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Introduction

Peripheral neuropathy (PN) is a neurological disorder that involves damage or disease of the peripheral nervous system associated with numbness, pain, weakness, and impaired balance. Individuals with PN often experience a distal to proximal progression of motor and sensory deficits such as loss of proprioception, muscle weakness, and loss of ankle reflexes. Since lower extremity proprioception plays a primary role in postural control, individuals with PN demonstrate difficulty maintaining balance, especially under conditions in which vision or vestibular input are also compromised. Clinically, the sensory deficits associated with PN are assessed using Semmes-Weinstein monofilaments and vibration testing. Additionally, the Mini-BESTest is a clinical performance measure that may be used to identify impaired dynamic balance and gait. The Mini-BESTest assesses anticipatory control, reactive postural control, sensory orientation, and dynamic gait. Although the Mini-BESTest has been found to be valid and reliable tool in persons with stroke and Parkinson's disease, its use in individuals with PN remains to be explored.

Purpose

The purpose of this pilot study was to identify possible relationships between the Mini-BESTest, common sensory examination measures, and fall history in individuals with PN.

Subjects

12 participants with a confirmed diagnosis of peripheral neuropathy were recruited. Inclusion criteria included: diminished or lost ankle reflexes and vibration sense in the foot, Semmes-Weinstein aesthiometry threshold of 3.84 or greater on the plantar surface of the foot, a minimum ankle range of motion of 5º dorsiflexion and 10º of plantarflexion, a minimum strength for ankles, knees, and hips of 2+/5 and the ability to ambulate without an assistive device for two minutes. Exclusion criteria included: a neurological condition in addition to peripheral neuropathy, significant pain or deformity of the lower extremities, open wounds on the feet, uncontrolled diabetes, and the inability to stand or walk safely for two minutes.

Figure 1. Semmes-Weinstein monofilament

Table 1. Subject Characteristics

Subject	Gender	Age (Years)	BMI	Duration (Years)	Cause	Sensory Threshold[a]	Vibration[b] (0-8)	Device Use	# Falls (12 mo)
1	M	55	36.9	2	GB	6.61	0	none	2
2	F	77	23.1	20	IPN	6.65	0	none	1
3	F	72	33.5	15	IPN	6.36	0	cane	1
4	F	84	21.7	15	IPN	4.88	0	none	1
5	F	70	23.6	13	IPN	4.57	0.5	cane	1
6	M	80	27.1	3	IPN	4.47	2	none	0
7	M	77	26.1	4	IPN	6.65	0	none	5
8	F	78	35.1	13	IPN	4.65	3.5	none	1
9	M	73	32.0	7	IPN	4.68	2.5	cane	0
10	F	77	28.3	20	IPN	6.52	0	cane	1
11	M	80	25.1	30	IPN	6.65	0	none	6
12	M	78	31.6	6	IPN	4.37	3.25	none	0
Mean		75.1	28.7	12.3		5.59	0.98		1.6
SD		7.4	5.1	8.4		1.03	1.41		1.9

Abbreviations: BMI, body mass index; GB, Guillain-Barré; IPN, idiopathic peripheral neuropathy
[a]Semmes-Weinstein threshold values averaged from three plantar surface sites for both feet (6 total sites).
[b] Vibration values as determined by 128 Hz semi-quantitative Rydel-Seiffer tuning fork averaged for both great toes.

Table 2. Correlation Between Outcome Measures

	Vibration	Semmes-Weinstein	12 Month #Falls	Mini-BESTest
Vibration	1.000			
Semmes	**-.817***	1.000		
12 Month # Falls	**-.680***	**.799***	1.000	
Mini-BESTest	-.103	-.011	-.084	1.000

Methods

All subjects were tested during a single visit. The clinical and functional tests were performed in the following order: 1) Semmes-Weinstein monofilaments testing at great toe 2) Vibration testing with 128 Hz semi-quantitative Rydel-Seiffer tuning fork 3) Mini-BESTest. Spearman's rank correlation coefficient was utilized to determine the strength of correlation between outcome measures to determine clinical application in the examination process and preview gait and balance deficits.

Data Analysis

Due to the small sample size and the use of ordinal measures the Spearman's rank correlation coefficient was utilized to determine the strength of correlation between the impairment and performance measures.

Results

There was no significant correlation found between the total Mini-BESTest score and falls or sensory tests. Strong correlations were found between number of falls in previous 12 months and both sensory tests : Vibration (r_s= -.680, p= .015) and monofilament testing (r_s=-.799, p= .002).

Discussion

The results of this study indicate that Mini-BESTest score did not correlate with the number falls in the previous 12 months or clinical measures of sensation. However, this study revealed strong correlations between # of falls in the previous 12 months and the sensory tests. Based on these findings clinicians should use caution when interpreting the meaning of Mini-BESTest results in individuals with PN until further research is done. Additionally, clinicians should consider using objective measures of sensation when evaluating patients with PN. Future research is needed to confirm these findings and determine the usefulness of the Mini-BESTest for predicting fall risk in individuals with PN.

Figure 2. Vibration testing