomalies in children with Down syndrome.

Aims: To verify the importance of podiatric evaluation in patients with Down syndrome for the early diagnosis and treatment of minor orthopaedic problems.

Methods: Case-control study of 50 children affected by Down syndrome (aged 4-10 y) without major orthopaedic malformations compared to 100 healthy children. A complete podiatric examination was performed on all patients and controls.

Results: Children with Down syndrome showed several orthopaedic anomalies including bony deformity of the forefoot (90%), flat foot (60%), isolated calcaneal valgus (24%), knee valgus (22%) and pronated flat foot (16%). These abnormalities were responsible for postural alterations as confirmed by baropodometric examination.

Conclusion: The data demonstrated a greater incidence of minor orthopaedic alterations and suggest the necessity of regular podiatric examinations in the follow-up of this syndrome.
Treatment Alternatives

Therapy

Surgery

Braces

Custom Orthotics
   Typically made by impression of foot
   Casting, x-ray, etc
   Can be time consuming, expensive

Prefabricated Orthotics
   Manufactured to generic specifications
   Based on manufacturer, fit will vary

Combination of above
Nolaro24

Connecticut-based prefab supplier since 2011

20+ years custom orthotic experience

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Covered in Webinar 3/2

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- Foot/leg Pain
- Toe Walking

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- Foot/leg Pain
- Toe Walking
- In Toeing

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Parent Testimonials

Pretty much right after receiving and wearing his first pair, the pain (and complaining) stopped! The difference littleSTEPS made for our son proved undeniable - Robyn F

she was running around crazy and I have never seen her do that before her magical inserts. Thank you for helping her be able to run and play and not know the difference. - Shannon M

"Before using LittleSteps my son used to go to bed crying of foot cramps and leg pains. We had to use pain relievers and give nightly foot massages to help him go to sleep. Once he started using LittleSteps the problem stopped-Immediately! – Janelle

Immediately upon using his orthotic inserts, his balance improved resulting in less falls, better coordination and he no longer complains of fatigue in his legs with walking and running. Best of all, his confidence has increased greatly! Melissa D, Physical Therapist (MSPT)
THANK YOU!