Could a simple plantar pressure system reflect balance or functional outcomes?

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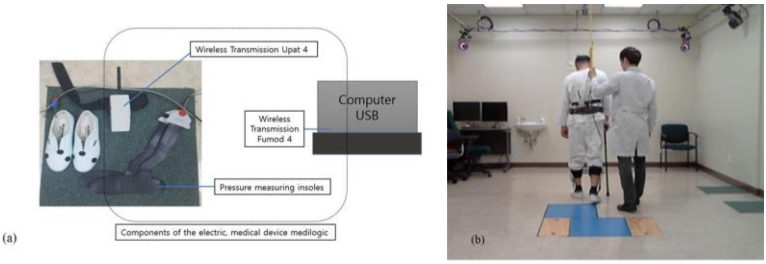
Introduction

Spinal cord injury (SCI) with neurological deficits can lead to mobility limitations. Quantitative measurements that can evaluate the kinematic, kinetic, and spatiotemporal parameters of gait are important for addressing these limitations. The plantar pressure system can measure spatiotemporal parameters relatively easily and conveniently.

This study aimed to identify the relationship between various gait parameters and the Berg balance scale (BBS) and modified Barthel index (MBI) scores in patients with SCI.

Methods

This is an observational cross-sectional study. A total of 23 patients with SCI were recruited between September 2019 and August 2020. Gait parameters were obtained using an insole pressure measurement system, and the spatiotemporal parameters were extracted. BBS and MBI analyses were also performed. Kendall's rank correlation coefficient (Kendall's Tau) and Spearman's rank correlation coefficient (Spearman's rho) were used to analyze the correlation of gait parameters with BBS and MBI scores in patients with SCI.



Results

Gait parameters significantly correlated with BBS score were walking speed, stride duration, double support phase, stride duration variability, stance phase duration of weak side, stance phase duration variability of strong side, effective foot length of weak side, and width of gait line of strong side; but none of these variables were significantly correlated with MBI score.

Parameter	SCI (n=23)
Age (mean ± SD, years)	70.4 ± 8.4
Female/ male (n)	12/8
Height (mean ± SD, m)	1.6 ± 0.1
Weight (mean ± SD, kg)	59.3 ± 8.4
Post-injury time (months)	3.7 (1 ~ 17)
Neurological level	
Cervical	11
Thoraco-lumbar	12
MBI (mean ± SD)	55.6 ± 25.7
BBS (mean ± SD)	24.8 ±.6

Table1. Demographics of subjects with spinal cord injury (SCI)
SCI: spinal cord injury; SD: standard deviation; MBI: modified barthel index; BBS: Berg Balance Scale

Parameter	BBS		MBI	
	Kendall's tau	Spearman's rho	Kendall's tau	Spearman's rho
Walking speed (km/h)	0.41*	0.51*	0.15	0.19
Stride length (m)	0.16	0.23	0.04	0.08
Stride duration (s)	-0.53*	-0.68*	-0.10	-0.13
Double support phase (%)	-0.30*	-0.43*	-0.13	-0.19
Stride duration variability (rel. SD)	-0.33*	-0.43*	-0.22	-0.23
Stance phase duration_weak (%)	-0.48*	-0.65*	-0.20	-0.32
Stance phase duration_strong (%)	-0.13	-0.20	-0.04	-0.84
Stance phase duration variability_weak (rel.SD)	-0.15	-0.22	-0.10	-0.13
Stance phase duration variability_strong (rel.SD)	-0.27*	-0.37*	-0.21	-0.25
Effective foot length_weak (%)	0.32*	0.39*	0.20	0.27
Effective foot length_strong (%)	-0.02	-0.03	0.02	0.01
Width of gait line_weak (%)	0.22	0.39*	0.13	0.29
Width of gait line_strong (%)	0.28*	0.43*	0.25	0.33

Table 2. Relationships between balance/ functional score and spatial-temporal parameters in SCI subjects.
* significant at $p < .05$, Kendall's rank correlation, Spearman's rho.
BBS ; berg balance scale, MBI ; modified barthel index

Conclusion

Based on the gait parameter values obtained by this easy and convenient way, if gait rehabilitation involves supplementing and strengthening the patient's deficient gait parameters, it is expected that balance will be improved