Gait Analysis of Slope Lateral Walking: A Preliminary Study

Chien-Ju Lin[1] Lin-Hwa Wang[1, 2] Fong-Chin Su[1,*]

[1]Institute of Biomedical Engineering, National Cheng Kung University, Tainan, 701, Taiwan ROC
[2]Department of Physical Education, National Cheng Kung University, Tainan, 701, Taiwan ROC

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Abstract

Objective: The purposes of this study were to investigate the differences in gait parameters of lower extremity joints and the center of the pressure between level and slope lateral walking, and hopefully to improve labor safety.

Method: Four normal subjects participated in this study. The entire lateral walking cycle can be divided into the stance phase and the swing phase. Slope inclinations were set at 5 degree. The subjects walked from the bottom of the slope to the top. The data was collected for 5 seconds for each trial.

Results: Similar pattern was found in the first and the second force plate which indicated that the increasing height on the slope didn't change the trajectory of center of pressure.

Conclusions: The pattern of the ankle joint of the left foot was significantly different from that of the right ankle during level and slope lateral walking. The results will help labors to decrease the possibility of being injured, and to promote the performance.

Keywords: Slope, Force plate, Gait analysis, Lateral walking, Center of pressure

Introduction

With labors' dedication, the economy continues developing. As the production process becomes more and more complicated nowadays, more operating risks are involved. As a result, the workers' occupational safety turns into one of the primary concerns for all the developing countries.

Tubular steel scaffolding is commonly used in Taiwan as construction false work and finishing structure of high headroom buildings. According to labor law, when it's necessary for labors to work on 2-meter or higher scaffoldings, the width of the scaffoldings should not be narrower than 30 centimeters. And since the center of pressure (COP) is the point where the force is collectively exerted at the surface, the measurement of the COP has been a successful tool for gait analysis [1].

To investigate the phasic activity of the lower extremity muscles during upslope and downslope walking, five muscles of ten healthy men were examined by telemetered electromyography (EMG)[2]. The muscles were the tibialis anterior (TA), gastrocnemius (Gc), rectus femoris (RF), semitendinosus (St), and gluteus maximus (GM). The inclinations of the slope were 3, 6, 9 and 12 degrees. EMG of the muscles and the time factors of a walking cycle were recorded by a 12-channel polygraph simultaneously. In upslope walking, the duration of TA, St and GM activity was longer and that of RF activity was shorter than in level walking. The phasic pattern of Gc in upslope walking was the same as in level walking. In downslope of Gc and RF activity was longer than on the level. St showed biphasic activities. The phasic pattern of TA and GM were nearly the same as the pattern in level walking. The phasic activity of the muscles altered when the upslope inclination was over 6 degrees, or over 3 degrees in downslope. The findings indicate that the muscles stabilize knee and ankle joint much more in slope walking than in level walking, and in slope walking, they also exert themselves to elevate or lower the body weight. The determinations of step length, width, time factors and deviation in the center of pressure during upslope and down slope walking in 17 healthy men between the ages of 19 and 34 were made by a force plate [3]. Slope inclinations were set at 3, 6, 9 and 12 degrees. At 12 degrees, walking speed, the product of step length and cadence, decreased significantly ($P<.01$) in both upslope and down slope walking. The most conspicuous phenomenon during upslope walking was found in cadence. The steeper the slope, the smaller was the cadence. On the other hand, the most conspicuous phenomenon in downslope walking was step length. The steeper the slope, the shorter the step length was.

Kinematic and kinetic parameters are important for investigation of gait patterns. To authors' best knowledge, however, no studies had focused on the kinematic or kinetic changes during slope walking. In our previous studies [4-7], gait models were established to analyze the phenomena occurred in patients and normal subjects. The technique can be

*Corresponding author: Fong-Chin Su
Tel: +886-6-2760665; Fax: +886-6-2343270
E-mail: fcsu@mail.ncku.edu.tw