TEXAS WOMAN'S UNIVERSITY™

School of Physical Therapy Dallas & Department of Health Studies

Pushing a Sled: Assessing its Impact on Gait Temporospatial Parameters in Young Healthy Adults

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Abstract

BACKGROUND: Resistance exercise (RE) has been demonstrated as a superior modality for increasing muscle strength, muscle endurance, power, and motor performance. The sled used in this study is a novel device that provides proportional increase in resistance with increased speed.

PURPOSE: To examine the impact of resistance on gait temporospatial parameters using a resistance sled in healthy young adults while walking and running.

METHODS: Fifteen young adults (ages 21-35) were recruited to participate in this study. Sensors (accelerometers and gyroscopes) were placed on each subject at the chest, waist, both wrists, and ankles. Each participant performed three trials of 40 feet for the following conditions: self-paced walking (W), self-paced walking while pushing the sled (WP), and maximal speed running while pushing the sled (RP).

RESULTS: A repeated measures MANOVA was conducted to compare gait temporospatial parameters across conditions. Results indicate significant differences (P <0.005) between all conditions for stride length, cadence, double support time, swing %, and stance %. Stride length decreased across all conditions: W (85+/-3.0), WP (68+/-4.1), and RP (56+/-7.0). Cadence decreased while WP (92+/-10.1), yet increased during RP (169+/-14.9), compared to W (109+/-6.7). During WP and RP, participants demonstrated greater gait cycle percentage in stance phase [(WP, stance phase: 66+/-1.6, swing phase: 34+/-1.6) and (RP, stance phase: 57+/-2.7, swing phase: 42+/-2.7)] when compared to W (stance phase: 37+/-2.1, swing phase: 37+/-2.2).

CONCLUSIONS: Longer stance phase with proportional increase in resistance could be utilized as a combined resistance and gait training tool as opposed to only gait training. Future studies should focus on neuromuscular activation of the lower extremity, specifically the muscles involved in the gait cycle stance phase, when walking or running with resistance.

Introduction

Resistance exercise (RE), a general term referring to exercise requiring one to exert a force against resistance, has been demonstrated to be a superior modality for increasing muscle strength, muscle endurance, power, hypertrophy, and motor performance. In addition to the benefits that come alongside enhancing muscular fitness, regular participation in resistance training results in improvements in body composition, blood glucose levels, insulin sensitivity, and blood pressure regulation. RE promotes muscle strength and mass, which increases bone mass and may serve as a valuable measure to prevent, slow, or even reverse bone mass loss in people with osteoporosis. The mental health benefits associated with RE may prevent and improve depression and anxiety and decrease fatigue.

The XPO Trainer is a novel device which provides low rolling resistance at low speeds with an immediate and automatic proportional increase in resistance with increased speed.

Resistance sleds are typically utilized in athletes and younger populations, so for comparison purposes, we have recruited participants of a comparable age range for this study.

Methodology

Purpose:

Examine the impact of using the XPO Trainer at low and fast speeds on muscle activity and kinematics in young, apparently healthy adults between 21-40 years of age.

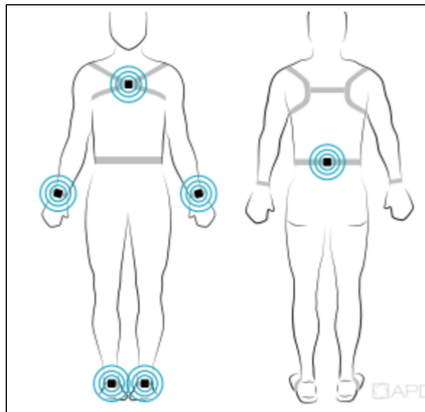
Methods:

There were 15 participants between the ages of 21 and 35.
After consent was given:

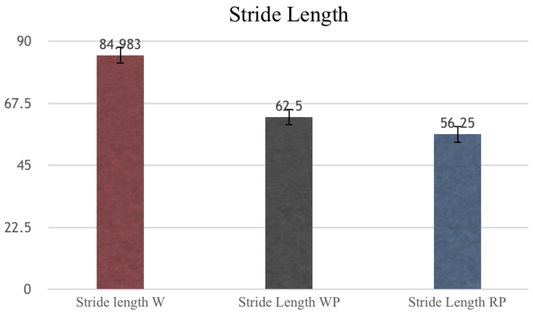
1. APDM Mobility Lab™ sensors were placed on each participant to assess motion analysis and measure kinematics of step/stride length, cadence, gait speed, and single/double limb support.
   a. Six mobility lab sensors were placed on the wrists, ankles, waist, and chest of each participant for the duration of the protocol.
2. Each participant was asked to complete the protocol across a pre-marked 40 ft. distance.
3. The protocol for this study was to
   a. walk at a natural pace
   b. walk (push) at a natural pace while pushing the XPO sled
   c. run (push) while pushing the XPO sled as hard and fast as possible
4. Each trial was repeated three times, and the average of each is depicted in the results.

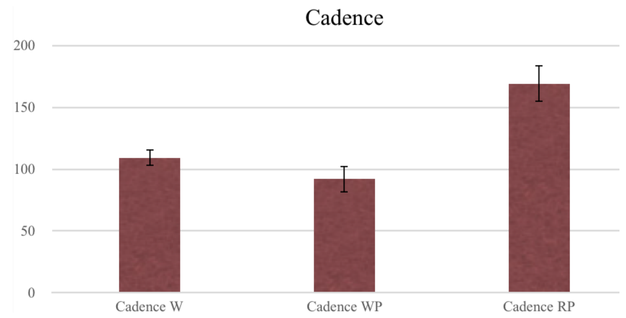
Results

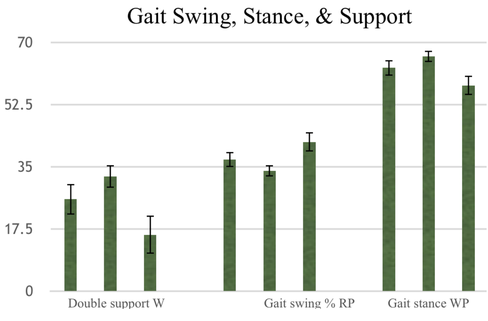
Mobility Lab Sensors

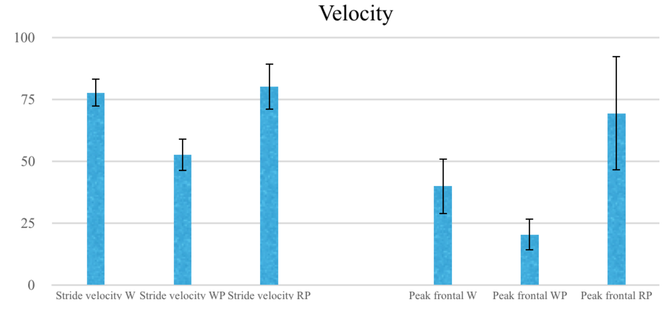


Resistance Trainer Sled









Conclusion

- **Sled Resistance can modify your gait parameters while walking/running pushing.**
- **Longer stance phase with proportional increase in resistance could be utilized as a combined resistance and gait training tool as opposed to only gait training.**

Future Directions

- The future directions for this study include incorporating electromyographic (EMG) data to research the neuromuscular activation of the resistance sled.
- The EMG data should focus on the abdominal, lower back, and lower extremity muscles, specifically the muscles involved in the gait cycle stance phase, when walking or running with resistance.