Effect of sensorimotor orthoses on rearfoot motion in patients with CMT: a pilot study

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Introduction

Charcot-Marie-Tooth disease (CMT) is the most common hereditary peripheral neuropathy, with an incidence of 1 in 2,500 [1]. CMT is characterised by progressive weakening of the distal muscles and sensory loss of the limbs, particularly around the foot and ankle resulting in poor balance, walking impairments, cavus foot deformity and lateral ankle instability [2, 3]. Clinical anecdotes suggest that foot orthoses designed on the 'sensorimotor' paradigm proposed by Lothar Jahrling can improve lateral ankle stability during gait in patients with CMT.

Aim

The purpose of this study was to investigate the effect of sensorimotor orthoses on frontal plane ankle motion in people with CMT.

Participants

Participant details are shown in Table 1. Four males and one female with CMT aged 31 to 64 years volunteered for the study.

Interventions

Each participant were fitted with an extra depth prefabricated pedorthic shoe and a custom-made orthoses prescribed according to the sensorimotor paradigm (Figure 1).

A) B)

***Figure 1**:* A) The Gadean Walker shoe (Malaga, WA, Australia) used in the study. B) The custom sensorimotor orthoses worn by participants.

Procedure

Participants completed five walking trials along a 12m walkway at a self-selected velocity while wearing the shoe, and shoe with orthoses in a randomised order.

***Figure 2**:* University of Sydney Laboratory set-up to collect gait data.

***Table 1**:* Physical characteristics of participants

Variable	Patient 1	Patient 2	Patient 3	Patient 4	Patient 5
Sex	Male	Female	Male	Male	Male
Age (years)	31	51	47	65	54
CMT type	1A	undefined	undefined	X linked	1A
Height (m)	1.82	1.68	1.83	1.85	1.76
Weight (kg)	79.6	106.8	82.4	83.9	83.6
Dorsiflexion strength (N)	187	117	101	0	103
Plantarflexion strength (N)	204	218	206	0	246
Foot Posture Index (Score)	-5	-1	-1	-12	8
Berg Balance score	56	56	54	45	53

Data analysis

Three-dimensional ankle joint complex motion was measured using a 14 camera motion-analysis system. Rearfoot motion was attained by detachable wand triad-marker through a window in the heel counter of the shoe. Data were time-normalised by linear interpolation to the stance phase and ensemble-averaged across trials and participants. Maximum and mean frontal plane motion from initial contact until 50% of stance was calculated. Paired sample t-tests were undertaken to assess significance between conditions. Participants were asked to nominate which condition felt more stable during walking.

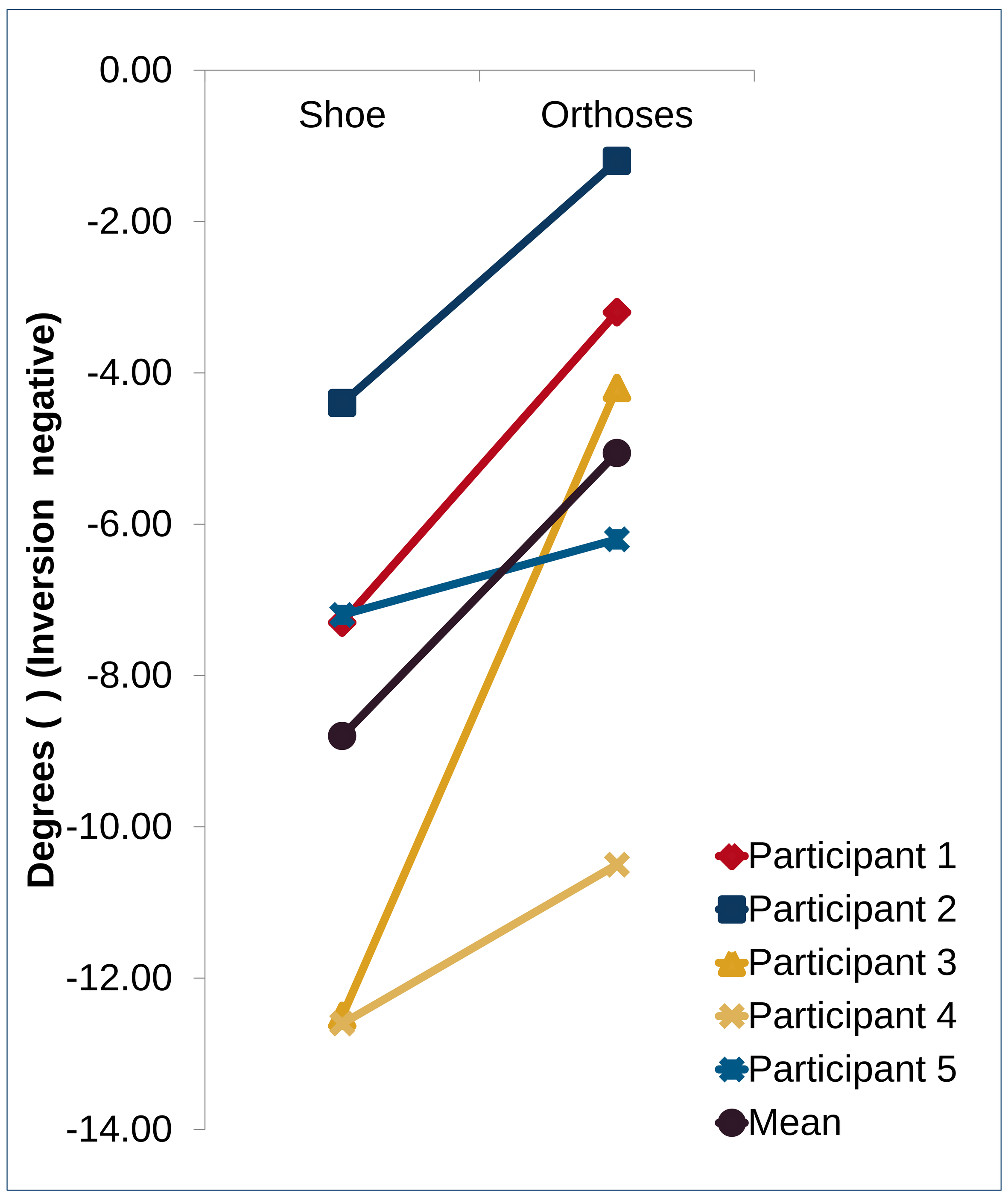

***Figure 3**:* Mean ankle frontal plane motion during the first 50% of the stance phase while walking in the shoes, and shoes/orthoses conditions.

Main findings

Gait velocity was not altered between the shoe [1.16m/s (0.13)] and shoe/orthoses [1.7m/s (0.12], *p*=0.537). Mean ankle eversion increased during loading while wearing the shoe/orthoses [mean change 3.7 (2.8), *p*=0.041] (Fig 3). Maximum ankle eversion increased during loading while wearing shoe/orthoses [mean change 3.6 (2.9), *p*=0.051] (Fig 4). All 5 participants reported a sense of increased stability while walking with the shoe/orthoses.

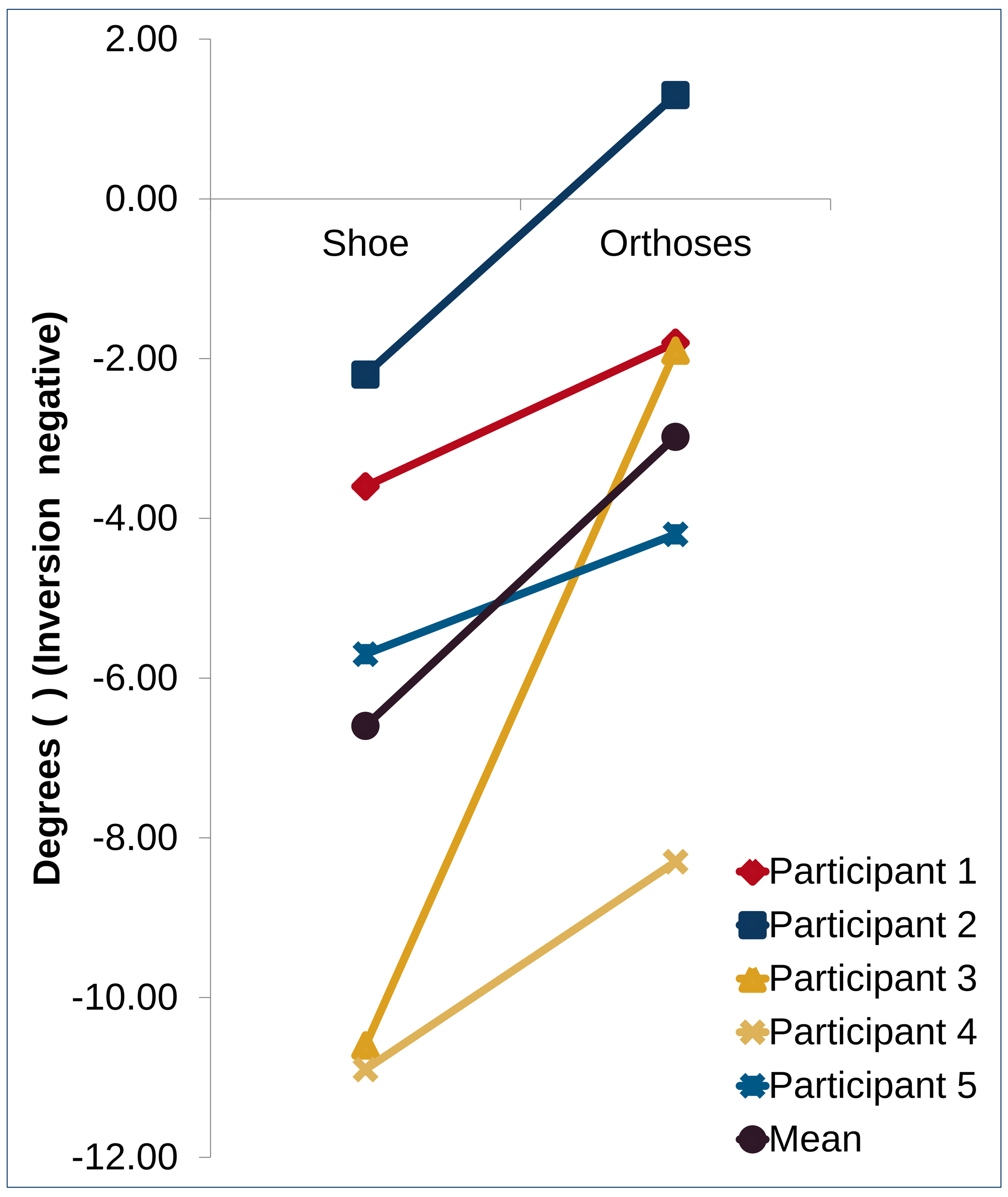

***Figure 4**:* Maximum ankle frontal plane motion during the first 50% of the stance phase while walking in the shoes, and shoes/orthoses conditions.

Conclusion

Sensorimotor orthoses increase ankle eversion in people with CMT and may provide increased gait stability during the loading phase of gait.

References

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