Do we always walk the same way? A 6-month Gait Reliability Study

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Summary

This study evaluated spatiotemporal gait metric reliability over 1-week and 6-month periods in healthy individuals walking at a self-selected pace. Reliability was higher within the first week compared to six months. The findings highlight natural gait variations over time, which should be considered in clinical assessments and long-term monitoring.

Introduction

Quantifying a person's biomechanical gait characteristics is a crucial clinical tool for assessing normal and abnormal locomotion [1]. Studies evaluating dysfunctional gait (e.g. neurological [2] or orthopaedical [3] conditions), often rely on healthy walking patterns to evaluate comparisons. Although valuable insights can be ascertained from longitudinal gait assessments, spatiotemporal gait metric fluctuations are not clearly defined in the healthy population. Therefore, the goal of this study was to evaluate the reliability of gait metrics during a 1-week and 6-month walking protocol in healthy people to inform future clinical and longitudinal gait studies.

Methods

Six healthy (2F, 4M; age: 25.9±3.3; BMI: 24.6±3.5 kg/m^2) participants completed the study; data collection is ongoing for four new participants. During the first session, participants provided feedback to find their preferred walking speed (range: 1.2-1.4 m/s), which was then used on all subsequent days, on a force plate treadmill (300 Hz, FIT5, Bertec, US). For each data collection protocol, a 2-minute warm-up preceded the gait session, which was immediately followed by a 6-minute level walking trial. In week 1, the protocol was repeated for five consecutive days; subsequent recordings were done weekly to obtain 29 recordings over 6 months.

Gait events were identified via vertical ground reaction force thresholds to calculate 12 spatiotemporal gait metrics and their variability (standard deviation, coefficient of variation) and asymmetry counterparts. Between-session reliability was calculated within the 1-week and 6-month protocols using intraclass correlations ($ICC_{3,1}$) with absolute agreement [4].

Results and Discussion

$ICC_{3,1}$ results are presented in Table 1. Higher ICC scores were obtained during week 1; 10/12 metrics of interest were deemed excellent (> 0.90) [4] compared to 5/12 metrics for the 6-month protocol. Single support time and swing time had the lowest ICC, which we hypothesize is caused by inconsistent neuromotor adjustments during the least stable portions of the gait cycle (i.e., due to the small base of support and the relatively high center of gravity [5]). Therefore, these metrics can be considered more susceptible to changes also during longitudinal studies.

Table 1: Spatiotemporal gait variables - ICC results

Variables	1 Week	6 Months
Cadence	**0.934**	**0.916**
Double Support Percentage	**0.983**	0.704
Double Support Time	**0.989**	0.843
Single Support Percentage	**0.984**	0.707
Single Support Time	0.453	0.536
Stance Perseverance	**0.982**	0.704
Stance Time	**0.974**	**0.940**
Step Time	**0.948**	**0.904**
Stride Length	**0.942**	**0.920**
Stride Time	**0.923**	**0.919**
Swing Percentage	**0.982**	0.703
Swing Time	0.628	0.488

ICC values considered excellent (>0.9) [4] were marked in **bold**

Asymmetry, coefficient of variation and standard deviation ICCs metrics demonstrated higher reliability during the 1-week protocol compared to the 6-month protocol (Figure 1).

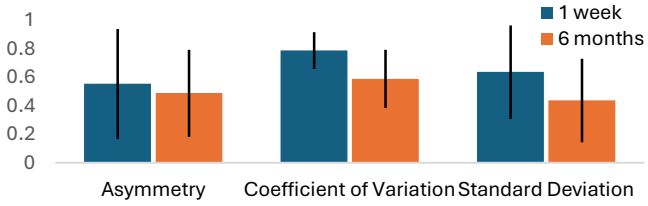

Figure 1: ICC averages for asymmetry, coefficient of variation and standard deviation of combined spatiotemporal gait variables for 1-week (blue) and 6-months (orange).

Conclusions

This study found that gait parameter reliability was higher within one week of continuous data collection, with 83% of the variables showing excellent ICC values (>0.90) [4], compared to 41% over six months. These findings highlight the influence of natural gait variations over time, emphasizing the need for careful consideration of assessment timing when establishing normative datasets and monitoring gait patterns in clinical and research settings.

References

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