Validation of the Actibelt® speed measurement in patients with dizziness and vertigo

Walking velocity is an important control variable in gait disorders due to sensory or cerebellar disfunction. Non-preferred walking speeds are closely linked to a higher risk of falls. A compensation strategy of patients to avoid these speed sectors can be assumed. So far speed measurements are only possible in a laboratory environment. Actibelt® is a promising tool that allows speed estimation based on accelerometer data. The used algorithms have not been validated for patients with sensory or cerebellar disorders.

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Validation of the Actibelt® speed measurement in patients with dizziness and vertigo

Aims

- Validation of Actibelt® speed measurement for different velocities: slow, self chosen, fast
- Validation of Actibelt® speed measurement in patients with sensory (vestibular) or cerebellar disorders

Background

- walking velocity is an important control variable in gait disorders due to sensory or cerebellar disfunction.
- non-preferred walking speeds are closely linked to a higher risk of falls (Figure 1)
- a compensation strategy of patients to avoid these speed sectors can be assumed.
- So far speed measurements are only possible in a laboratory environment
- Actibelt® is a promising tool that allows speed estimation based on accelerometer data
- the used algorithms have not been validated for patients with sensory or cerebellar disorders

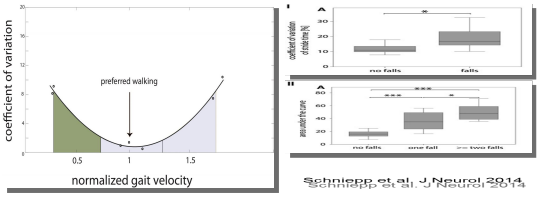

Table 4 Logistic models for the AUCs of gait variability and the fall frequencies

A	Logistic regression model 1 Non-fallers vs. fallers	For CV of stride length	For CV of stride time	For CV of base of support
AUC 0.25–1.75	Chi²; p value	9.64; p\ 0.01	11.92; p\ 0.01	2.43; n.s.
	Correct prediction	0.72	0.71	–
AUC 0.25–0.75	Chi²; p value	28.24; p\ 0.001	16.92; p\ 0.01	3.56; n.s.
	Correct prediction	0.94	0.74	–
AUC 0.75–1.25	Chi²; p value	7.26; p\ 0.05	10.92; p\ 0.01	4.40; n.s.
	Correct prediction	0.72	0.73	–
AUC 1.25–1.75	Chi²; p-value	8.45; p\ 0.05	9.21; p\ 0.05	2.43; n.s.
	Correct prediction	0.52	0.61	–
B	Logistic regression model 2 Group 0–2	For CV of stride length	For CV of stride time	For CV of base of support
AUC 0.25–0.75	Chi²; p-value	20.02; p\ 0.001	28.30; p\ 0.001	4.87; n.s.
	Correct prediction	0.63	0.83	–
AUC 0.75–1.25	Chi²; p-value	8.87; p\ 0.05	7.28; p\ 0.05	3.51; n.s.
	Correct prediction	0.67	0.54	–
AUC 0.75–1.25	Chi²; p value	4.94; n.s.	2.96; n.s.	4.84; n.s.
	Correct prediction	–	–	–
	Correct prediction	–	–	–
AUC 0.25–1.75	Chi²; p value	14.71; p\ 0.05.	19.34; p\ 0.001	3.64; n.s.
	Correct prediction	0.50	0.72	–

Logistic regression model 1 describes the binomial model for the dependent variable "fall category" (fallers vs. non-fallers). Covariates were the AUCs (0.25–0.75 of PWS; 0.75–1.25 of PWS; 1.25–1.75 of PWS, 0.25–1.75 of PWS)
Logistic regression model 2 describes the multinomial model for the dependent variable "fall frequency" of the preceding 12 months (group 0, no fall; group 1, one fall; group 2, two or more falls). Covariates were the AUC (0.25–0.75 of PWS; 0.75–1.25 of PWS; 1.25–1.75 of PWS, 0.25–1.75 of PWS)
AUC area under the curve;CV coefficient of variation;PWS preferred walking speed

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Methods

- Systems: GAITRite®, Actibelt®

Procedures

- Estimation of the slow, self chosen and fast walking speed for real overground locomotion (GAITRite®, laboratory conditions)
- Training of the different velocities
- Measurement of gait velocity using the Actibelt® system controlled by the gold standard on a straight 50m track; respectively 2x50m in low, self chosen and high speed

Probands

- **Healthy** Probands (20-60years old): **N=30**
- Patients with **bilateral vestibulopathy** (20-60 years old): **N=15**
- Patients with **cerebellar ataxia** (20-60 years old): **N=15**

Perspective

- The ability to measure gait characteristics and gait speed in off-laboratory situations offers the oppurtunity to detect walking speed compensation strategies that are applied in real-world mobility
- This might promote future studies on therapeutic interventions which train the ability to optimize walking speed during locomotion in order to avoid falls.