Toe Walking: When Do We Need to Worry?

Olga M. Morozova, MD, Thomas F. Chang, MD, and Mackenzie E. Brown, DO

Toe walking refers to the lack of heel strike during the stance phase of the gait cycle. It is a common variation of normal gait development in children. Persistent toe walking past 2–3 years of age warrants further evaluation as toe walking can be associated with cerebral palsy, muscular dystrophy, and autism spectrum disorders. The diagnosis of idiopathic toe walking is a diagnosis of exclusion used for children with persistent toe walking and no associated medical condition. Despite variable pathophysiology, the treatment of toe walking has similarities across diagnoses as it is focused on the maintenance of range of motion through the ankle.

Curr Probl Pediatr Adolesc Health Care 2017;47:156-160

Human gait has evolved over the last several million years into the well-defined pattern that we recognize today. It is well known that even though "we all learn to walk without instruction; there is very little deviation from the norm".[1] Typical heel–toe pattern develops by 24–42 months.[1–3] The pattern of toe walking, or lack of heel strike with initial contact is commonly present in children who are starting to walk, however, frequently causes significant parental concern, referrals to specialists, and, sometimes, unnecessary treatment.[3] To answer the question of when to worry, we will review different clinical scenarios with only one common symptom – toe walking; we will discuss recommendations for when and what further investigations are necessary.

Case 1: A 4-Year-Old Boy With a History of Persistent Toe Walking

He was born prematurely at 28 weeks' gestation and achieved his motor milestones in delayed fashion. He started to walk at 24 months, always on his toes. No other significant medical history is noted. His family history is unremarkable. His physical exam is positive for hypertonia, hyperreflexia, and weakness in the lower limbs. During gait observation, he is noted to ambulate consistently on his toes, he is unable to achieve flat foot stance, and he demonstrates exaggerated knee flexion and hip flexion, adduction, and internal rotation. His passive range of motion is within functional limits in bilateral lower limbs.

The case describes a young boy with hypertonia in the lower limbs due to spastic diplegic cerebral palsy (CP). While the etiology of hypertonia may vary, much of the pediatric literature related to hypertonia focuses on cerebral palsy. Children with CP present with increased muscle tone, decreased muscle strength, diminished selective motor control, and impaired balance and/or coordination. Gait is frequently affected with toe walking being a common finding due to hypertonia in the plantar flexors.[1] Treatment options for tone management in children with hypertonia include stretching, bracing, pharmaceuticals, and surgery (Fig 1). Various pharmaceutical options can be reviewed in the "Hypertonia" section.

Case 2: A 5-Year-Old Healthy Boy Presents as His Mother is Concerned That He is Walking Up On His Toes Frequently

As an infant and toddler he met his motor milestones but was late to meet his language milestones. His mother describes him as an aloof child and he tends to have temper tantrums. Family history is unremarkable. On exam he ambulates on his toes with absent heel strike 75% of the time, his ankles can be passively dorsiflexed to neutral bilaterally.

From the Division of Pediatric Rehabilitation Medicine, Children's National Health System, Washington, DC.

Curr Probl Pediatr Adolesc Health Care 2017;47:156-160
1538-5442/$ - see front matter

http://dx.doi.org/10.1016/j.cppeds.2017.06.004

FIG 1. Treatment options for toe walking: (A) stretching and bracing in a child with cerebral palsy and (B) serial casting.

This case describes an otherwise healthy patient with persistent toe walking lacking motor neuron or muscular symptoms. In the absence of neuromuscular findings, persistent toe walking may be indicative of a neuropsychiatric disorder. Currently, autism spectrum disorder is the neuropsychiatric disorder with the highest reported number of toe walkers followed by children with communication and language disorders.[4–8] And, while the link between toe walking and neuropsychiatric disorders has been well studied and validated, less clear is the physiological cause for toe walking in children with these disorders. It is proposed that persistent toe walking in these children is a result of a dysfunction in sensory processing.[4–6]

Coordinated gross motor movement relies on an intact sensory system. The sensory system is responsible for proprioceptive feedback that guides body positioning and posture. Deficits of the sensory system thus will lead to difficulty coordinating movements and normalizing posture. Children with autism may have sensory dysfunction, specifically impaired sensory integration. Sensory integration refers to neurological organization and interpretation of sensory input to the body from the environment.[7] A child with dysfunctional sensory integration will be challenged by impairments in tactile, vestibular, and proprioceptive input. It has been hypothesized that the children with sensory challenges may adjust their gait to a toe walking pattern to address the distorted sensory input.[6]

There are several theories that describe why dysfunctional sensory input leads to toe walking. Some of the proposed explanations describe the gait pattern as sensory seeking, for example, placing pressure on the ball of the foot may stimulate tactile receptors in the skin; the bouncy gait of toe walking may influence vestibular input; changes in the body's positioning via toe walking may alter proprioceptive feedback to knees and ankles. Conversely, other theories suggest that toe walking is a sensory avoidant behavior, such as toe walking to reduce surface contact with the ground and decrease sensory input to the feet. Of note, it has been proposed that the same sensory processing deficits that lead to toe walking may be partly responsible for the social and language impairments in these children, as dysfunctional sensory processing may affect their ability to properly interact with others.[4,7]

As with all persistent toe walking these children are at risk for developing tight heel cords that can limit range of motion at the ankles. Researchers have trialed various therapy practices to correct toe walking in children with neuropsychiatric comorbidities including overcorrection techniques and auditory reinforcement. However, currently there are no validated treatment options specifically for toe walking in children with neuropsychiatric disorders.[8] The treatment available is aimed at maintaining range of motion at the ankle through stretching, casting, bracing, botulinum toxin injection and surgical lengthening of the heel cords. Like idiopathic toe walkers indications for intervention will be unique to each case.

Persistent toe walking puts children at risk for developing tight heel cords and contractures that can limit range of motion at the ankles.

Case 3: A 4-Year-Old Boy With a History of Toe Walking for About 1 Year

This is a healthy boy who has a history of delayed independent ambulation at age of 19 months. He has