

SPATIO_TEMPORAL GAIT ANALYSIS USING AN INSTRUMENTED WALKWAY. NORMAL DATABASE, VALIDITY AND RELIABILITY

¹ Martine Ourth, ¹ Jérôme Pauls, ² Patrick Salvia, ^{1,2} Marcel Rooze, ¹ Veronique Feipel

¹Laboratory for Functional Anatomy, ²Laboratory of Anatomy, Biomechanics and Organogenesis, Université Libre de Bruxelles, email: vfeipel@ulb.ac.be, web: www.homepages.ulb.ac.be/~anatem/

INTRODUCTION

Spatio-temporal gait analysis is commonly used to identify and quantify gait abnormalities in clinical settings. Among the tools available the GAITRite® instrumented walkway offers ease of use, portability, and absence of need of patient instrumentation. Several studies [1,2,4-8] have analysed the reliability and validity of this system, concluding for most of them that the GAITRite® is a valid and reliable tool. Some controversial issues remain [1,2,4] concerning the validity of spatial parameters. This study aimed at establishing a large database of normal spatio-temporal gait parameters and verifying the concurrent validity and long-term test-retest reliability of the GAITRite® system.

METHODS

We recruited 100 healthy (SF-12 questionnaire) subjects (informed consent and ethics committee approval), aged 15 to 80 years, which were requested to perform 7 (5 at preferred speed and 2 at fast speed [6]) gait trials, barefoot, on a GAITRite instrumented walkway (Platinum model, 6.10 m long). The participants were divided according to six age categories, 10 men and 10 women per group, except for the age groups above 60 years, where N = 10. Concurrent validity (simultaneous sampling by an 8-camera Vicon 612 system and 2 AMTI force plates) was evaluated for 8 subjects. Long-term test-retest reliability (3 to 4 months) was evaluated for 10 subjects.

A repeated-measures ANOVA was used to evaluate the effect of velocity, age, side and gender on spatio-temporal gait parameters. Reliability and validity were quantified using the Bland and Altman method [9].

RESULTS AND DISCUSSION

Concurrent validity can be considered excellent. Mean differences (MD) averaged 0.5% of the mean value at preferred speed (SE = 0.6%) and 0.7% at fast speed (SE = 1.6%). For 2 of the 12 comparisons at preferred speed and 4 at fast speed, MD exceeded 2% of the mean.

Long-term reliability can be considered good. Mean differences were 0.8% (SE 1.8%) on average at preferred speed and 3.3% (SE 3.2%) at fast speed. At fast speed, temporal parameters were less reliable than spatial ones, as was the toe in/out angle. These results confirm those of previous studies [1-3,5-8] and provide additional information regarding long-term reliability and concurrent validity. As opposed to previous work, neither for validity nor for reliability was a significant bias found [10].

A normative database was constituted from the main study data. No significant right/left asymmetry was observed. The results for the main spatio-temporal parameters are presented in fig. 1 and table 1. The results were in agreement with previous findings [1,2,5-7].

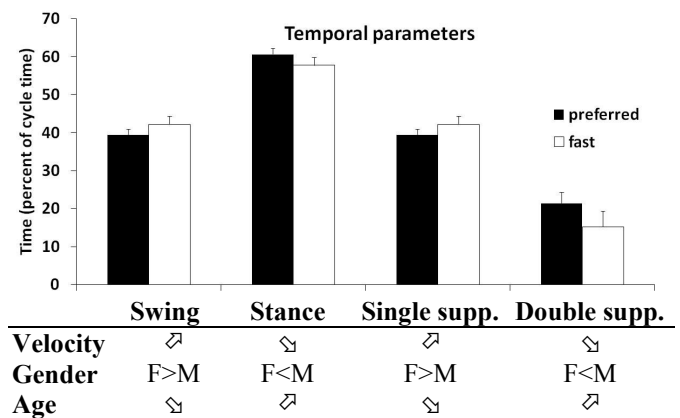


Figure 1. Temporal gait parameters and effects (ANOVA) of velocity, gender and age.

CONCLUSIONS

Excellent validity of the GAITRite® system for measuring spatio-temporal gait parameters was shown. Its long-term reliability is reasonable for clinical applications. This study enabled to clarify, in a larger healthy sample, the effects of age, gender and velocity on spatio-temporal gait parameters. The normal database that was constituted will be used as a reference for clinical applications.

REFERENCES

1. Bilney B, et al. *Gait Posture*. **17**: 68-74, 2003.
2. Cutlip R, et al. *Gait Posture*. **12**: 134-138, 2000.
3. Kressig R, et al. *Aging Clin Exp Res*. **18**: 174-176, 2006.
4. McDonough A, et al. *Arch Phys Med Rehabil*. **82**: 419-425, 2001.
5. Menz H, et al. *Gait Posture*. **20**: 20-25, 2004.
6. van Uden C, et al. *BMC Musculoskelet Disord*. **5**: 13, 2004.
7. Webster K, et al. *Gait Posture*. **22**: 317-321, 2005.
8. Youdas J, et al. *Arch Phys Med Rehabil*. **87**: 1648-1652, 2006.
9. Bland J, et al. *Lancet*. **i**: 307-310, 1986.
10. Paterson K, et al. *Arch Phys Med Rehabil*. **89**: 2360-2365, 2008.

	Preferred speed	Fast speed	Gender effect	Age effect	Velocity effect
Velocity (m/s)	1.3 (0.2)	2.1 (0.4)	NS	↘	↗
Step length (m)	0.68 (0.09)	0.81 (0.12)	NS	↘	↗
Stride length (m)	1.35 (0.18)	1.63 (0.24)	NS	↘	↗
Support base (m)	0.09 (0.03)	0.09 (0.03)	F<M	NS	NS
Toe in/out angle (°)	5.7 (5.4)	4.8 (5.0)	NS	↗	↘

Table 1. Average (SD) values of some spatio-temporal gait parameters and effects (ANOVA) of velocity, gender and age.