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The significance of tibial somatosensory evoked potentials on gait parameters of spinal cord injury patients.

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Introduction

Regaining the ability to walk has always been a crucial rehabilitation goal for spinal cord injury (SCI) patients. Abnormal gait in SCI patients arises due to motor deficits below the level of injury, along with accompanying sensory and proprioceptive deficits. In this study, our aim was to explore the significance of Tibial SEP (T-SEP) results in sensory and proprioception of SCI patients and highlighting the relationships between T-SEP results with temporospatial and kinematic gait parameters of SCI patients.

Methods

Retrospective analysis was carried out on fourteen SCI patients who underwent gait analysis. Each limb was analyzed separately, resulting in a total of 28 limbs. Gait analysis was conducted using a computerized 3D motion capture system (Vicon Motion System, Oxford, UK).

Results

The analyzed limbs were categorized into those with normal T-SEP latencies and those with abnormal T-SEP latencies. Basic characteristics were compared between the two groups, revealing significant differences only in the ASIA sensory score for light touch (p= 0.0192) and pinprick (p=0.0077) (ASS (L), ASS (P)), and Tibial (p=0.00002) and Peroneal (p=0.0495) SEP latencies. Temporospatial gait parameters did not show significant differences between the two groups. However, when comparing kinematic parameters, the group with abnormal T-SEP latencies exhibited significantly lower peak hip abduction in swing (p=0.0081), greater knee flexion at initial contact (p=0.0363), lower range of motion of knee flexion (p=0.0197) and lower peak dorsiflexion in swing (p=0.0272). The Pearson correlation of T-SEP latencies and gait parameters showed significant correlation between T-SEP latencies with walking speed/leg length (r=-0.407), minimum hip flexion (r=0.454), peak hip abduction in swing (r=-0.376), knee flexion at IC (r=0.465) and range of knee Flexion (r=-0.387).

		Normal T-SEP mean ± standard deviation *median (IQR)	Abnormal T-SEP mean ± standard deviation *median (IQR)	P value
Age (years)		44.20 ± 17.03	51.92 ± 16.85	0.2400
Sex	Male (n)	13	13	0.4841
	Female (n)	2	0	
Duration (years)		2.00 (4.83)*	0.42 (1.83)*	0.1118
NLI	Cervical (n)	10	10	0.6860
	T/L (n)	5	3	
Height (m)		1.71 (0.07)*	1.71 (0.04)*	0.8526
Weight (kg)		65.0 (19.65)*	68.3 (12.70)*	0.2296
Leg length (cm)		85.0 (2.50) *	85.0 (2.50) *	0.7273
AMS (L/Ex)		20 (0.50) *	20 (0.00) *	0.6494
AMI		15 (3.50) *	15 (3.00) *	0.3805
ASS (L)		50 (19.50)*	33 (9.00) *	0.0192^
ASS (P)		50 (20.50) *	30 (9.00) *	0.0077^
Tibial SEP		39.73 ± 3.63	45.61 ± 2.07	0.00002^
Peroneal SEP		38.23 ± 5.01	41.77 ± 3.91	0.0495^

Table 1. Characteristics of the participants. ^ indicates p<0.05

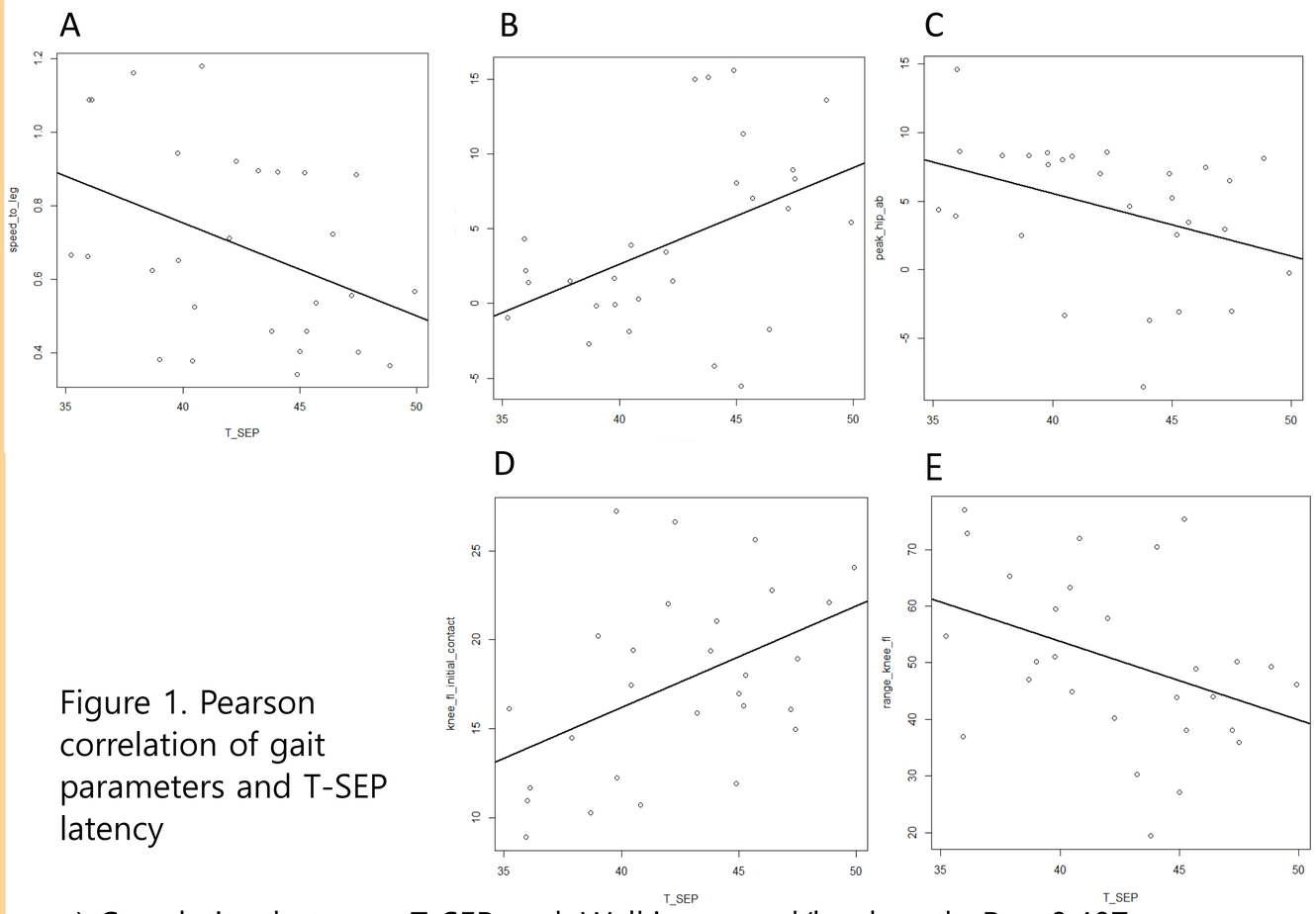

Figure 1. Pearson correlation of gait parameters and T-SEP latency

a) Correlation between T-SEP and. Walking speed/leg length. R= -0.407
b) Correlation between T-SEP and minimal hip flexion. r= 0.454
c) Correlation between T-SEP and peak hip abduction. r=-0.376
d) Correlation between T-SEP and Knee flexion at initial contact. r= 0.465
e) Correlation between T-SEP and range of knee flexion. r= -0.387

	Normal T-SEP mean ± standard deviation *median (IQR)	Abnormal T-SEP mean ± standard deviation *median (IQR)	P value
Mean pelvic tilt	14.45 ± 2.57	15.49 ± 4.14	0.4243
Range of pelvic tilt	5.20 (3.01)*	3.30 (2.38)*	0.1020
Mean pelvic rotation	0.35 ± 3.82	0.03 ± 2.88	0.8095
Maximum hip flexion	39.25 ± 4.54	38.63 ± 4.12	0.7107
Minimum hip flexion	2.81 ± 5.21	5.82 ± 6.65	0.1910
Range of hip flexion	28.49(7.35)*	27.45(9.25)*	0.3220
Peak hip abduction in swing	8.02 (2.63)*	2.95 (8.27)*	0.0081^
Mean hip rotation in stance	-7.39 ± 10.51	-9.90 ± 13.44	0.5829
Knee flexion at IC	15.71 ± 5.47	19.74 ± 3.94	0.0363^
Time of peak knee Fl in swing	0.78 ± 0.04	0.77 ± 0.07	0.6769
ROM of knee Fl	56.38 ± 11.80	43.41 ± 15.75	0.0197^
Peak Dorsiflexion in stance	12.42 ± 4.74	10.92 ± 4.81	0.4140
Peak Dorsiflexion in swing	5.11± 2.85	2.20 ± 3.72	0.0272^
Mean foot progression angle in stance	2.11 ± 2.46	3.00 ± 5.13	0.5746

Table 2. Kinematic parameters for normal and abnormal Tibial SEP groups. ^ indicates p<0.05

Conclusion

Patients with abnormal tibial SEP demonstrated sensory and proprioception deficits, which appear to impact their gait kinematic parameters. Although the importance of sensory and proprioception in the gait of SCI patients has been discussed, there have been no studies shedding light on the effect of SEP results on gait parameters of SCI patients and also correlation between gait parameters and T-SEP latencies. Based on the presented results, we believe that, for SCI patients, tibial SEP results can be used to predict gait patterns, and rehabilitation efforts may be focused on intervening with kinematic factors to help patients regain functional gait abilities.

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