

Toe walkers

NIKOLAOS LALLOTIS

M.Ch.(Orth)

Assistant Professor in Pediatric Orthopaedics

INTERBALKAN MEDICAL CENTER

THESSALONIKI GREECE

toe walkers



TOE WALKERS

Children that are walking systematically on tip toes , after 2 yrs, without an obvious neurological or orthopaedic disorder, are

IDIOPATHIC HABITUAL TW

CONGENITAL SHORT TENDO CALCANEUS


J Hall, B Salter J Bone Joint Surg Br 1967

WALKING on tip toes is a **CLINICAL** sign, **NOT** a diagnosis



Toe walkers

- Minimal diplegic children
- prematurity
- Syringomyelia - tethered cord
- AUTISM spectrum
- Psychomotor disorders
- Muscular dystrophy
- IDIOPATHIC or HABITUAL

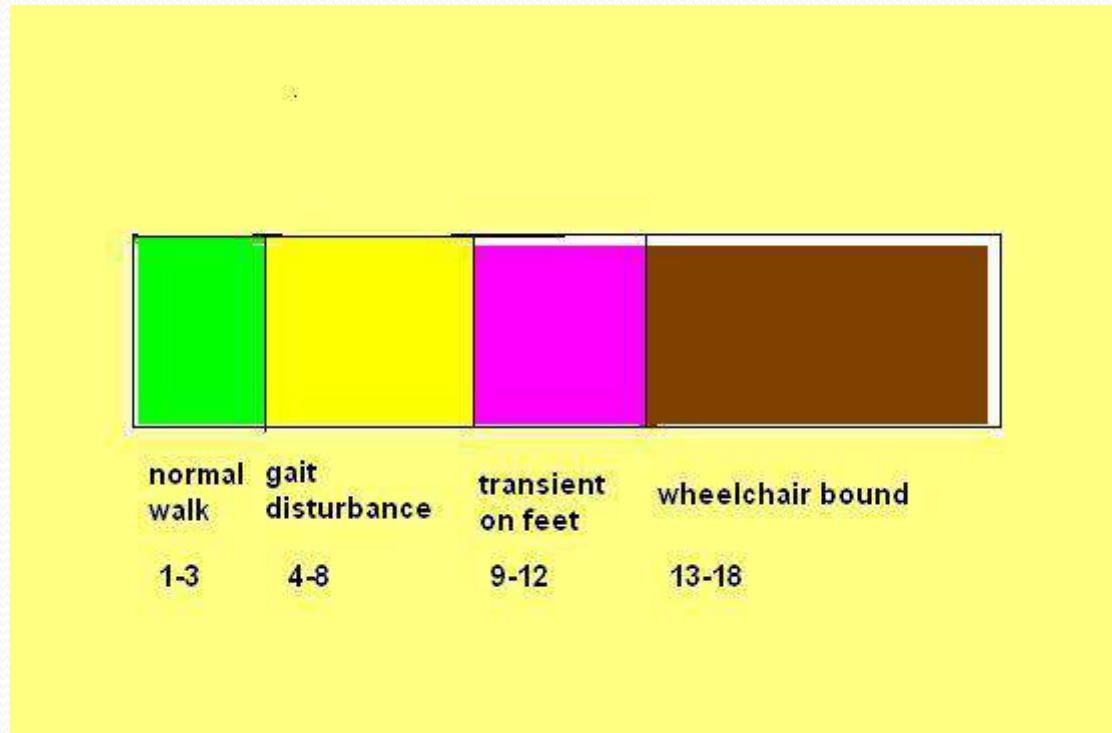


Toe walkers move around all the time
They can support the entire foot on the floor, on request
They correct the gait, when concentrating

**Toe walking is
one of the
FIRST
CLINICAL
SIGNS in
DUCHENNE
MUSCULAR
DYSTROPHY**



Duchenne muscular dystrophy



Duchenne muscular dystrophy

- Reduced velocity on running
- Difficulties to climb
- TOE WALKING
- Inability to hip hop

Duchenne muscular dystrophy



Duchenne muscular dystrophy ambulation period

- Increased lordosis
- Weakness of pelvic muscles
- Dynamic equinus for ambulation
- Pseudohypertrophy of calf muscles
- Initial presentation as TOE WALKERS



Duchenne muscular dystrophy

Ambulation period

- Assessment for progression of the disease
- Gowers time
- GAIT ANALYSIS
- DST time increases with progression of the disease.
- **N Laliotis Gait analysis in Duchenne muscular dystrophy**
M Ch Orth Thesis University of Liverpool 1992

Achilles elongation surgical treatment

NeuroRehabilitation. 2010 Jan 1;27(2):189-91.

Complete immobility as a potential biomechanical complication of Achilles tendon lengthening.

Gaber TA, Gautam V, Azer A.

Rehabilitation Medicine, Leigh Infirmary, Greater Manchester Neuro-rehabilitation Network, Leigh, UK. tgaber@doctors.net.uk

Abstract

Proximal muscle weakness is a common association of muscular dystrophies. Knees and hip extensor weakness limit the patients' ability to counteract flexor knee joints' moments. Therefore, patients try to toe walk to move the ground reaction force (GRF) anteriorly to help to stabilise the knee.

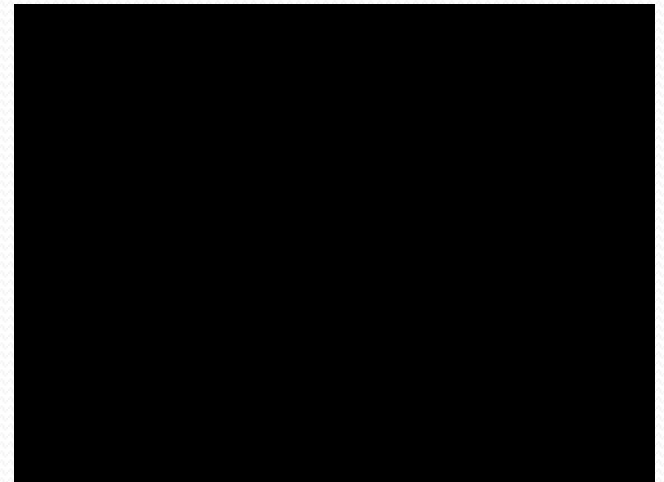
TOE WALKERS

CRITERIA for diagnosis

Idiopathic TE

Clinical examination WALKING

- SPIN test
- WALKING after spin
- WALKING on heels
- Toe walking: causes, epidemiology, assessment, and treatment. Ruzbarsky JJ et al. Curr Opin Pediatr. (2016)



Clinical examination laying on the couch supine and prone

- Ankle : ROM with knee flexed and extended
- ROM : knee and hip
- EXTERNAL ROTATION of the hip



Minimal diplegic vs ITW

- Prematurity, risk babies
- Delay in motor development
- POSITIVE family history
- **Spasticity, clonus**
- [Soleus H-Reflex and Its Modulation With Vibration in Idiopathic Toe Walkers and Typically Developing Children.](#)
- Rossi EM, Nevalainen P, Mäenpää H, Lauronen L.
- J Child Neurol. 2018 Apr;33(5):351-358

ITW

- External rotation of the hip, out toeing
- Funny walking (ballet dancing)
- REDUCE velocity when walk on heels
- EASILY walk on heel, when they are asked

Toe walkers 1-2 yrs old toddlers



Minimal diplegic vs ITW

- GAIT ANALYSIS
- REDUCED Knee flexion in stance and in swing
- Anterior pelvic tilt
- Double bump in ankle kinetics

Differentiation of ITW and diplegic cerebral palsy

- Hicks and Gage J Pediatr Orthop 1988
- Kelly et al kinematic patterns of TW J Pediatr Orthop 1997
- Policy et al EMG studies J Pediatr Orthop 2001
- Rose et al EMG differentiation J Pediatr Orthop 1999
- **Identifying methods for quantifying lower limb changes in children with idiopathic toe walking: A systematic review.**
- Caserta A, Morgan P, Williams C.
- Gait Posture. 2019

Ankle kinetics has 3 rockets

- 1st rockets heel strike
- 2nd rocket plantar contact (ankle dorsiflexion)
- 3d rocket push of action (ankle plantarflexion)

Classification of ITW based on gait analysis Alvarez et al

Literature Review of Idiopathic Toe Walking: Etiology, Prevalence, Classification, and Treatment.

Pomarino D ^{1,2} , Ramírez Llamas J ^{1,2} , Martin S ^{1,2} , Pomarino A ^{1,2} . Foot Ankle Spec. 2017 Aug;10(4):337-342

- Idiopathic toe walking-A follow-up survey of gait analysis assessment.

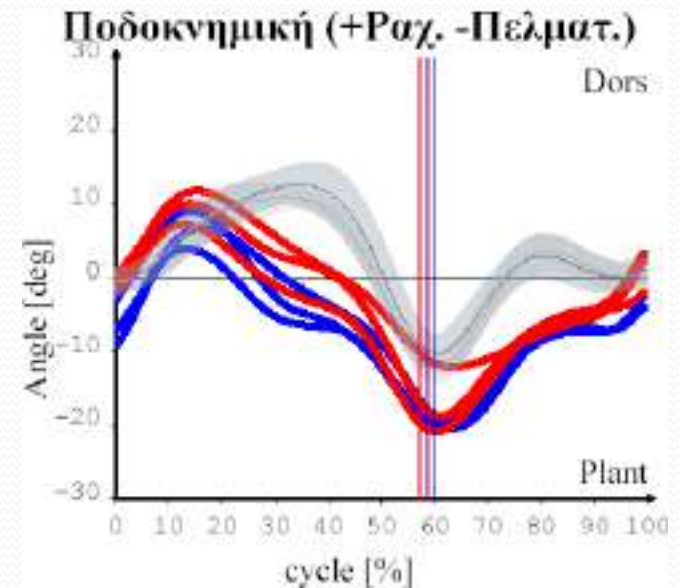
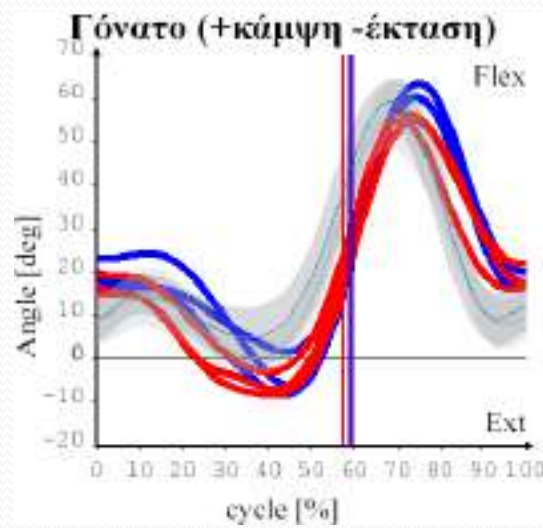
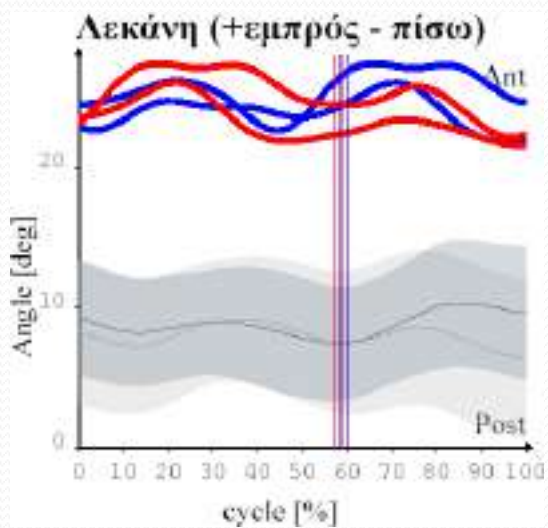
O'Sullivan R, Munir K, Keating L.
Gait Posture. 2019 Feb;68:300-304.

The effect of persistent toe walking on the skeletal development of the pediatric foot and ankle.

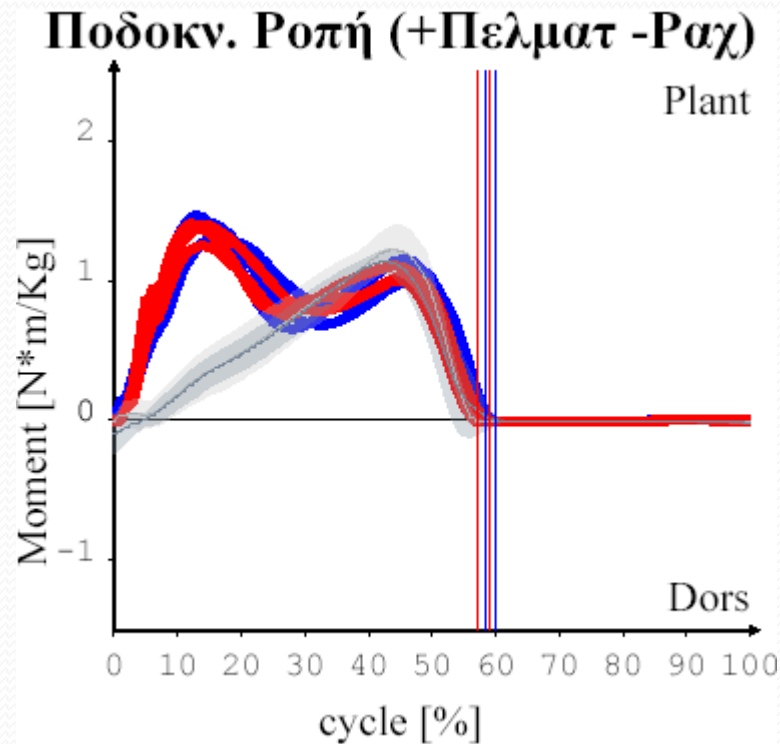
Sinclair MR 1 , Lind AA 1 , Knowlton JQ 2 •
J Pediatr Orthop B. 2018 Jan;27(1):77-8

talus deformity

Gait analysis IN Idiopathic TW



Gait analysis kinetics of the ankle



Full length foot orthoses have an immediate treatment effect and modify gait of children with idiopathic toe walking.

Michalitsis J, Murphy AT, Rawicki B, Haines TP, Williams C.
Gait Posture. 2019 Feb;68:227-231



Botulinum toxin injection

Laliotis N Botulinum
toxin injections in
cerebral palsy
Ορθοπαιδική 2007

Laliotis N Ankle
kinetics in children with
cerebral palsy
EEXOT 1998

Brunt et al Effect of BTX
on gait of children who
are ITW J Surg Orthop
Adv 2004



Botulinum toxin injection

Effective in diplegic children, combined with appropriate physiotherapy, as PART of the entire management

Botulinum toxin injection

J Bone Joint Surg Am. 2013 Mar
6;95(5):400-7. doi:
10.2106/JBJS.L.00889.

Botulinum toxin A does not improve
the results of cast treatment for
idiopathic toe-walking: a randomized
controlled trial.

Engström P 1 , Bartonek Å, Tedroff K,
Orefelt C, Haglund-Åkerlind Y,
Gutierrez-Farewik EM.



Application of casts

- Short period of improvement
- Relapse of ITW
- Difficult to be approved from children
- Outcomes of Noninvasively Treated Idiopathic Toe Walkers.
- Radtke K, Karch N, Goede F, Vaske B, von Lewinski G, Noll Y, Thren A.
- Foot Ankle Spec. 2019 Feb;12(1):54-61

Serial casting for ITW and children with spastic diplegia

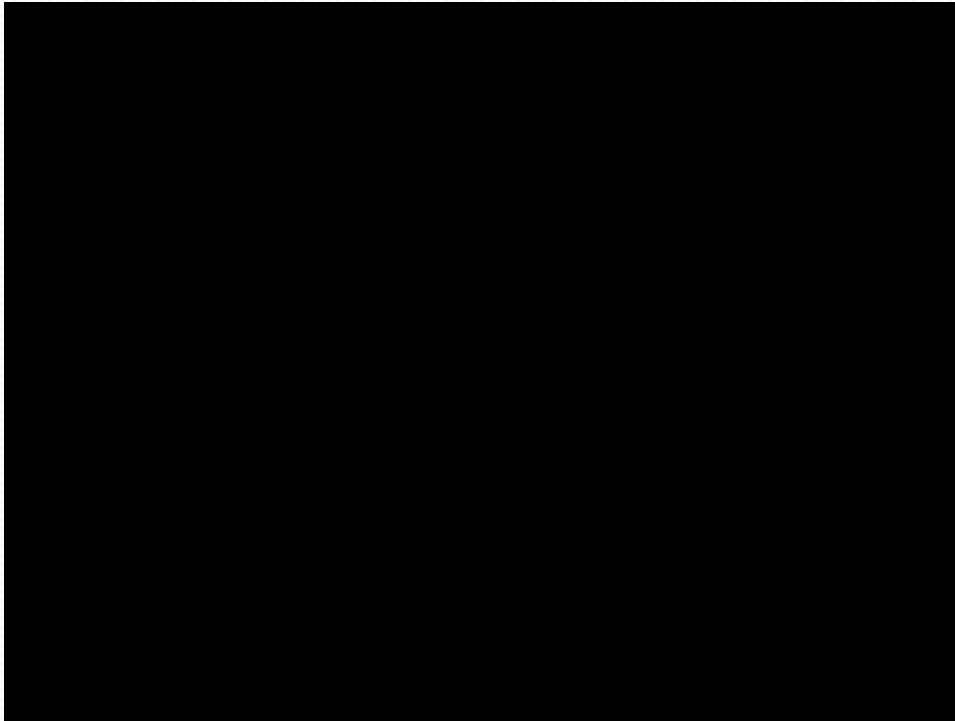
- Brower et al Ontario Canada
J Pediatr Orthop 2000
- 8 CP children and 8 ITW
- 3-12 yrs old
- Immediately ALL improved
- CP returned to digitigrades gait, in 6 wks
- ITW in 3 months

Surgical treatment

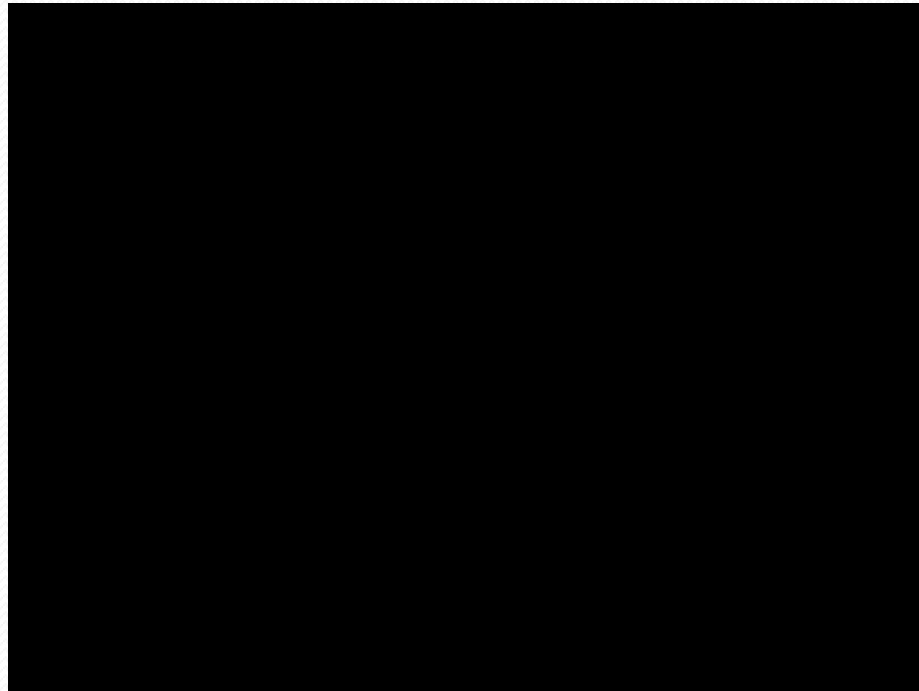
- Failure of conservative treatment
- Children older than 5-6 yrs old
- Contracture of the achilles
- STANDING ON TIP TOES



Surgical treatment



Surgical treatment :
request to walk on heels



Surgical technique

- Achilles lengthening
- Open or closed
- Gastrosoleus lengthening (Vulpius or Baker)
- Contracture in knee flexion - extension

Surgical technique

- Measurement for achilles lengthening
- How much to lengthen?

Post surgical regime

- Regular physiotherapy
- Out toeing
- Reduced velocity
- braces

results

- Improvement of gait with heel strike (initial contact)
- Reduced external rotation of the hip
- Gradual improvement of gait velocity in heel strike
- Muscle strength on tip toeing

toe walkers : (2008-2014)

- 85 children toe walkers
- 72 IDIOPATHIC

- SURGICAL
TREATMENT
7 children

All with open
lengthening of the
achilles

ITW A comparison of treatment methods

Stricker and Angulo J Pediatr Orthop 1998

- Relapsing of TW in casting in 2 yrs
- Low compliance with REPEATED casting
- Effective surgical treatment in children older than 7 yrs

Comprehensive outcomes for surgically treated idiopathic toe walkers

- McMulkin et al Shriners Hosp Spokane J Pediatr Orthop 2006
- 14 children with pre and post op gait analysis
- Improved dorsiflexion of the ankle joint
- Normalized peak knee flexion
- FPA remained SIGNIFICANTLY increased
- The procedure has no effect on hip external rotation

Toe walkers

Common problem in children

Normal activities, mainly aesthetic

Positive family history

Toe walkers

Diagnosis

Conservative treatment in early stages
is usually effective

Surgical treatment in achilles
shortening

Appropriate postoperative regime

Merci bien

