

THE EFFECT OF THE CANE GAIT STYLE ON THE STRIDE INTERVAL IN HEALTHY YOUNG ADULTS

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Summary

The effect of the cane gait style on the stride interval was determined using the scaling exponent α from the detrended fluctuation analysis (DFA). The subjects were 30 healthy young adults. The gait styles were no-cane gait, 2-point cane gait, and 3-point cane gait. The cane gait was performed with the right hand holding the cane. The scaling exponent α of the stride interval of the ipsilateral lower limb on the side holding the cane changed significantly depending on the cane gait style. On the other hand, the scaling exponent α of the stride interval of the contralateral lower limb did not change significantly depending on the cane gait style. This difference is thought to be because the ipsilateral lower limb on the side of the cane emphasizes movement adaptations to assist stability and weight. In comparison, the contralateral lower limb tends to maintain the typical gait pattern.

Introduction

Gait is a rhythmic, automatic movement controlled by the spinal and supraspinal centers. In 1995, Hausdorff used detrended fluctuation analysis (DFA) to quantify fluctuations using a scaling exponent α [1]. He reported that in normal people, the scaling exponent α takes values of $0.5 < \alpha < 1$ and that fluctuations show fluctuation characteristics with long-term correlation. The scale exponent α decreases with age and disease, and is a valuable index that can be used as one of the gait evaluations [2]. However, in clinical practice, there are cases in which gait is impossible without using a cane or walker, and it is necessary to investigate how the scaling exponent α changes depending on the cane gait style. In the present study, we examined how the scaling exponent α changes with different styles of cane gait.

Methods

The subjects were 30 healthy young adults (15 men and 15 women, mean age 21 years). The gait style was barefoot gait without a cane, 2-point cane gait, and 3-point cane gait. The subjects held the cane with their right hand. Subjects walked at a self-selected comfortable gait speed for 10 minutes on a 20-meter gait track with a figure-8 shape. Triaxial accelerometer sensors from the Delsys Trigno Wireless EMG System were attached to the heels and lumbar region (L4-L5 level), with a sampling rate of 1000 Hz, to measure acceleration during gait. Time series data for the lower limb stride interval (time) were obtained from the acceleration data in the heel, and time series data for the step interval were obtained from the acceleration data in the lumbar region. The scaling exponent α was calculated from these time series data at least 600 points using DFA and compared for the three gait styles. A comparison of the scaling exponent α among the

three gait styles was performed using a paired one-way analysis of variance (ANOVA) to test significance. If a significant difference was found, multiple comparisons were made using the Bonferroni method to test the significance among the three groups. The significance level was established at less than 5% in all cases.

Results and Discussion

The scaling exponent α of the stride interval of the ipsilateral lower limb on the side holding the cane changed significantly depending on the cane gait style (Fig.1). On the other hand, the scaling exponent α of the stride interval of the contralateral lower limb on the side holding the cane did not change significantly depending on the styles of cane gait. The presence or absence of change in the scaling exponent α of the lower limb and the contralateral lower limb is presumed to be due to the difference in the effect of cane use on a specific lower limb. In particular, the ipsilateral lower limb on the side holding the cane emphasizes movement adaptation to assist stability and weight support. In comparison, the contralateral lower limb tends to maintain the typical gait pattern, so it is thought that the influence of the cane gait style leads to different results.

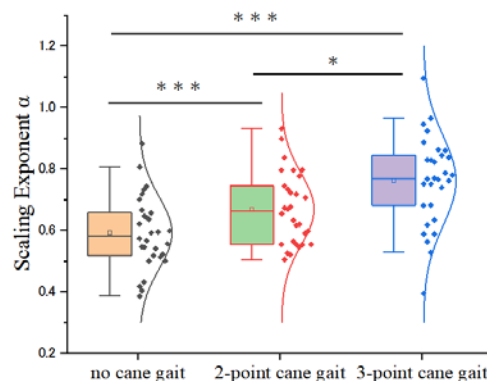


Figure 1: Scaling Exponent α of Stride Interval of Lower Limb

Conclusions

It was revealed that the cane gait style affects the variability of the stride interval of the ipsilateral lower limb with cane use and that the 3-point cane gait forms a more stable gait rhythm than the 2-point cane gait.

References

- [1] Hausdorff JM et al. (1995). *J Appl Physio*, **78**: 349–358.
- [2] Hausdorff JM et al. (1997). *J Appl Physio*, **82**: 262–269.