Novel Wearable Technology for Assessing Spontaneous Daily Physical Activity and Risk of Falling in Older Adults with Diabetes

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Abstract

Background:

As baby boomers age and their expected life span increases, there is an unprecedented need to better manage the health care of elders with diabetes who are at increased risk of falling due to diabetes complications, frailty, or other conditions. New clinical and research tools are needed to measure functioning accurately and to identify early indicators of risk of falling, thus translating into more effective and earlier intervention.

Methods:

The objective of this pilot study was to validate a significant change in hardware and algorithm to track activity patterns using a single triaxial accelerometer through validation of timed up and go and standard measures of balance and gait. We recruited a convenience sample of eight older adults with diabetes and peripheral neuropathy (age, 77 ± 7 years old) who were asked to wear the sensor for imposed daytime activity performed in our gait laboratory. Subjects were stratified into risk of falling categories based on Tinetti scores. We examined the accuracy of the suggested technology for discrimination of high- versus low-risk groups.

Results:

The system was accurate in identifying the number of steps taken and walking duration (random error <5%). The proposed algorithm allowed accurate identification and stratification of those at highest risk of falling, suggesting that subjects with high risk of falling required a substantially longer duration for rising from a chair when compared with those with low risk of falling ($p < .05$).

Conclusions:

Our new single triaxial accelerometer algorithm successfully tracked postural transition, allowing accurate identification of those at high risk of falling, and could be useful for intermittent or even continuous monitoring of older adults with diabetes. Other potential applications could include activity monitoring of the diabetes population with lower extremity disease and of patients undergoing surgical procedures or as an objective measure during rehabilitation.

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Abbreviations: (CI) confidence interval, (PT) postural transition, (SI-ST) sit-to-stand, (ST-SI) stand-to-sit, (TUG) timed up and go

Keywords: body-worn sensor, diabetes care, foot ulcer, home telemonitoring, physical activity monitoring, risk of falling, wearable technology

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