Cleveland Clinic Innovations

Cleveland Clinic Postural Stability Index

Jay L Alberts, PhD, Mandy Miller Koop, PhD, Sarah Ozinga, PhD, Susan Linder, PhD, Tanujit Dey, PhD – Cleveland Clinic Lerner Research Institute

PRODUCT
Objective postural stability (PS) metrics using body-worn inertial sensors

INDICATIONS
Postural stability monitoring in patients with neurological disorders (Parkinson's disease, multiple sclerosis, Alzheimer's, stroke, and other conditions impacting neuro-motor function)

VALUE PROPOSITION
- First of its kind postural stability assessment tool that effectively captures biomechanical data in three directions (Lateral, Anteroposterior, and Rotational)
- Opportunity to apply postural stability data in a myriad of neurological disorders to assist in the clinical management of these conditions and improve patient outcomes

DEVELOPMENT STAGE
Validation assessment complete

PUBLICATIONS
Ozinga SJ, Linder SM, Alberts JL. Use of Mobile Device Accelerometry to Enhance Evaluation of Postural Instability in Parkinson Disease. Arch Phys Med Rehabil. 2017 Apr;98(4):649-658.

Ozinga SJ, Alberts JL. Quantification of postural stability in older adults using mobile technology. Exp Brain Res. 2014 Dec;232(12):3861-72.

CONTACT INFORMATION
Jerry Wilmink, PhD
Director, Business Development and Licensing
wilminj@ccf.org
216.314.6397

IDF# 2015-067

OPPORTUNITY

Neurological conditions including Parkinson's disease, multiple sclerosis, Alzheimer's, and stroke continue to present substantial challenges to patients with respect to maintaining independence and overall quality of life. At the core of this issue is postural stability (PS), a necessary component of body position control and a key enabler of the performance of daily tasks. Common neurological disease states, neurological injuries, and advanced age may all contribute to a significant decrease in PS that places patients at an increased risk of falling which may lead to additional injuries or, in some cases, death. In the United States, falls are the leading cause of injury and injury mediated death among adults aged ≥65 years (older adults). In 2020, 14 million (27.6%) older adults reported falling during the previous year and almost 39,000 older adults died due to a fall in 2021.

At present, there is a severe unmet need in medical technologies that are capable of objectively quantifying PS and subsequently applying this data in a clinically meaningful manner. Current attempts at addressing this gap in clinical assessment lack sensitivity and fail to capture complete biomechanical data sets that can be used to consistently identify mild balance impairments.

SOLUTION

We have developed a postural stability index system that uses body-worn inertial sensors to precisely quantify postural sway in three directions - medial/lateral (ML), anterior/posterior (AP), and trunk rotation (TR). This system relies on advanced algorithms to derive sensitive time and frequency domain metrics like peak-to-peak sway, root mean square acceleration and normalized path length. These measurements are then converted into z-scores and percentiles indicating instability severity compared against a comprehensive library of healthy controls. A "stability cube visual" separates sway into quadrants against norms permitting colored vectors to illustrate both sway direction and magnitude. This visual allows clinicians to quickly identify / assess instability and fall risk.

The development of this health technology system offers a first-in-class opportunity to standardize the collection and application of postural stability (PS) measurements in patients with neurological disorders, injuries, or advanced age. This biomechanical data can then be applied to aid in clinical decision making and improve patient outcomes.
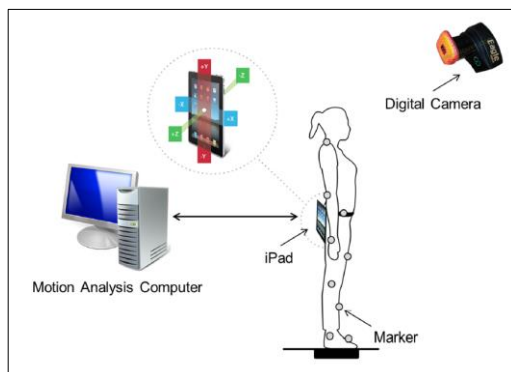

Figure: General schematic of the proposed Cleveland Clinic Postural Stability Index system. The proposed body-worn tablet solution allows clinicians to quickly and reliably assess instability and fall risk in three directions with respect to age-matched normative values.