Human Backward Locomotion Analysis in the Different Level

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Abstract

The purpose of this study was to investigate the different level treadmill during the back locomotion. Backward walking is used increasingly as a rehabilitation technique for individuals with neurological and orthopaedic impairments（Laufer Y 2003）. Backward locomotion was good for rehabilitation technique.Ten people (age 21.5±0.52 years) volunteered to participate in the study and underwent the following tests before. We recorded movement using the Vicon analysis system to define stand phase and swing phase. Using Biopac mp150 to record surface EMG（1000 sampling frequency）. We recorded backward walked in different level（0^0、5^0、10^0）.The EMG activities were recorded from the following muscles：Rectus Femoris；Vastus Lateralis；Vastus Medialis；Biceps Femoris；Semitendinosus； Gastrocnemius and Tiblialis Anterior.All trial we was select complete gait cycle（100％）. We use linear envelop to see the muscle activities. During the stand phase the muscle activity turn was VM and BF and TA. There was muscle co-contraction in BF and TA. During the swing phase the muscle activity turn was BF、RF、GT、TA、VL and VM. There was muscle co-contraciton in BF and RF（60%）、GT and TA（70%） and VL and VM（90%）.When we increase the treadmill level, we find the muscle co-contraction was RF、VL and VM（90%）and BF and ST（80%）.

Keyword: Locomotion, Different Level

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INTRODUCTION

In recent years, the predominant philosophy of physical therapists and athletic trainers in treating lower extremity injuries has focused on the use of closed kinetic chain exercises. While a variety of techniques are typically used to create a closed kinetic chain environment, one that has evoked particular interest is backward walking. The functionality of both backward and forward walking in rehabilitation is quite obvious. However, it has been suggested that backward walking may offer some benefits beyond those experienced through forward walking alone. Gray (1989) reported his observation that backward walking appeared to create more muscle activity in proportion to effort than forward walking. Thus, numerous studies have examined a variety of locomotion parameters to determine the unique differences between backward walking and forward walking（Winter, et. al., 1989; Flynn, et. al., 1994; Myatt, et. al., 1995）.

Both Vilenskv, et. Al., (1987) and Kramer and Reid (1981) concluded that backward walking was different from forward walking. They reported that backward walking was associated with increased cadence and decreased stride length when compared with forward walking. Cipriani, et. Al.,(1995) concluded that backward walking up an incline may place additional muscular demands on an individual. These authors also observed that the joint kinematics involved in backward walking were substantially different from those of forward walking. In contrast, however, Winter and Pluck (1989) concluded that backward walking was a near mirror image of forward walking.

Backward walking is a common tool for lower extremity rehabilitation in the clinical setting or recreation Sports. That is used increasingly as a rehabilitation technique for individuals with neurological and orthopedic impairments（*Ortega, J.*

D.,& Farley, C.T., 2007). Backward walking is used increasingly as a rehabilitation technique for individuals with neurological and orthopaedic impairments（Laufer, Y., 2003）. Backward locomotion was good for rehabilitation technique. Data from humans suggests that up- and downslope walking require different control strategies than level walking (Lay et al., 2006). The purpose of this study was to investigate the different level treadmill during the back locomotion（treadmill at 0^0、5^0 and10^0 ）. To observing the lower extremity muscle activity at the different level.

METHODS

PARTICIPANTS

Ten people (age 21.5±0.52 years, BMI 24.62±2.53 kg/m^2) volunteered to participate in the study and underwent the following tests before. They were no orthopedic or neurological abnormalities that would impair gait.

INSTRUMENTATION

A motor drive treadmill (Cambridge Model 3050, Quinton Instruments Inc., Seattle, M'A) was used for all of the backward. We recorded movement using the Vicon analysis system consisting of 9 digital cameras (Vicon 612, Oxford Metrics) to define stand phase and swing phase. Using Biopac mp150 to record surface EMG(1000HZ). All data was synchronized with the Vicon analysis system (200HZ)so that every fifth EMG data sample occurred at a single corresponding video sample.

Muscle activity was recorded differentially from the following muscles：Rectus Femoris；Vastus Lateralis；Vastus Medialis；Biceps Femoris；Semitendinosus； Gastrocnemius and Tiblialis Anterior on the left leg.

PROCEDURE

To provide an opportunity to acclimate to backward walking on a treadmill, all subjects were required to complete the 10-minute practice session at 0^O of inclination. Each subject was prepped for electrode placement by cleaning and abrading the skin surrounding the motor point for each of the seven muscles : Rectus Femoris, Vastus Lateralis, Vastus Medialis, Biceps Femoris, Semitendinosus, Gastrocnemius and Tiblialis Anterior. The maker set was identified on the basis of specific superficial anatomical 42 landmarks.

Prior to data collection for the backward walking trials, all subjects were requested to walk backward on the treadmill for 1 minute. All subjects were backward walked three minutes. We recorded backward walked in different level (0^0、5^0、10^0) .

During data collection, the order for administration of the three inclination conditions was randomized for each subject. Prior to collecting data for each condition, the subject completed a 1-minute accommodation period, which was then followed by a 1-minute period during which the EMG and video data were collected. A 2-minute rest period was then given before progressing to the next condition. Throughout all the trials, the subject was simply instructed to walk at a comfortable self selected pace.

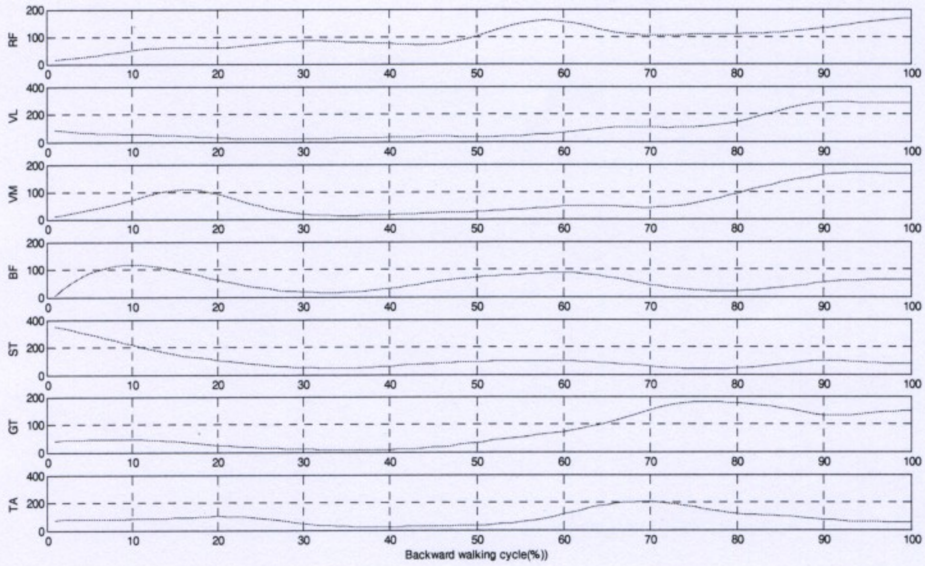
ANALYSIS

We selected complete gait cycle (100%) of the All trials. These markers were used to define a five-link model, consisting of the trunk, pelvis, thigh, shank, and foot segments. The positions of these markers were tracked by the video processor during analysis, and the resulting path data smoothed with a second-order zero lag Butterworth filter with a low pass cut-off of 10 Hz.

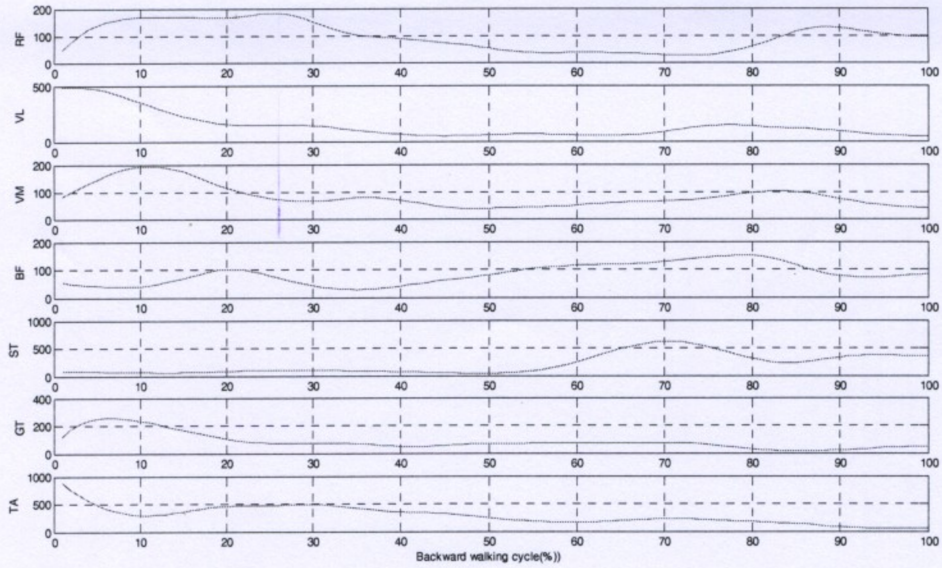
RESULTS

We use linear envelop to see the muscle activities. The results show in Figure 1, Figure 2 and Figure 3. Muscle activity during backward walking changed in each different phase of gait. When we increased the treadmill level Rectus Femoris muscle increased activity in the 0-20 % phase. Vastus Lateralis increased activity in 0-20% phase. Vastus Medialis got more activity in 0-20% phase. Biceps Femoris got more activity in 0-20% phase. Semitendinosus got more activity in 60-90%. Gastrocnemius got more activity in 0-20% phase.

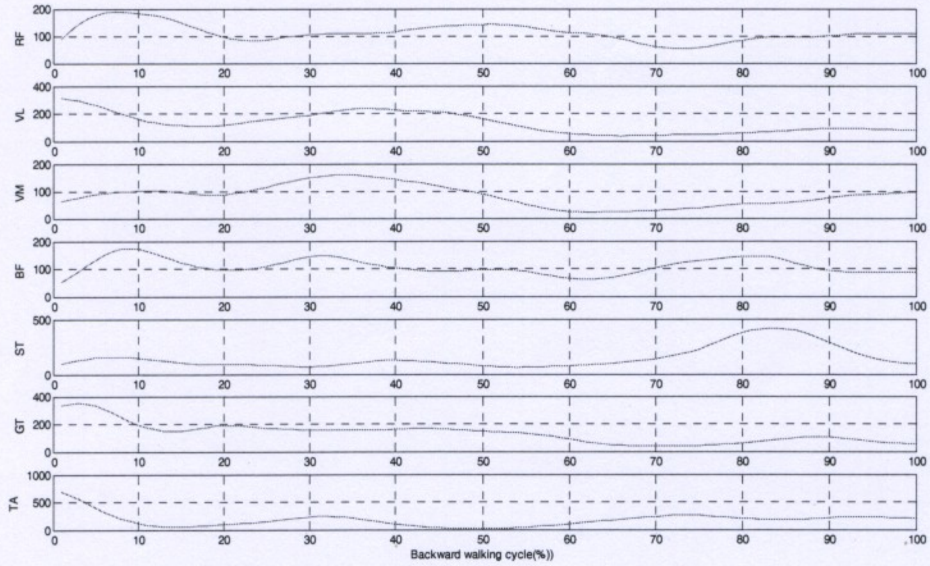
Tiblialis Anterior decreased activity in 60-80% phase..



0^0 inclination



5^0 inclination



10^0 inclination

DISCUSSION

In this study, we discussion the muscle activity. We find that when subject backward walking in the treadmill. During the stand phase the muscle activity turn was VM and BF and TA. There was muscle co-contraction in BF and TA. During the swing phase the muscle activity turn was BF、RF、GT、TA、VL and VM. There was muscle co-contraciton in BF and RF（60%）、GT and TA（70%）and VL and VM（90%）.When we increase the treadmill level, we find the muscle co-contraction was RF、VL and VM（90%）and BF and ST（80%）.These results were the same with Chen, L. Y.,(2000）. Backward walking up an incline may place additional muscular demands on an individual. When we increased the treadmill level, muscle increased activity in different phase. These results may be used as a guide for adapting a rehabilitation program. We suggested that if we increase incubation. It will be helpful for our body.

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