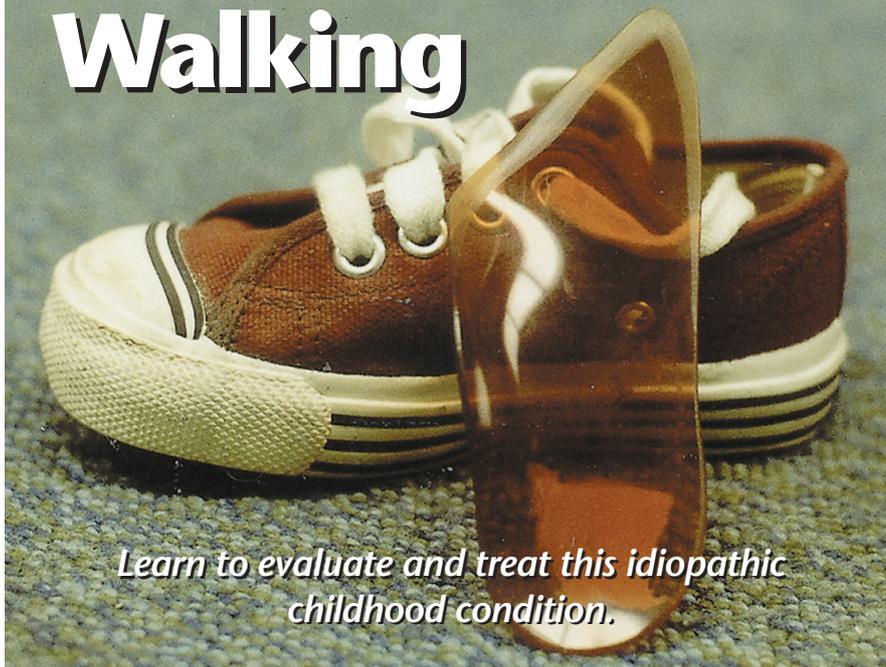


Habitual Toe Walking



Learn to evaluate and treat this idiopathic childhood condition.

Objectives

After reading this article the podiatric physician should be able to:

- 1) Recognize a pediatric patient that exhibits habitual toe walking
- 2) Take a proper medical and family history of a child suspected of toe walking
- 3) Understand other medical conditions that may cause a child to toe walk
- 4) Perform an appropriate physical examination to rule out non idiopathic toe walking etiologies
- 5) Develop a treatment plan for a child that is determined to be a habitual (idiopathic) toe walker

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Following this article, an answer sheet and full set of instructions are provided (p. 176).—**Editor**

By Mark A. Caselli, DPM

Habitual toe walking is a condition in which orthopedically and neurologically normal children prefer to and persistently ambulate on the balls of their feet. Since this type of gait pattern in children is not truly a habit, better terms may include idiosyncratic or

idiopathic toe walking. The usual developmental sequence for learning to walk does not include walking on the toes²⁹ and generally proceeds gradually to a heel-toe pattern with a heel strike at 18 months and a heel-to-toe gait achieved by age three.³⁷ Tiptoe walking, though, is considered by many to be a normal variant or phase that some children

go through when learning to walk,^{8,16,17,40} which is generally outgrown three to six months after first walking^{34,40} or by age seven.²⁰ Yet toe walking has been observed well into adolescence and even adulthood.

The etiology of toe walking has been attributed to: congenital short tendo calcaneus;¹⁷ abnormal soleus

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muscle;⁴⁰ unknown central nervous system defect;²⁰ autosomal dominant inheritance with unequal penetrance;²⁴ delayed maturation of the cortical spinal tract;⁴⁰ normal transient phase of development;⁴² vestibular dysfunction;^{12,25} viruses;⁷ time spent in baby walkers;⁵ and habit.¹⁶ Though the actual cause of idiopathic toe walking is unknown, muscle biopsies taken from a group of 25 toe walkers demonstrated some common abnormalities in the muscle fibers and associated capillaries suggesting that there might be an underlying neuropathic process.¹⁴ Toe walking has also been found to occur with high frequency in children with cerebral palsy⁴ and muscular dystrophy³¹ and has been associated with autism,⁴² childhood schizophrenia,¹² delayed language development,^{1,2} and low IQ.²

Studies in the literature that deal with toe walking that is not associated with neuromuscular or mental disease vary in their conclusions from toe walking having no long-term neuro-orthopedic consequences to the possibility that persistent toe walking results in significant ankle equines, requiring surgery (Table 1). Toe walking that is not associated with cerebral palsy has been estimat-

ed to occur in 7% to 24% of the normal childhood population.^{1,8,15}

Medical and Family History

The diagnosis of habitual toe walking is one of exclusion, in which other causes of toe walking, such as ankle equinus, cerebral palsy, or myopathy are ruled out.^{16,20,26} A thorough medical histo-

A normal child will tend to become fatigued while walking on his/her toes much earlier than the habitual toe walker.

ry, family history, gait evaluation, musculoskeletal examination, and neurologic examination are necessary for this purpose.

A prenatal, intrapartum, and postnatal history is of paramount importance in ruling out neuromotor disease. The prenatal history should include family as well as maternal history. It is important to ascertain whether or not other mem-

bers of the family are toe walkers. Family history of toe walking in the literature ranges from 10% to 88% and is considered to be a characteristic of toe walking (Table 1). Pregnant women at both extremes of the reproductive age group, under 16 and over 30, are in the obstetric high-risk group, which may lead to neurologic deficit in the newborn. Previous obstetric history, including number of pregnancies, miscarriages, birth weight, and health status of other children, should be obtained. A history of having taken any medicines or home remedies during pregnancy as well as drug abuse, both narcotic and non-narcotic, is important since they may affect the fetus and the newborn. Length of gestation should be obtained since premature and postmature infants are at risk. The mother's own measure of fetal activity is sometimes helpful in assessing maturity and vigor of the fetus.

Intrapartum events, such as fetal heart rate, rupture of membranes, length of labor, maternal medications, and other complications of labor and delivery should be obtained. The history of the immediate postnatal course, including fetal distress and hypoxic episodes, can indi-

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**TABLE 1
TOE WALKING STUDIES**

Study	Number	Family History (%)	First Walked (Months)	Ankle Dorsiflexion
Sobel and Caselli ³³	60, ages 1-15 years (33 males, 27 females)	30	11.1	-20° to +40° (Average +6.2°)
Hall et al ¹⁷	20 (15 males, 5 females)	10	—	-30° to -60°
Griffin et al ¹⁶	6, ages 5-9 years (3 males, 3 females)	67	8-13	-10° to +5°
Furrer ¹⁵	28 (20 males, 8 females)	50	13	+4° to +16°
Katz and Mubarak ²¹	8 (4 males, 4 females)	88	—	-10° to +5° (Average 0°)
Kalen et al ²⁰	18 (14 males, 4 females)	71	11.7	-30° to +5° (Average -10°)
Hicks et al ¹⁸	7	—	12.3	-5° to +20° (Average 3°)

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cate injury to the central nervous system. Birth weight and length of hospital stay is important and easily-obtained historical information.

The next part of the history should consist of obtaining the child's developmental milestones. A child should be able to sit upright independently by six to seven months and should begin walking



Fig. 1: Typical stance of a habitual (idiopathic) toe walker.



Fig. 3: Scissor gait of spastic cerebral palsy.

between 9 and 15 months. Toe walkers have been reported to walk on time, begin toe walking immediately when first starting to walk and are usually able to demonstrate a heel-toe gait (Table 1). A child with habitual toe walking will usually have a normal birth and developmental history. The length of time the child remains on his toes compared to the total length of ambulation time and whether or not this



Fig. 2: A tread mat is a simple tool that can demonstrate valuable gait pattern information.



Fig. 4: Pseudoscissor gait can mimic cerebral palsy.

ratio is increasing or decreasing is important in predicting the course of the toe walking.

Gait Evaluation

The initial approach to the child with habitual toe walking should consist of gait analysis, beginning with careful gait observations. The child should be evaluated with and without shoe gear, since shoes can often mask the true nature of the child's gait pattern. The following are observations that are consistent with the diagnosis of habitual toe walking. These observations are made with the child walking bare-foot.(Fig. 1)

1) The child walks on his/her toes (balls of their feet) in a well-coordinated, balanced, and efficient manner.

2) While toe walking, the child exhibits a normal angle and base of gait.

3) The child is capable of running with minimal to no tripping or falling.

4) The child is capable of walking both forward and backward easily while toe walking.

5) The child is capable of standing with his/her heels on the ground (full foot contact).

6) The child may take his/her first few steps in a heel-to-toe or full-foot contact fashion and rise to toe walking only when increasing the speed of ambulation.

In summary, the gait observations of a child with habitual toe walking should be similar to those of a normal well-coordinated child who has elected to walk on his/her toes for a short period of time, the one distinguishing difference being that the normal child will tend to become fatigued while walking on his or her toes much earlier than the habitual toe walker.

There are several gait analysis techniques, including the tread mat and video recording, that can be valuable tools in both the diagnosis and assessment of the progression of habitual toe walking. These methods also provide a permanent, objective record.

Tread Mat

The tread mat (as modified from the original clinical descriptions and applications of Richard O. Schuster,

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DPM) is a simple, inexpensive method of creating a permanent record of a child's gait pattern. (Fig. 2) It reveals changes that are not always perceptible to the eye. The materials required for making a tread mat include (1) a roll of dark colored paper, approximately 20 inches wide; (2) fine powder such as talc or plaster powder; and (3) a can of hair spray to permanently affix the powder to the paper, if so desired. The procedure for making a tread mat includes placing the powder at the end of a 15 to 25 foot strip of paper. The child is then placed in the powder and encouraged to walk along the mat. This can be accomplished by

asking the parent to stand at the opposite end of the paper. As the child walks or runs to the parent, a powder impression is made on the paper.

In evaluating a child with habitual toe walking the percentage of forefoot and heel contact can be assessed by observing the transference of powder onto the paper. This technique will often reveal signs of heel contact that may not be discernible by visual gait analysis. The tread mat can also be used to evaluate the angle of gait, base of gait, length of step, and width of stride.

Video Gait Analysis

Video gait analysis is a useful tool in the evaluation of habitual toe walking as well as any other gait disturbance. Video gait analysis allows for both slow motion and stop frame evaluation of gait patterns. Straight-line comparison drawings can be made; thus, measurements such as heel elevation at any given phase of gait can be compared from one visit to the next. This analysis provides an invaluable tool in maintaining accurate records of progress over the treatment period.



Fig. 5: Classic high top straight last shoe is effective in inhibiting toe walking progression.

Physical Examination

A thorough musculoskeletal examination should be performed on all patients presenting with a chief complaint of habitual toe walking. The static lower extremity examination of the habitual toe walker should demonstrate normal foot and leg alignment and appearance. There should be no significant frontal, transverse, or sagittal plane deformities and no signs of muscle atrophy. Special attention must be paid to the evaluation of ankle dorsiflexion. The habitual toe walker will usually demonstrate at least 5 to 10 degrees of passive ankle dorsiflexion with the knee extended and the subtalar joint held in its neutral position. (Table 1) Although some patients diagnosed solely as habitual toe walkers exhibit a slight ankle equinus, this appears to be an accommodation secondary to them spending long periods of time toe walking.³³ A significant ankle equinus, even if present, does not appear to be the prime etiology of habitual toe walking.

Habitual toe walkers should demonstrate a normal neurologic status. In addition to exhibiting normal neuromotor development for their age, their deep tendon reflexes, vibratory, positional, pain, and temperature sensations as well as their muscle power should be within normal limits. Electromyographic studies of Griffin et al¹⁶ showed that habitual toe walkers demonstrated no evidence of clonus or of muscle activity at rest. These studies further showed that gastrocnemius and soleus-muscle activity during the swing phase was present during toe-toe gait in both normal walkers as well as in habitual toe walkers. Before treatment, habitual toe walkers demonstrated increased amplitude and prolonged duration of activity of the tibialis anterior muscle during heel-toe gait as well as overlap of tibialis anterior activity with gastrocnemius and soleus activity. After treatment with serial casts, the gait pattern of the habitual toe walkers as recorded electromyographically was normal.

Differential Diagnosis

Habitual toe walking is a diagnosis of exclusion and therefore early examination of toe walkers is impor-

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tant in differentiating the habitual toe walker from the following serious neuromuscular, psychological, and skeletal pathologies that can cause other forms of toe walking.

Cerebral Palsy

Cerebral palsy (perinatal encephalopathy)^{3,10,27,30,38} is a fixed non-progressive neurologic deficit acquired before, during, or in the months after birth. Despite the non-progressive nature of the damage, the clinical expression may change as the child matures. The medical history may reveal perinatal cerebral injury. Although there are many forms of cerebral palsy, the most common and the one most likely to produce a toe walking-like gait is the spastic form.³⁰ Neuromotor developmental milestones, including independent ambulation, are usually significantly delayed. The physical examination demonstrates increased tone, hyperactive reflexes, and an extensor plantar response. The child is usually brought to the physician out of fear of motor retardation. A movement disorder may occur in any single limb or any combination of limbs.

Talipes equinovarus or equinovalgus foot deformities are often present along with an unstable scissor gait pattern.(Fig. 3) The equinus can be due to a spastic gastrocnemius or gastrocnemius and soleus muscle. Electromyographic studies³⁰ have demonstrated that some cerebral palsy patients have a primitive extensor reflex elicited by knee extension that causes contraction of both the soleus and gastrocnemius muscle. Presence of the primitive extensor reflex or spasticity of the gastrocnemius muscle corresponds to a bouncing gait pattern in which the heel comes down when the knee is bent. Studies have suggested that electromyographic testing may be helpful in differentiating patients with mild cerebral palsy from those with idiopathic toe walking.^{28,33,38}

Pseudoscissor Gait

A variant of habitual toe walking, pseudoscissor gait, must be recognized and differentiated from the scissor gait pattern of cerebral palsy.(Fig. 4) Pseudoscissor gait oc-

curs when there exists a combination of habitual toe walking and adducted limb position due to internal tibial torsion and/or internal femoral position (femoral antetorsion). The child with a pseudoscissor gait pattern usually demonstrates greater stability than the child with a scissor gait from cerebral palsy. Although the child with a pseudoscissor gait may frequently trip and fall, he ex-

hibits no signs of spasticity or neuromotor deficit.

Mental Retardation

Mental retardation is often associated with toe walking.^{22,25} Mental retardation refers to cognitive ability (as measured by intelligence tests) and to the resultant summation of a person's competency in social adaptation. It is often

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possible to imply mental deficiency in infancy by recognizing the infants' total disorder (for example, Down syndrome). Behavioral clues to the diagnosis include perseveration, dependency on routine, distractibility, fear, lack of spontaneity, and poor judgment. Repetitive physical activities disturbing



Fig. 6: Construction type boots with outer sole wedge offer a more acceptable approach for many parents.

to others such as rocking, head banging, and temper tantrums are likely.

Neurologic functioning is frequently altered as evidenced by hypertoncity, hypotonicity, ataxia, altered reflexes, poor coordination, and seizures. Speech is delayed and facial expression often shows the "stigmata of degeneracy."^{32,41}

Toe walking among mentally retarded children is seen by Montgomery²⁵ as being due to vestibular dysfunction. Immediately after vestibular stimulation (trampoline bouncing and spinning in a hammock), 13 of 17 mentally retarded toe walkers temporarily discontinued toe walking. Montgomery found that the most consistent finding among the 17 mentally retarded children who toe walked was hypotonia and inadequate vestibular integration.

Autism

Autistic^{11,12,22,41,42} children are principally disturbed in their lack of emotional rapport and in their behavioral characteristics. They show seclusiveness, irritability when seclusiveness is disturbed, day dreaming, bizarre behavior, decrease of interest, regression of interpersonal interests, and sensitivity to criticism. There is a gradual withdrawal from affective contact with people and an increasing tendency to brood. Speech becomes disorganized and limited to early infantile interest. Among 52 3-13 year-old autistic children, Colbert and Koebler found ten persistently toe walked.¹¹ This toe walking was not an isolated phenomenon, but only part of their spontaneous whirling, dancing, and jumping behavior.^{12,22} All of these children tested as being mentally defective but their neurologic examinations were within normal limits. Weber⁴² notes that the definitive stepping movements prior to autonomous walking by a normal child take place on the forefoot between the 9th and 16th months. She concluded that toe walking by both autistic and nonautistic children with developmental disturbances (but without pyramidal symptoms) arises from the "fixation of a normal transient stage of development."

Diastematomyelia

Diastematomyelia^{19,41} consists of a partial or complete division of the spinal cord by tissue located in the midline of the spinal canal. Neurologic deficits are usually not apparent at birth. The spinal cord is tethered to the spinal canal, which grows caudally relative to the cord. A mixed upper and lower motor neuron deficit involving bladder and bowel function and progressive disturbances in gait begin to develop at two or three years of age. Suspicion is aroused by overlapping cutaneous anomalies such as hypertrichoses, dimples, lipomas, or vascular malformations. A cavus deformity of the feet is common. The feet take on varus or valgus positions due to flaccid or spastic paralysis. Foot ulcerations appear due to analgesia and trauma. Differentiation

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from habitual toe walking is made easier by the progressive nature of diastematomyelia where toe walking begins at two or three years of age and increases in severity. Habitual toe walking is present at the start of autonomous walking and diminishes with age.

Muscular Dystrophy

Muscular dystrophy³⁹ of the Duchenne as well as the mild limb-girdle form are associated with toe walking. The toe walking and a pointed foot posture at rest are the result of a disturbance of the antagonistic balances of the variously afflicted muscle groups. Contractures appear after some years. If the diagnosis of muscular dystrophy is missed and patient is immobilized either to stretch the triceps surae or post surgical lengthening, it is very difficult to recover muscle function. Temporal clues are important in ruling out muscular dystrophy as a cause of toe walking in a child. Limb girdle muscular dystrophy's first symptoms usually appear in the second decade. With the more common Duchenne muscular dystrophy, the child may walk later than expected with frequent falls while learning to walk. The toe walking is not evident until three or four years of age and progressively increases. Other signs of Duchenne muscular dystrophy include rocking from side to side with a waddling gait, lumbar lordosis, and difficulty in climbing stairs and rising from the floor.

Gastrocnemius Soleus Muscle Equinus

Gastrocnemius soleus muscle equinus is probably the most common entity to be ruled out in considering the diagnosis of habitual toe walking.³ Indeed, the author has found that many persistent habitual toe walkers demonstrated a slight limitation of ankle dorsiflexion, but hardly enough to be responsible for the observed 30 to 60 degrees of positional equinus during gait.

The Silfverskjold test, first used to differentiate spastic gastrocnemius equinus from spastic gastrosoleus

equines, can be usefully applied to evaluate non-spastic short calf muscles.^{27,35,38} Limited dorsiflexion present with the knee extended and absent with the knee flexed indicates a functionally shorter gastrocnemius muscle. Dorsiflexion limited equally with knee extended or flexed is consistent with a combined gastrocnemius soleus muscle equinus.

Clinically, a child with a gastrocnemius soleus muscle equinus will stand with an abducted stance angle and will often exhibit a genu recurvatum (knee hyperextension) and significant midtarsal pronation. The child walks and runs with an early heel lift-off creating a bouncing gait pattern.

Treatment

Although habitual toe walking is often considered a transient retardation of a normal stage of development, it is nevertheless associated with problems that warrant active treatment. Ambulation is awkward and when combined with internal limb rotational deformities will often lead to instability with injuries due to tripping and falling. Decreasing the toe walking attitude and accelerating the progression to heel-toe gait is also valuable in decreasing parents' anxiety over this condition

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Treatment of habitual toe walkers might include shoe therapy, orthosis therapy, auditory feedback, and surgery.



Fig. 7: Gait plates may help in mild cases of toe walking with intoe gait.

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as well as probably reducing a structural ankle equinus that may result from persistent toe walking.³³

Many approaches have been employed in the treatment of the child with habitual toe walking. These methods include shoe therapy, orthoses, serial casting, cognitive muscle management, and surgery.

Shoe Therapy

Shoe therapy consists of the use of a rigid sole straight last shoe. The rigid sole does not permit the child to dorsiflex at his metatarsal-phalangeal joint, preventing forefoot support and thus bringing the heel down to the ground. Whenever possible, high top shoes should be used. (Fig. 5) This prevents the child's



Fig. 8: An ankle foot orthosis (AFO) prevents toe walking progression.

heel from slipping out the back of the shoe and also allows for the interior modification of the shoe such as the addition of heel lifts. The effectiveness of the shoes in inhibiting toe walking can be enhanced by adding a 1/8 to 3/8 inch outer sole wedge. The wedge increases the rigidity of the sole as well as inducing foot abduction that further forces the heels to the ground. In older children, we have found it beneficial to increase the height of the heel of the shoe to the point at which the child exhibits a heel-toe gait pattern. The heel height is later reduced gradually on subsequent visits every few months. A high top construction boot with a rigid sole and outer sole wedge can also be used. (Fig. 6) The author has found this treatment modality to be very effective in reducing the toe walking progression. The key to success in shoe therapy is to start treatment at a young age (as soon as toe walking is noticed) and continue use of the shoes until the child no longer toe walks when barefoot. The rigid shoes are often worn for six months to two years (the older the child, the longer the shoes are worn).

Orthosis Therapy

Orthotic devices used in the treatment of habitual toe walking include heel lifts, gait plates and ankle-foot orthoses. Heel lifts placed in shoes accommodate for the dynamic equinus and act as a biofeedback for muscle cognition by providing proprioception to the heels during gait. The lifts should be high enough to make contact with the heels during gait and then gradually reduced. Gait plates,

rigid foot orthoses designed to induce out-toe, may be of benefit in mild cases of habitual toe walking. (Fig.7) The gait plate orthoses are used in flexible soled sneakers and the resultant abductory influence will often bring the heels down to the ground. Ankle-foot orthoses, braces that prevent motion from occurring at the ankle, can be used as both ambulatory devices and as night splints. (Fig. 8) During ambulation, these devices serve as a viable alternative to walking casts and as night splints they may be used to prevent the development of contractures in the posterior leg musculature.

Short leg walking casts^{6,16,26} applied from six to eight weeks have been shown to be successful in the treatment of habitual toe walkers. (Fig. 9a & 9b) Electromyographic studies performed after this regimen of treatment revealed a normal gait pattern.

Auditory Feedback

Auditory feedback, as a method of cognitive muscle management, has been shown to have a positive effect on reducing toe walking. In one study,¹³ eight children with dynamic equinus were able to increase the time their heels contacted the ground by 45 percent and the number of times their heels contacted the ground by 42 percent six months after the end of augmented auditory feedback training. Seven of the eight originally could have their ankles dorsiflexed to the perpendicular and one child lacked five degrees to reach the perpendicular with his foot inverted and knee in extension. A switch had been placed under the more involved heel and bringing the

heel down produced a sound. Each child sought to achieve that sound as frequently and for as long as possible during three months of one hour daily practice sessions.

Surgical Intervention

Surgical lengthening of the Achilles tendon should only be considered when

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Fig. 9: a & b Walking casts can be fabricated from (a) plaster or (b) fiberglass.

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a significant structural gastrosoleus muscle equinus can be demonstrated. It must be emphasized that the structural equinus probably represents a concomitant physical finding and is not the primary etiology of the toe walking. Percutaneous Achilles tendon lengthening followed by below-knee walking casts has been reported to yield positive results,^{23,36} though it has been the author's experience, as well as that of Hall and associates,¹⁷ who treated a group of 20 children who were persistent toe walkers with tendo-Achilles lengthening, that postoperatively some of the children still walk on their toes. This would seem to fortify the assumption that habitual toe walking is neurogenic in origin rather than musculoskeletal.

Summary

Habitual toe walking has been presented as a prolongation of a normal stage of development that requires conservative treatment to prevent or ameliorate associated gait abnormalities such as tripping and falling, as well as possible significant residual ankle equinus. An approach to the evaluation of a child with toe walking should include (1) medical and family history (prenatal, intrapartum, and postnatal), (2) gait evaluation, (3) musculoskeletal examination, and (4) neurologic examination. Pathologic entities producing toe walking have been explored in order to differentiate those conditions from idiopathic (habitual) toe walking. The most common etiologies of toe walking (non-habitual) would include gastrosoleus equinus and cerebral palsy. Treatment of habitual toe walkers might include shoe therapy, orthosis therapy, auditory feedback, and surgery. ■

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Dr. Caselli is Staff Podiatrist at the VA Hudson Valley Health Care System And Adjunct Professor, Department of



Orthopedic Sciences at the New York College of Podiatric Medicine. He is Former Chairman, Department of Orthopedic Sciences and Director, Department of Podiatrics at NYCPM.

EXAMINATION

See answer sheet on page 177.

- 1) Which one of the following disorders has not been found to be associated with habitual toe walking?
 - A) Cerebral palsy
 - b) Schizophrenia
 - C) Poliomyelitis
 - D) Muscular dystrophy

- 2) A history of fetal distress or hypoxic episodes occurring shortly after birth is important since it can indicate:
 - A) Autistic tendencies
 - B) Central nervous system damage
 - C) Skeletal deformities
 - D) Major joint instability

- 3) Obtaining a history of a child's developmental milestones is important in assessing neuromotor development. A child should be able to sit independently in a high chair by what age?
 - A) 3 to 4 months
 - B) 6 to 7 months
 - C) 9 to 12 months
 - D) None of the above are correct

- 4) The history of a habitual (idiopathic) toe walker will usually include which one of the following?
 - A) Slight delay in beginning to walk independently
 - B) Begin toe walking 3-6 months after beginning to walk
 - C) Able to demonstrate heel-toe gait
 - D) Tend to trip and fall frequently

- 5) Which one of the following gait observations is not typical of a habitual toe walker?
 - A) Normal angle and base of gait
 - B) Cannot walk backwards
 - C) Can stand with heels on floor
 - D) May take occasional heel to toe steps

- 6) Electromyographic studies of habitual toe walkers demonstrated which one of the following characteristics?
 - A) No different than that of the non-toe walker
 - B) Clonus with muscle activity at rest
 - C) Overlap of gastrocnemius and anterior tibial activity
 - D) Increased quadriceps activity

- 7) Cerebral palsy is a primary differential for habitual toe walking. Which one of the following findings is most significant in making the diagnosis of cerebral palsy?
 - A) Constant tripping and falling
 - B) Beginning ambulation at 28 months
 - C) Severe in-toeing
 - D) Low birth weight

- 8) Which type of cerebral palsy is most commonly associated with toe walking?
 - A) Spastic
 - B) Athetotic
 - C) Ataxic
 - D) Rigid

- 9) Which of the following is not characteristic of pseudoscissor gait?
 - A) Internal tibial torsion
 - B) Toe walking
 - C) Tripping and falling
 - D) Spastic muscles

- 10) Toe walking seen associated with mental retardation has been speculated to be due to:
 - A) Tight posterior muscle group
 - B) Hypotonia
 - C) Vestibular dysfunction
 - D) Poor coordination

- 11) Autistic children that toe walk have been found to have all but which one of the following characteristics?
 - A) Early walker
 - B) Neurologically normal
 - C) Toe walking combined with whirling
 - D) Mentally defective

- 12) Which one of the following is a common finding in diastematomyelia?
 - A) Neurological defects at birth
 - B) Flatfoot deformity
 - C) Neuropathic foot ulcerations
 - D) Symptoms improve with age

- 13) Which one of the following treatment modalities should not be instituted in a child with muscular dystrophy?
 - A) Shoe therapy
 - B) Ankle foot orthosis (AFO)
 - C) Gait plates
 - D) Auditory feedback

- 14) Which one of the following disorders is characterized by a waddling gait?
 - A) Spastic cerebral palsy
 - B) Autism
 - C) Duchenne muscular dystrophy
 - D) Diastematomyelia

- 15) The most important characteristic for a shoe to have in order to inhibit toe walking is a:
 - A) Straight last

Continued on page 176

- B) High top
- C) Rigid sole
- D) Heel lift

16) Modifications that can be added to a shoe to improve heel contact progression include all of the following except:

- A) High top
- B) 1/4 inch inner sole wedge
- C) Heel lift
- D) Steel sole plate

17) Shoe therapy for habitual toe walking should be instituted for:

- A) 1-2 months
- B) 3-6 months
- C) 1-2 years
- D) Until toe walking ceases

18) Which one of the following orthoses has not been found helpful in inhibiting toe walking progression?

- A) Twister cable
- B) Gait plates
- C) Ankle foot orthosis (AFO)
- D) Heel lifts

19) Studies have shown that the following surgical procedure has been found effective in the treatment of toe walking?

- A) Z-plasty of the tendo-Achilles
- B) Slide lengthening of the posterior tibial tendon
- C) Percutaneous Achilles tendon lengthening
- D) None of the above

20) Based on this article, which of the following statements best describes habitual (idiopathic) toe walking?

- A) Habitual toe walking is a totally benign condition
- B) Habitual toe walking is a self limiting condition that always resolves in early childhood
- C) Habitual toe walking should be aggressively treated surgically
- D) Habitual toe walking warrants early conservative treatment to inhibit the toe walking progression and reduce resultant ankle equinus

See answer sheet on page 177.

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(Rehm)**

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| 5. A B C D | 15. A B C D |
| 6. A B C D | 16. A B C D |
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Toe Walking
(Caselli)**

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| 5. A B C D | 15. A B C D |
| 6. A B C D | 16. A B C D |
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