



## ORIGINAL ARTICLE

# Do children with attention deficit and hyperactivity disorder (ADHD) have a different gait pattern? Relationship between idiopathic toe-walking and ADHD<sup>☆</sup>

Víctor Soto Insuga<sup>a,\*</sup>, Beatriz Moreno Vinués<sup>a</sup>, Rebeca Losada del Pozo<sup>a</sup>,  
María Rodrigo Moreno<sup>a</sup>, Marta Martínez González<sup>b</sup>, Raquel Cutillas Ruiz<sup>c</sup>,  
Carmen Mateos Carmen<sup>c</sup>

<sup>a</sup> Servicio de Pediatría, Hospital Universitario Fundación Jiménez Díaz, Madrid, Spain

<sup>b</sup> Servicio de Pediatría, Complejo Hospitalario Universitario de Albacete, Albacete, Spain

<sup>c</sup> Servicio de Rehabilitación, Hospital Universitario Fundación Jiménez Díaz, Madrid, Spain

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**KEYWORDS**

Idiopathic  
toe-walking;  
Toe-walkers;  
Attention deficit and  
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disorder;  
Sensory processing

**Abstract**

*Introduction:* Idiopathic toe-walking (ITW) is described as a gait pattern with no contact between the heels and the ground in children older than 3 years. The diagnosis is clinical, making it necessary to rule out other neurological and orthopaedic conditions. A relationship between ITW and vestibular dysfunction and/or proprioceptive sensibility has been proposed. Children with neurodevelopmental disorders (autism, language and cognitive disorders) often have ITW.

*Objectives:* To determine the frequency of ITW in children with attention deficit disorder and hyperactivity (ADHD).

*Patients and method:* A study was conducted on children diagnosed with ADHD, with normal neurological examination, with no alterations in MRI scan, cognitive disorder or autism. A complete clinical anamnesis was performed and Achilles shortening was measured with a goniometer.

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\* Corresponding author.

E-mail address: [victorsotoinsuga@gmail.com](mailto:victorsotoinsuga@gmail.com) (V. Soto Insuga).

**Results:** The study included 312 children with a mean age of 11 years (73.7% boys). The ADHD combined subtype was the most frequent (53.8%), followed by the inattentive (44.9%), and hyperactive (1.3%). ITW was observed in 20.8% of patients, particularly in the combined subtype ( $P = .054$ ). Only 32 of them (49.2%) had Achilles shortening. ITW was associated with sociability disorders ( $P = .01$ ), absence of pain in legs ( $P = .022$ ), and family history of ITW ( $P = .004$ ). Only 11% had previously visited a doctor for this reason.

**Conclusions:** As in other neurodevelopmental disorders, children with ADHD have frequently more ITW and Achilles shortening than controls, especially if they presented with a social communication disorder or a family history of ITW. An early diagnosis is essential to establish effective treatments.

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## PALABRAS CLAVE

Marcha de puntillas idiopática;  
Andadores de puntillas;  
Trastorno por déficit de atención e hiperactividad;  
Procesamiento sensorial

## ¿Caminan de manera diferente los niños con trastorno por déficit de atención hiperactividad (TDAH)? Relación entre marcha de puntillas idiopática y TDAH

### Resumen

**Introducción:** La marcha de puntillas idiopática (MPI) se describe como el patrón de marcha sin apoyo del talón en niños mayores de 3 años. El diagnóstico es clínico y obliga a descartar otras enfermedades neurológicas y traumatológicas-ortopédicas. Se postula su relación con una disfunción vestibular o de sensibilidad propioceptiva. Los niños con trastornos del neurodesarrollo (trastorno del espectro autista, trastorno del lenguaje y cognitivo) presentan frecuentemente MPI.

**Objetivos:** Analizar la frecuencia de MPI en niños con trastorno por déficit de atención e hiperactividad (TDAH).

**Pacientes y método:** Estudio en niños diagnosticados de TDAH con exploración neurológica normal, sin alteraciones en neuroimagen ni trastorno cognitivo o trastorno del espectro autista. Se realizó anamnesis completa y se valoró la presencia de acortamiento aquileo con goniómetro.

**Resultados:** Se analizó a 312 niños con edad media de 11 años, el 73,7% varones. El subtipo combinado fue el más frecuente (53,8%), seguido del inatento (44,9%) e hiperactivo (1,3%). Un 20,8% de los pacientes presentaban MPI, que era más frecuente en el subtipo combinado ( $p = 0,054$ ). Solo 32 de estos (49,2%) presentaban acortamiento aquileo. La presencia de MPI se relacionó con alteraciones en el área de la sociabilidad ( $p = 0,01$ ), ausencia de dolor en miembros inferiores ( $p = 0,022$ ) y antecedentes familiares de MPI ( $p = 0,004$ ). Solo el 11% habían consultado por este motivo previamente.

**Conclusiones:** Al igual que en otros trastornos del neurodesarrollo, los niños con TDAH presentan con mayor frecuencia MPI y acortamiento aquileo, especialmente entre aquellos con trastornos de comunicación social o antecedentes familiares de MPI. Es fundamental una identificación precoz para instaurar tratamientos eficaces.

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## Introduction

Idiopathic toe walking (ITW) is defined as a gait pattern in children aged more than 3 years characterised by the bilateral absence of heel contact with the ground ('walking on tiptoes'). It is a clinical diagnosis that requires ruling out other neurologic or traumatologic-orthopaedic conditions that may cause a similar gait.<sup>1,2</sup> Before age 2 years, this pattern is considered normal, and it resolves spontaneously in most children, as demonstrated by a longitudinal study by Engström et al. with follow up of a cohort of Swedish children through age 5 years. Only 30 of the 70 children who toe-walked at the beginning of the study continued to do so at age 5 years.<sup>3</sup>

Based on several studies, the prevalence of ITW in healthy children is estimated at 7–24%.

In addition to pain and increased instability, children with persistent ITW lose the ability to dorsally flex the ankle, which results in a shortened Achilles tendon.

When it comes to the aetiology of ITW, a hereditary pattern of ITW has been described since the earliest studies. Other studies have proposed impairments in sensory processing and proprioception as the cause of this gait pattern.<sup>4–6</sup>

The increased prevalence of ITW in children with autism spectrum disorder is well known, but several studies have also reported an association of ITW with other neurodevelopmental disorders. In a sample of 163 children, Accardo

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