

Development and validation of a walking speed measurement device



DukeHealth

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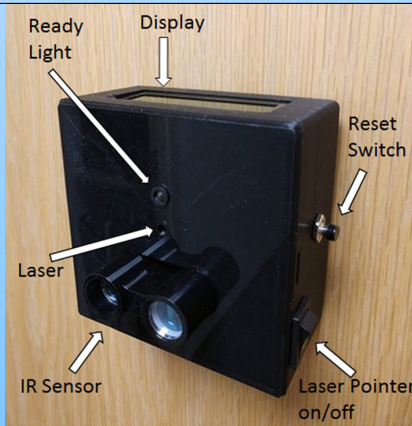
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Background

- As the 6th vital sign, gait speed is a strong predictor of functional status and survival amongst older adults
- Current methods require either a trained technician with a measuring tape and stopwatch or high-tech laboratory sensors/devices
- These methods are prone to error between timers and trials

Device Design

- Low cost (<\$200) alternative to current methods
- Determines distances by LIDAR sensor
- LEDs show user when to walk and when data is being captured
- Walking speed is displayed automatically on an LCD screen
- Adjustable measuring distances



Gaitbox Device Image

Research Objective

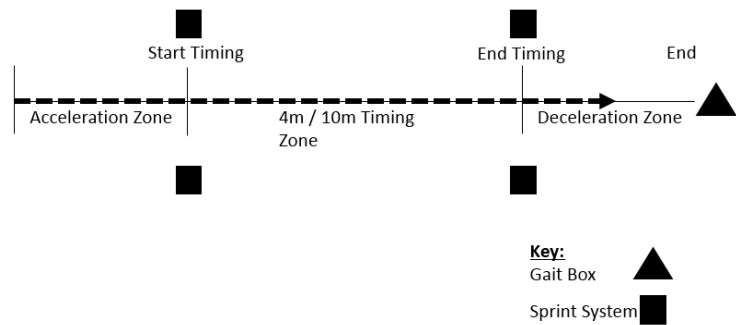
- Validate Gaitbox device for the NIH toolbox 10-meter clinical walk test
- Previous study demonstrated validation for the 4-meter NIH walk test

NIH Walk Test

- Clinically validated walking speed test
- 2 m acceleration & deceleration zones with a 10 m / 4 m timing zone
- Standard stopwatch to record time
- Walker instructed to walk at a comfortable pace

Study Design

- Prospective, validation study with participants completing the NIH-WT
- Gaitbox, stopwatch with human timer, and Sprint System (IR break beam) used simultaneously to measure gait speed
- Each participant completed 4 walk tests, one practice & 3 recorded tests
- Gaitbox recorded speed measurements across 10 m, 7.62 m (MS walk test), 4 m, and over the course of the first and second halves of the walking test
- Stopwatch and Sprint System measured gait speed only at 10 m
- Participants instructed to walk toward the Gaitbox at a comfortable pace



Testing schematic

Setting

- ProMotion Fitness Center and Multiple Sclerosis Institute, Shepherd Center, Atlanta, GA
- Under Shepherd Center IRB

Participants

- Convenience sample of male and female subjects 18 or older
- 44 subjects represented SCI, MS, and otherwise healthy populations

Outcome Measure

- Gaitbox considered accurate measure of walking speed & accurate replacement for clinical gold standard (stopwatch & human timer) if within 2% of Sprint System

Results

- 0.988 ($p < 0.0001$) correlation between Gaitbox and Sprint System at 10 m with a difference in means of 0.008 ± 0.041 ($P = .22$)
- No systematic bias across all gait speed measurements

Conclusion

- Gaitbox is an accurate way to measure gait speed for the 10 m NIH-WT
- Based on this work and previous validation studies, the Gaitbox can be used to accurately and precisely measure gait speed in clinical and research settings

Future Work

- Long term evaluation studies
- Optimizing user interface for clinicians
- Transferring technology

