



Original Research

Do Textured Insoles Affect Postural Control and Spatiotemporal Parameters of Gait and Plantar Sensation in People With Multiple Sclerosis?

Alon Kalron, PhD, Diana Pasitselsky, BPT, Michal Greenberg-Abrahami, MA,
Anat Achiron, MD, PhD

Abstract

Background: Balance and gait deficits are common in people with multiple sclerosis (MS). Physical interventions directed at improving balance and walking abilities have been implemented using various approaches. Nonetheless, no mode of training has been universally agreed upon.

Objectives: To determine whether textured insoles have immediate effects on postural control and spatiotemporal parameters of gait and plantar sensation in people with MS and to explore effects 4 weeks after insole wear as to whether any immediate effects are maintained over time.

Design: Within-subject experimental study with a 4-week intervention phase.

Settings: Multiple Sclerosis Center, Center of Advanced Technologies in Rehabilitation, Sheba Medical Center, Tel-Hashomer, Israel.

Participants: Twenty-five relapsing-remitting patients diagnosed with MS, 16 women and 9 men, aged 49.6 years (standard deviation = 6.5 years).

Intervention: Textured insoles customized according to foot size and adapted to the participant's casual shoes.

Main outcome measures: Spatiotemporal parameters of gait and center of pressure (CoP) excursions during static postural control were studied using the Zebris FDM-T Treadmill. Light-touch and pressure-sensation thresholds were determined using the Semmes-Weinstein monofilaments test.

Results: Textured insoles did not alter static postural control parameters when examined with eyes open. Examination during the eyes-closed task demonstrated an immediate reduction in the CoP path length (298.4 mm, standard error = 49.7 mm, versus 369.9 mm, SE = 56.3 mm; $P = .04$) and sway rate (12.0 mm/s, standard error = 1.4 mm/s, versus 15.1 mm/s, standard error = 1.6 mm/s; $P = .03$) after insertion of the textured insoles compared to casual shoes alone. These findings were maintained at termination of the insole 4-week intervention period. In terms of spatiotemporal parameters of gait, differences were not observed between casual shoes and shoes with textured insoles at baseline. Likewise, no differences were observed between initial and concluding gait trials. Significant differences in plantar sensitivity measures were not observed after the insole 4-week intervention phase.

Conclusions: Although there were improvements in some aspects of balance, the efficacy of textured insoles in the MS population remains unclear.

Introduction

Balance and gait deficits are common in people with multiple sclerosis (MS). These very disabling deficits reduce mobility and independence, lead to falls and injuries, and negatively affect quality of life [1-3]. In general, physical interventions directed at improving balance and walking abilities have implemented various approaches: for example, motor and sensory strategies [4], Feldenkrais exercises [5],

robot-assisted gait training [6], kickboxing [7], Pilates exercises [8], Ai-Chi exercises [9], Nintendo Wii games [10], strength and aerobic training [11], and neuromuscular facilitation [12,13]. Nevertheless, no mode of training has been universally agreed upon. Moreover, although PwMS use many fall prevention tactics, they nonetheless frequently fall [14]. Thus, additional types of intervention strategies aimed at improving balance and walking for people with MS should be considered.

It has been shown that feedback from plantar cutaneous afferents is important for the maintenance of normal balance when vision is inaccessible [15]. In addition, foot sole input contributes to the coding and the spatial representation of body posture [16]. Therefore, theoretically, wearing textured insoles can affect gait and balance by increased stimulation to the plantar surface of the feet, thereby influencing neuromuscular function. Several studies have reported that textured insoles reduce postural sway during standing in healthy young [17] and older [18-20] people. However, other studies have shown no clear benefit to healthy people [21] and older individuals who fall [22], during similar gait and balance tasks.

It is well known that somatosensory deficit is a common feature of MS. Furthermore, previous trials have demonstrated that slowed spinal somatosensory conduction in people with MS while standing leads to extremely delayed postural responses [23]. Therefore, it is reasonable to consider textured insoles as an intervention alternative aimed at improving gait and balance abilities in people with MS. To date, there has been limited research as to the effects of textured insoles on mobility performance in the MS population [24,25].

According to our literature investigation, 2 studies examined this intervention strategy in PwMS. Kelleher et al, in a small study of 14 patients with MS, reported several effects on gait kinematics and kinetics, including benefits to knee and hip excursion, and ground reaction forces when wearing textured insoles constructed from sandpaper [24]. Conversely, no immediate effects were demonstrated in gait and balance performance in a group of 46 patients with MS who wore textured insoles. However, following a 2-week intervention phase of insole wear, improvements were observed in spatiotemporal parameters of gait [25], although it was unclear whether the response was a placebo or learning effect.

It remains unclear as to whether textured insoles modify gait and balance performance and plantar sensation immediately and in the long term in people with MS. Given this knowledge, the purpose of the current study was 2-fold: (1) to determine whether textured insoles have immediate effects on postural control, spatiotemporal parameters of gait, and plantar sensation in people with MS; and (2) to explore effects 4 weeks after wearing the insoles as to whether any immediate effects are maintained over time.

Methods

Study Participants

This was a within-subject experimental study with a 4-week intervention phase. Twenty-five relapsing-remitting patients diagnosed with MS, 16 women and 9 men, aged 49.6 years (standard deviation = 6.5 years)

were recruited from the Multiple Sclerosis Center, Sheba Medical Center, Tel-Hashomer, Israel. Inclusion criteria included a neurologist-confirmed diagnosis of definite relapsing-remitting MS according to the revised McDonald criteria [26]; the ability to walk without an assistive device (eg, a cane or walker); and relapse-free for at least 30 days before testing. Exclusion criteria included orthopedic disorders that could negatively affect mobility; major depression or cognitive decline; pregnancy; blurred vision; cardiovascular disorders; peripheral neuropathy; and diabetes. All patients were characterized by mobility difficulties confirmed by a neurological examination. Patients were then scored according to the Expanded Disability Status Scale (EDSS), an accepted method of quantifying disability in MS [24]. Ethical approval for the study was obtained by the Sheba Institutional Review Board. All participants signed an informed consent form.

Textured Insoles

Insoles were customized for both left and right feet according to the participant's foot width and length. The insoles were 3 mm thick and made of elastic rubber and fabric. The coarse texture of the insole was designed with miniature square pyramids organized in a grid pattern (Figure 1). This material and design proved favorable, as it was considered sufficiently rough to provide sensory feedback, yet not rough enough to cause skin discomfort.

Sensory Evaluation

Light-touch and pressure-sensation thresholds were determined using the Semmes-Weinstein monofilaments test [27]. This measurement is a standardized test commonly used in research and sensory evaluation of peripheral and central nerve lesions and is usually used



Figure 1. Insole designed with miniature square pyramids organized in a grid pattern.

Download English Version:

<https://daneshyari.com/en/article/2715605>

Download Persian Version:

<https://daneshyari.com/article/2715605>

[Daneshyari.com](https://daneshyari.com)