Gait Analysis for Criminal Investigations: Using Physics and Kinovea Program to Identify Walking Patterns.

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Abstract

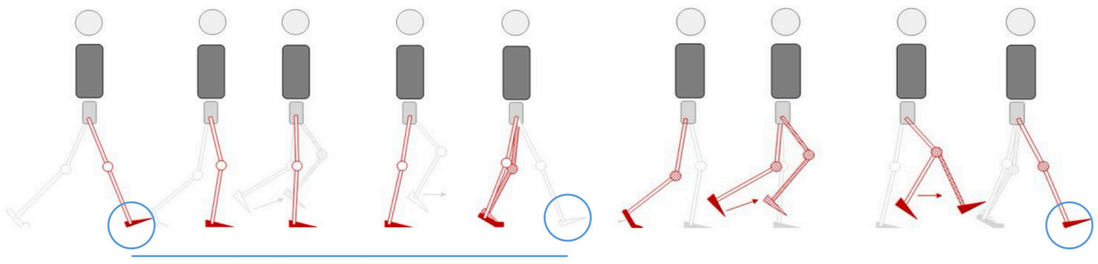
In contemporary criminal investigations, scientific principles are becoming more and more important, especially when it comes to confirming evidence. In this study, gait characteristics—particularly the right leg's movement and walking speed—are examined using physics-based analysis and Kinovea motion analysis software to determine their potential for suspect identification. Gait data were gathered from twenty male participants aged 20–35. A smartphone camera recording at 30 frames per second, mounted on a tripod with a contrasting background, was used for video capture. Physical markers were attached to the hip, knee, and ankle to enable accurate tracking. Gait footage was analyzed frame-by-frame under controlled conditions to extract biomechanical data. To test reliability, participants were randomly selected to perform a repeat gait test. The researchers then analyzed the newly recorded gait data to assess how well it matched to the original data. The results show that combining motion tracking with physics provides a low-contact and practical biometric method. This study supports the potential of gait analysis as a tool for future forensic investigations.

Objectives

- Study the differences in the walking patterns of individuals to serve as another means of identifying a person through video recording and then use data analysis software.

Results & Discussion

- Gait Cycle



(A) Stance phase (B) Swing phase

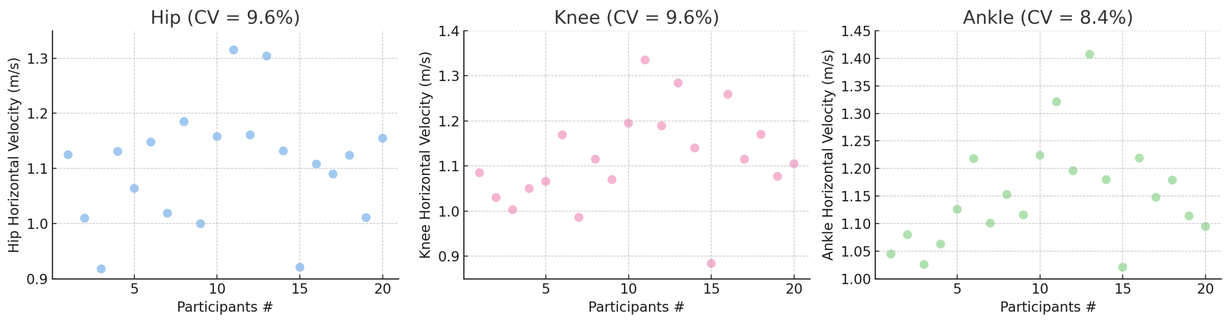


Fig 1-3. The graphs illustrate the average horizontal velocity of the hip, knee, and ankle of participants . The coefficient of variation (CV%) indicates the consistency of the data, with lower values (<10%) reflecting higher reliability.

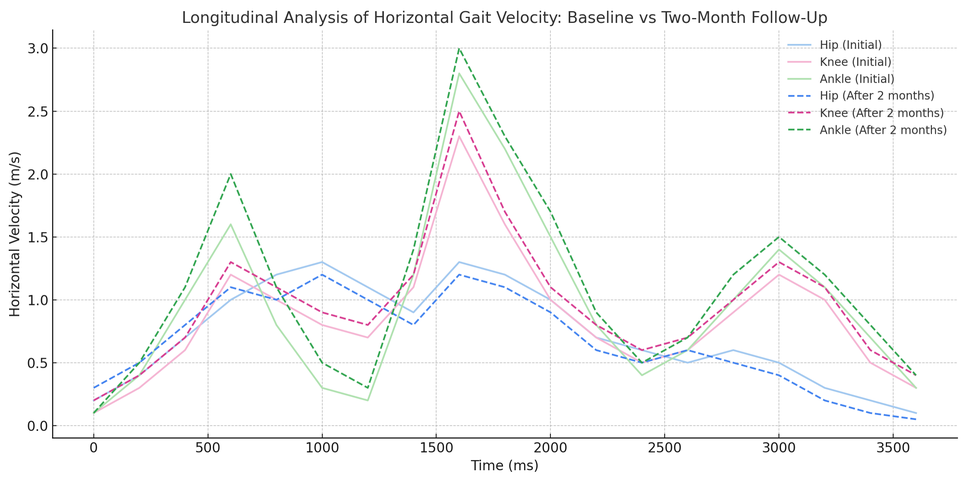


Fig 4. Horizontal gait velocity patterns from two time points (initial and two months later) show high consistency, with minor variations in velocity, supporting the reliability of gait as a forensic biometric marker when analyzed using Kinovea motion analysis software

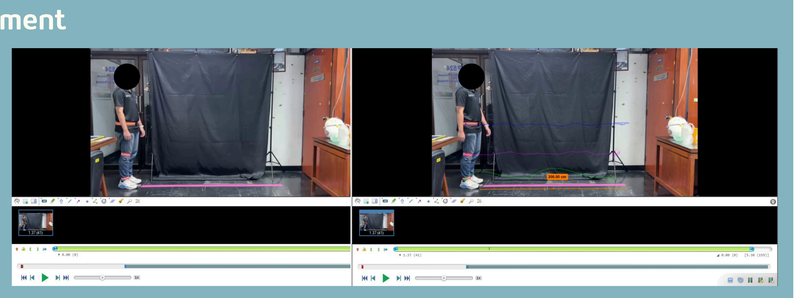
Methodology

1. Motion acquisition

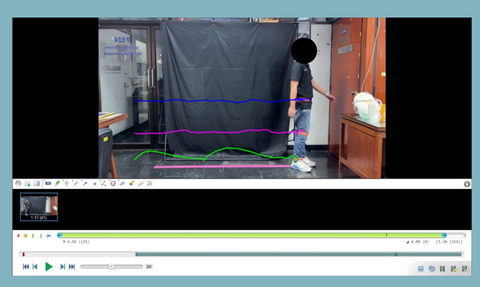
2. Criteria for Selecting Research Participants

3. Preparation of Equipment and Materials

4. Marker placement



5. Video recording with iPhone 13 camera with 1080 × 1920 HD resolution at 30 fps.



6. Take 20 video samples of all participants walking.

7. Data analysis

8. Kinovea

Conclusions

1. The coefficient of variation (CV) values for hip, knee, and ankle (9.6%, 9.6%, 8.4%) indicate consistent horizontal velocity patterns among participants.
2. Horizontal gait velocity patterns from two time points (initial and two months later) show high consistency, with minor variations in velocity, potentially supporting the reliability of gait as a forensic biometric marker when analyzed using Kinovea motion analysis software.
3. The study demonstrates that gait analysis, combined with Kinovea motion analysis software, is a promising initial method and can be further developed for use in future forensic applications.

Acknowledgements

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