Advancing Stroke Rehabilitation with 3D Gait Analysis – A Comparative Analysis of Mobile Application for Evaluation of Gait in Stroke Patients

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Introduction

Why stroke gait analysis matters

- Stroke is a leading cause of long-term disability, often resulting in impaired gait that requires ongoing rehabilitation and monitoring.
- Quantitative gait analysis is critical for assessing recovery and optimizing interventions.

Problem with current systems

- Traditional marker-based systems (e.g., Vicon, Qualisys) are expensive, resource-intensive and require dedicated spaces and skilled personnel, limiting routine use

Our solution: 3DGait

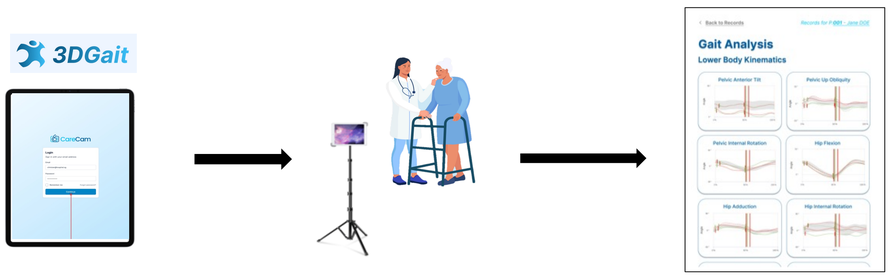
- Artificial intelligence (AI)-powered, markerless gait analysis system
- Designed for clinical, home and mobile use
- Validated in healthy individuals, demonstrating high accuracy in measuring spatiotemporal and angular gait parameters.

This study

- 3DGait's performance in stroke patients is evaluated against the gold-standard Vicon marker-based system.

3DGait: AI-powered markerless gait analysis using a single mobile device

3DGait is a **single camera, AI-driven, markerless gait analysis tool** that provides an precise evaluation of human gait. It captures 49 key gait biomarkers, spanning angular, temporal, and spatial metrics.

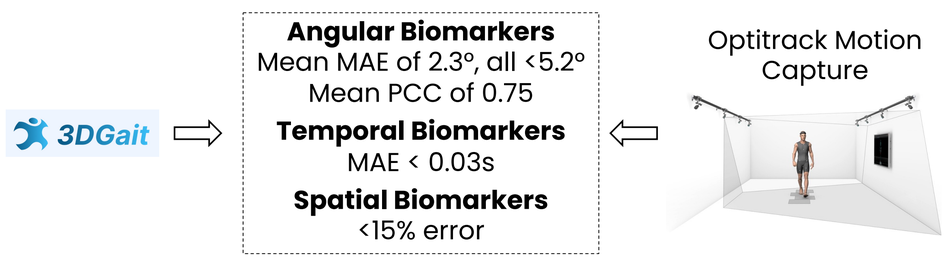


1 Camera | 1 Walk | 2 Minutes

Unlike traditional motion capture systems, 3DGait requires only 1 iPad, 1 short walk, and 2 minutes of processing time to provide a comprehensive gait analysis, making it an accessible and scalable solution for clinical use.

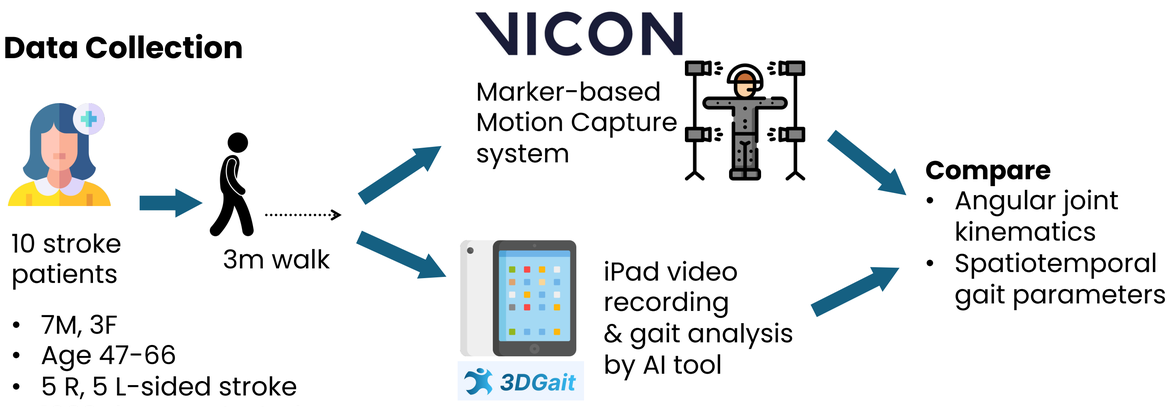
Accuracy of 3DGait in healthy subjects

Based on previous study (Guo et al., 2025)



Methods

Data Collection



- 7M, 3F
- Age 47-66
- 5 R, 5 L-sided stroke
- 1083 days post-stroke on average
- Functional Ambulation Category (FAC) 4-6

Evaluation metrics

- Mean-shifted Mean absolute error (MAE)
- Pearson's Correlation Coefficient (PCC)

Conclusion

- 3DGait shows **promising agreement** with Vicon marker-based motion capture system in stroke patients.
  - Average MAE of 0.10s, 0.05m, 0.03m/s for temporal, spatial and speed gait parameters
  - Average MAE of 3.32 degree, PCC of 0.60 for joint kinematics
- It enables **quick, accessible, cost-effective, and scalable** gait assessment using only a smartphone and no markers.
- Further validation on the full dataset (n = 30) and continued model refinement are underway to improve accuracy and support broader clinical deployment.

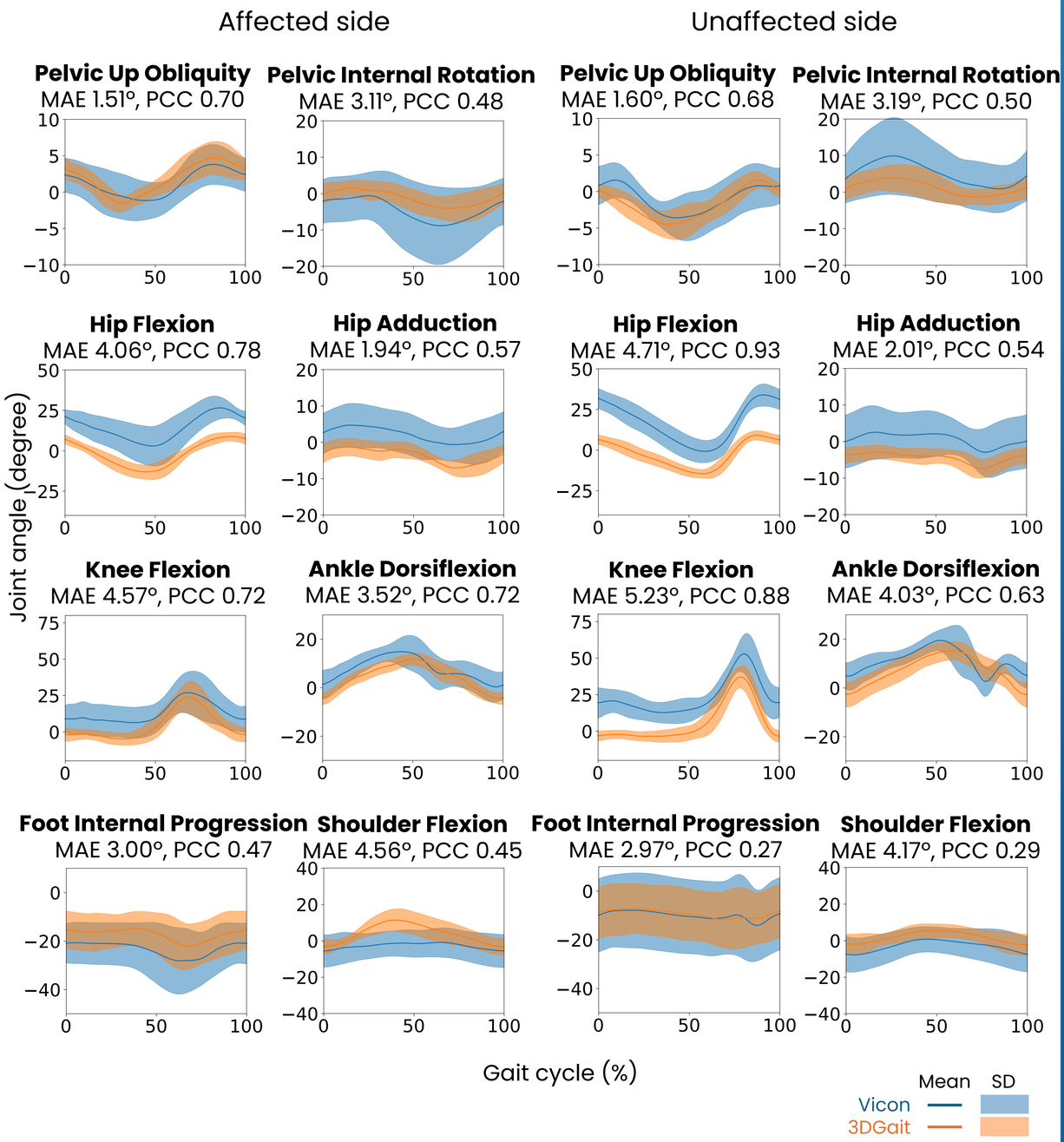
Results

Accuracy of spatiotemporal gait parameters

MAE of spatiotemporal gait parameters from 3DGait relative to Vicon

Parameter	Affected side	Unaffected side	Average
Stride duration (s)	0.08	0.09	0.09
Step duration (s)	0.09	0.08	0.09
Stride length (m)	0.04	0.04	0.04
Step length (m)	0.04	0.05	0.05
Gait speed (m/s)	0.03	0.03	0.03
Single support (s)	0.07	0.09	0.08
Double support (s)	0.14	0.12	0.13

Accuracy of angular joint kinematics



Acknowledgements

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References

Guo et al. (2025). Artificial intelligence-enhanced 3D gait analysis with a single consumer-grade camera. *Journal of Biomechanics, 112738.*

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