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Abstract

INTRODUCTION: 1 in 3 older adults will experience a fall each year. Falls are the leading cause of accidental death in adults over 65 years, and are the leading cause of nonfatal injuries and hospital admissions for trauma. Most falls occur during locomotion, and impaired gait and postural control have many implications that affect stability during walking. Dynamic posturography has been shown to be a good measure of postural stability, while measures of gait have been linked to age-related changes as well as discriminating between fallers and non-fallers. **Purpose:** To compare the relationship between spatiotemporal gait measures and computerized dynamic posturography. **METHODS:** 95 community dwelling senior citizens participated in this study. The GaitRite® Electronic Walkway was used to measure the gait variables: velocity (cm/s), stride length (cm), cadence (steps/min), double support time (%), swing time (%) and stride width (cm). The Sensory Organization Tests (SOT) on the NeuroCom® Smart Equitest is a computerized dynamic posturography system that evaluates the somatosensory (SOM) system, visual (VIS) system, and vestibular (VEST) systems. Pearson Product Moment Coefficient of Correlation was used with an alpha level ($p \leq 0.05$) set *a priori*. **RESULTS:** 61 female and 34 male participants had a mean age of 75.46 years (± 6.31). No correlations were found between gait measures and the SOT composite score. Small to moderate correlations were found between: velocity and vestibular ($r = .215$); stride length and visual ($r = .202$); double support time and somatosensory ($r = -.204$) and vestibular ($r = -.298$); swing time and somatosensory ($r = .207$) and vestibular ($r = .314$); and stride width and vestibular ($r = -.257$). **CONCLUSION:** These gait measures (with the exception of cadence) are related to the sensory systems of somatosensory (for processing the sense of touch and proprioception), visual (for assessing distances to and between), and vestibular (for sense of balance and spatial orientation) that control posture. None of these measurements related to the SOT composite score, and warrants future research to evaluate the individual sensory system rather than the overall composite score when relating dynamic posture and measurements of gait.

Purpose

The purpose of the present study was to test the relationship between gait measures as assessed by an electronic walkway to sensory organization tests assessed by a computerized dynamic posturographical scores. It was hypothesized that the gait measures chosen would be related to the various sensory systems that control posture.

Methods

Participants

95 independent community dwelling senior-citizens (61 – 91 years) were recruited. Each participant signed informed consents approved for by the Institutional Review Board. Participants were excluded if they had a previous history of peripheral or vestibular abnormalities, had experienced 2 or more documented falls within the previous 6 months, or were unable to ambulate without an aide.

Methods (cont.)

Procedure & Instrumentation

Gait was assessed utilizing the GaitRite® electronic walkway. It contains sensor pads connected to a computer station with a mounted camera. As the participant walks across the mat, the feet exert pressure which activates the sensor pads. As the sensor pads are switch on and off, the computer creates an image representative of these as foot prints. 7 gait variables were obtained for this study because of their predictive value of falls and included: velocity (cm/s), stride length (cm), cadence (steps/min), double support time of cycle (%), swing time of cycle (%), and step width (cm).

The Sensory Organization Test (SOT) on the NeuroCom® Smart Equitest System was used to assess dynamic posture by challenging the participants somatosensory, visual, or vestibular system. Inaccurate information is delivered to the eyes, feet and joints through sway referencing of the visual surround and support surface.

During the SOT, each participant was fitted with a padded harness that is attached to the device's framework in order to protect him/her from a fall. 6 conditions were performed, 3 trials per condition, for a total of 18 trials. Each of the following six conditions lasted 20 seconds.

The overall composite equilibrium score provides a representative score of the individuals' ability to maintain postural stability during all conditions. Effective use of the individuals' sensory inputs is determined from the overall pattern of scores on each of the six conditions.

GaitRite® Electronic walkway



NeuroCom® Smart Equitest



Data Analysis

Pearson Product Moment Coefficient of Correlation for moderate correlations of > 0.30 was utilized to determine significance and strength of the relationship and an alpha value of $p \leq 0.05$ was considered statistically significant with gait measures compared to those of the SOT conditions. Means \pm standard deviations for the demographic variables were calculated. SPSS version 19.0 was used for the analysis of all data.

Results

Participant's mean age was 75.46 years (± 6.31). Correlations revealed small size effects between double support time, swing time and SOM, stride length and VIS, and velocity, double support time, step width and VEST. Medium size effects were reported between swing time and VEST.

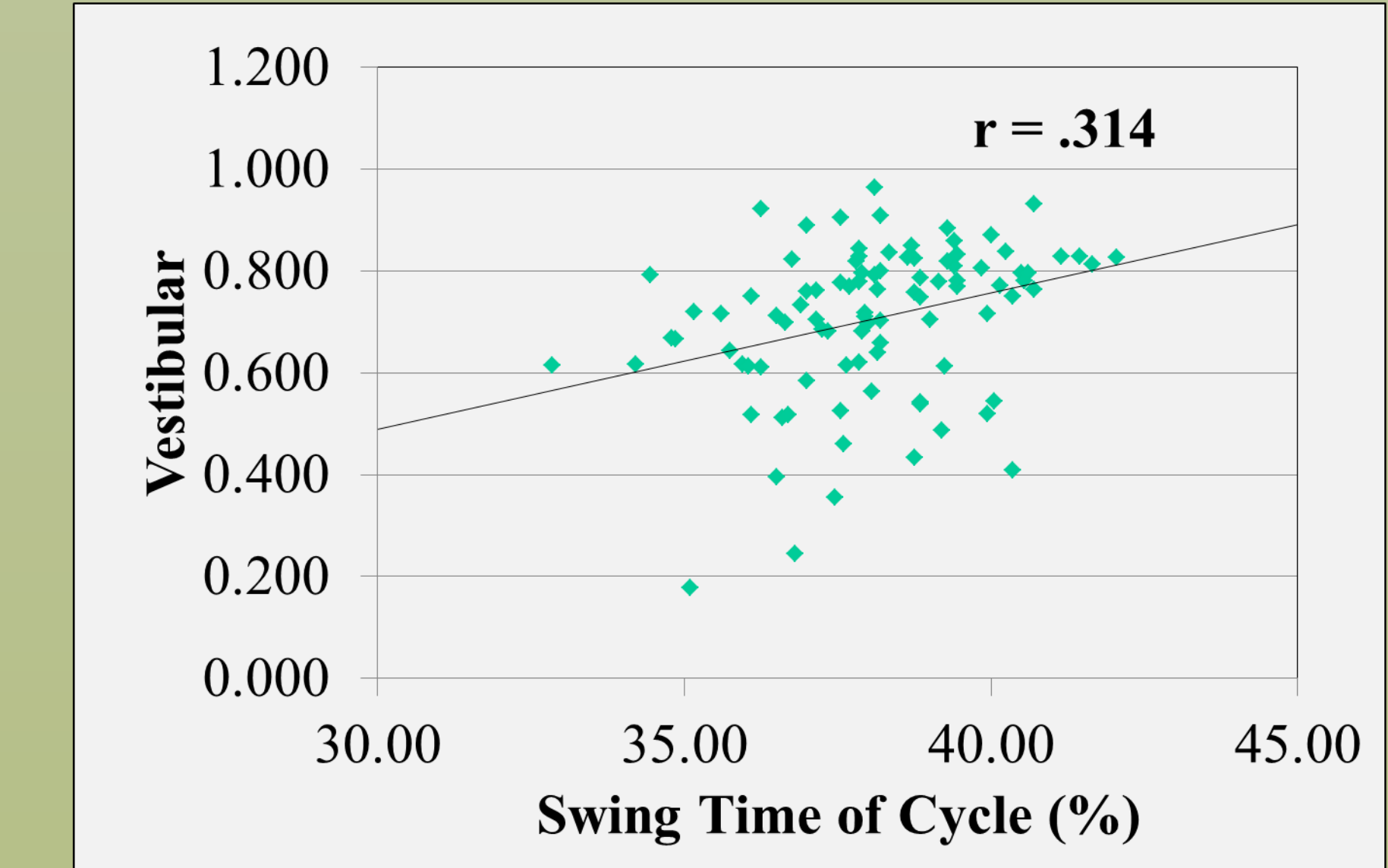
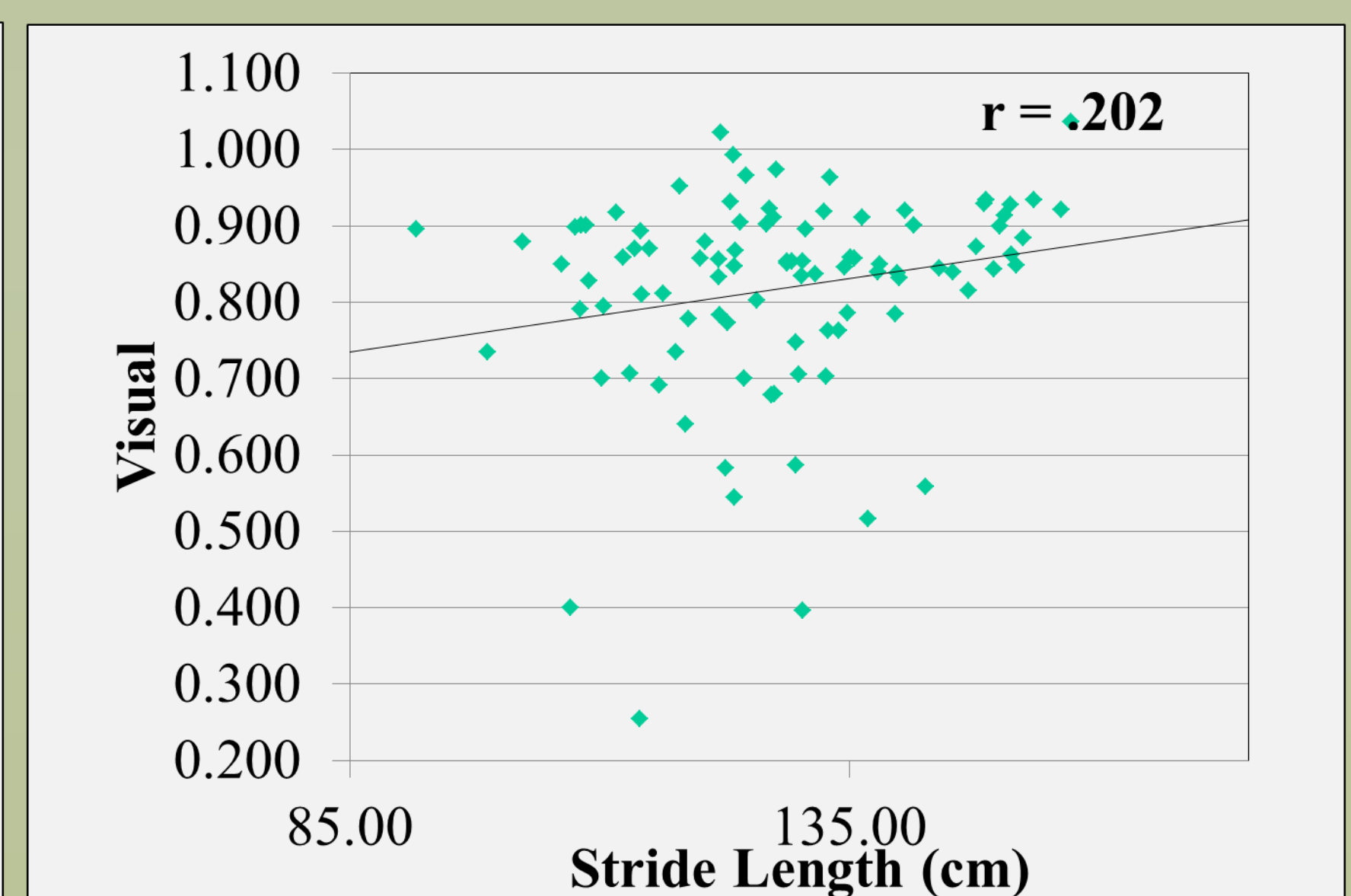
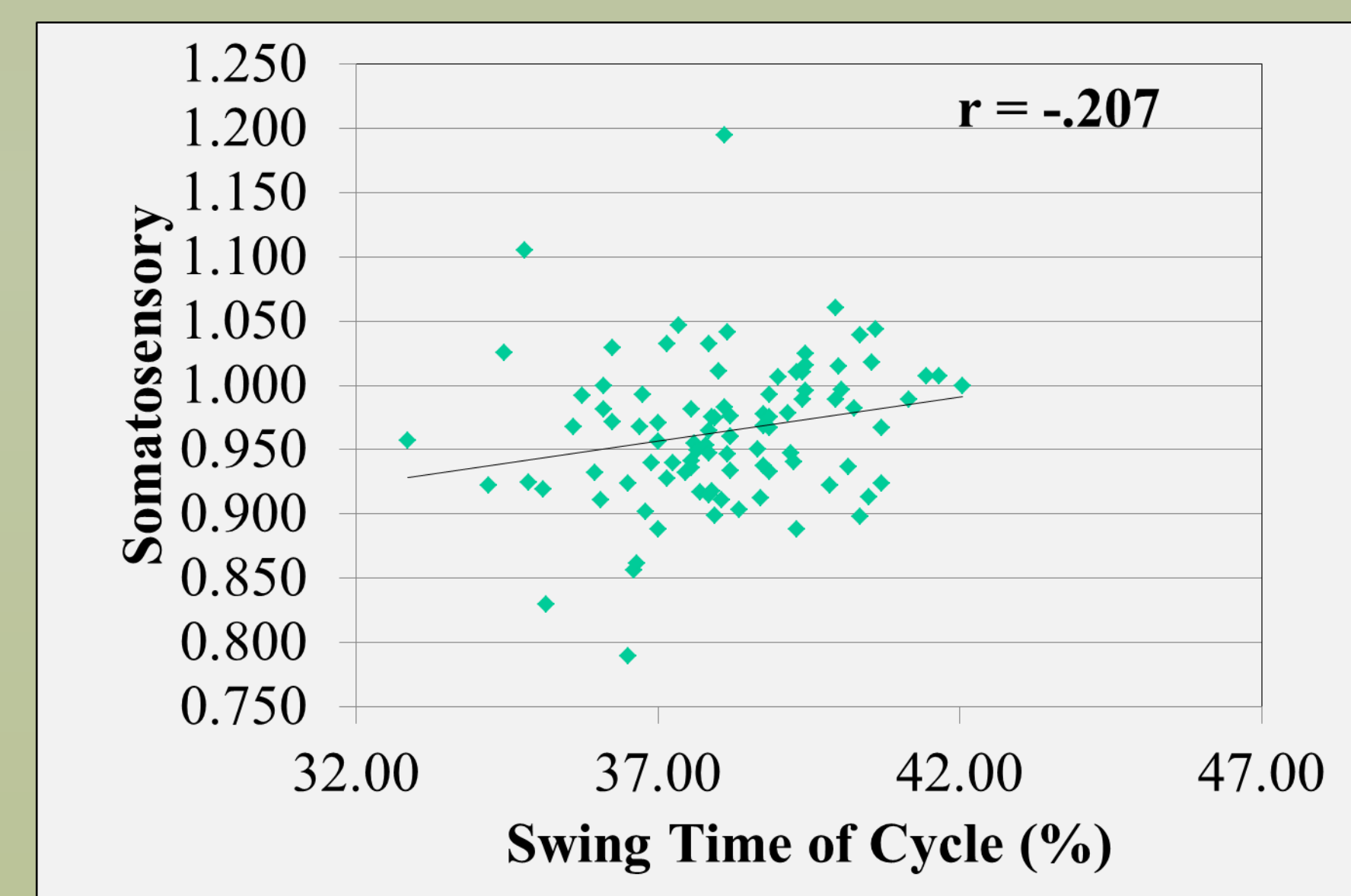
Participants Demographics

N	95
Age (yrs.)	75.46 (± 6.31)

Correlations between gait variables and SOT score (* denotes correlation)

	SOT	SOM	VIS	VEST
Velocity (cm/s)	.143	.076	.109	-.215*
Stride Length (cm)	.180	.072	.202*	-.148
Cadence (steps/min)	.007	.043	-.066	.191
Double Support Cycle (%)	-.174	-.204*	-.065	-.298*
Swing Time Cycle (%)	.165	.207*	.089	.314*
Step Width (cm)	-.069	-.039	-.065	-.257*

The 3 highest correlations of each sensory system were graphed



Conclusion

Swing time and SOM, These gait measures (with the exception of cadence) are related to the sensory systems of somatosensory (for processing the sense of touch and proprioception), visual (for assessing distances to and between objects while guiding body movements in relation to visual objects), and vestibular (for sense of balance and the spatial orientation) that control posture. Considering none of these measurements were related to the SOT composite score, warrants feature research to evaluate the individual sensory system rather than the overall composite score when relating dynamic posture and measurements of gait.