

## LOWER EXTREMITY KINEMATICS DURING JOGGING: INFLUENCE OF TREADMILL SETTINGS

<sup>1</sup> Lan-Yuen Guo, <sup>2</sup>Chieh-Huang Yang, <sup>1</sup>Wen-Lan Wu and <sup>3</sup>Fong-Chin Su

<sup>1</sup>Faculty of Sports Medicine, Kaohsiung Medical University, Kaohsiung, Taiwan

<sup>2</sup>Department of Physical Therapy, Tzu Chi College of Technology, Hualian, Taiwan

<sup>3</sup> Institute of Biomedical Engineering, National Cheng Kung University, Tainan, Taiwan

### INTRODUCTION

In recent years, more and more people have chosen to exercise using a treadmill in a gym or home setting. The main options available for jogging on a treadmill are (i) speed and (ii) inclination of the belt. Increased speeds and inclination not only increase the cardiopulmonary loading but also alter the lower extremity (LE) joint movement patterns[1, 2].

The current study to investigated LE joint movements during jogging at different speed and inclination settings.

### METHODS

Eighteen young males without neuromuscular or orthopedic problems were recruited in the experiment. The video-based motion capture system, HIRES Expert Vision System (Motion Analysis Corporation, CA, USA), with six CCD cameras, was used to collect kinematic data at a sampling frequency of 120Hz. Nineteen passive reflective markers were attached to bilateral lower extremities of the subject (Figure 1).

All subjects had a 5-minute warm-up period. One series of tests utilized four speeds (3.5 m/s, 3 m/s, 2.5 m/s, 2 m/s) with zero inclination. A second series of tests involved three slopes (15%, 10%, 5%) with the speed set at 3 m/s.



Figure 1: Marker setting

### RESULTS AND DISCUSSION

Increased the slope resulted in the lower extremity taking off the ground earlier during the jogging cycle. The main three joints of the LE had increased maximum flexion angles during the swing phase, but the maximum extension angles at stance phase were unchanged. For increased speeds, the hip and ankle joints had increased maximum joint extension angles during the stance phase, whereas the hip and knee joint had increased maximum flexion angles during the swing phase (Figure 2-4).

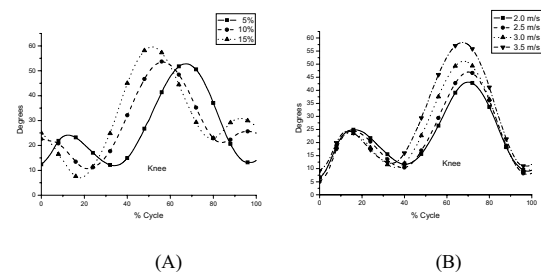


Figure 2: Knee joint motion during a jogging cycle with different incline (A) and speed (B) conditions.

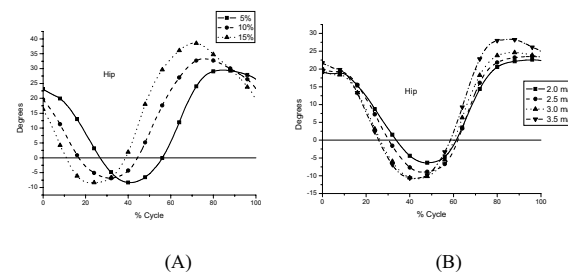


Figure 3: Hip joint motion during a jogging cycle with different incline (A) and speed (B) conditions.

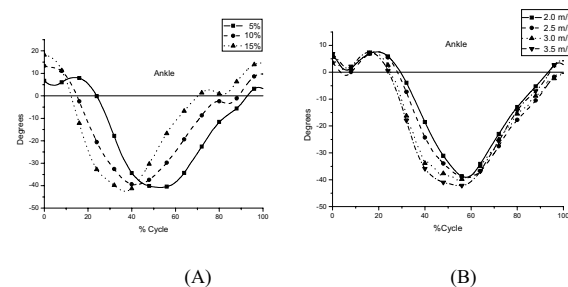


Figure 4: Ankle joint motion during a jogging cycle with different incline (A) and speed (B) conditions.

### CONCLUSIONS

Systematic kinematic investigations of the speed and incline settings on recreational treadmills show that LE joint motions are affected differently for each setting. This information can provide rehabilitation clinicians or athletic coaches with guidelines for selecting appropriate modes for jogging.

### REFERENCES

1. Mann, R.A, et al.. Am J Sports Med **8**, 345-50, 1980.
2. Novacheck, T.F. Gait Posture **7**, 77-95, 1998.

### ACKNOWLEDGEMENTS

Supported by grant NSC92-2320-B-277-003, Taiwan