



The Effect of Drop-Set Training on Muscle Activation and Muscle Fatigue

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Introduction

Muscle Fatigue is the inability of a muscle to generate force or power to maintain the quality of movement. Muscle fatigue can significantly limit physical performance in daily activities of living, during physical rehabilitation, and during health-related resistance exercise training. Our overall goal is to examine the relationship between resistance exercise training and the muscle fatigue process. In this study we measured the neuromuscular responses to a unique velocity and load-based resistance exercise training methodology.



This new resistance exercise training technique uses repetition-to-repetition changes (i.e., decrease) in movement velocity as an indicator to change the load (i.e., decrease resistance) within each set of a resistance exercise. Our previous research has shown that neuromuscular (i.e., EMG) indices of acute, local muscular fatigue are closely linked with decreases in movement velocity. We can determine on a rep-by-rep basis, with our custom-built technology and previous research, a specific, individualized change in movement velocity and then use this as the threshold for decreasing the resistance load as way to minimize muscular fatigue and increase the volume (i.e., number of repetitions X resistance load) of each set of a resistance exercise. We can study the use of this movement velocity and load-based resistance exercise training system to potentially enhance and/or optimize the benefits of resistance exercise for a variety of purposes.

Purpose

The purpose of this study is to examine acute, local muscle fatigue and muscle fiber activation adaptation patterns from a neuromuscular and external mechanical perspective. We are using a dynamic single-leg extension resistance exercise model and a drop-set training template to better understand the muscle fatigue and muscle activation processes.

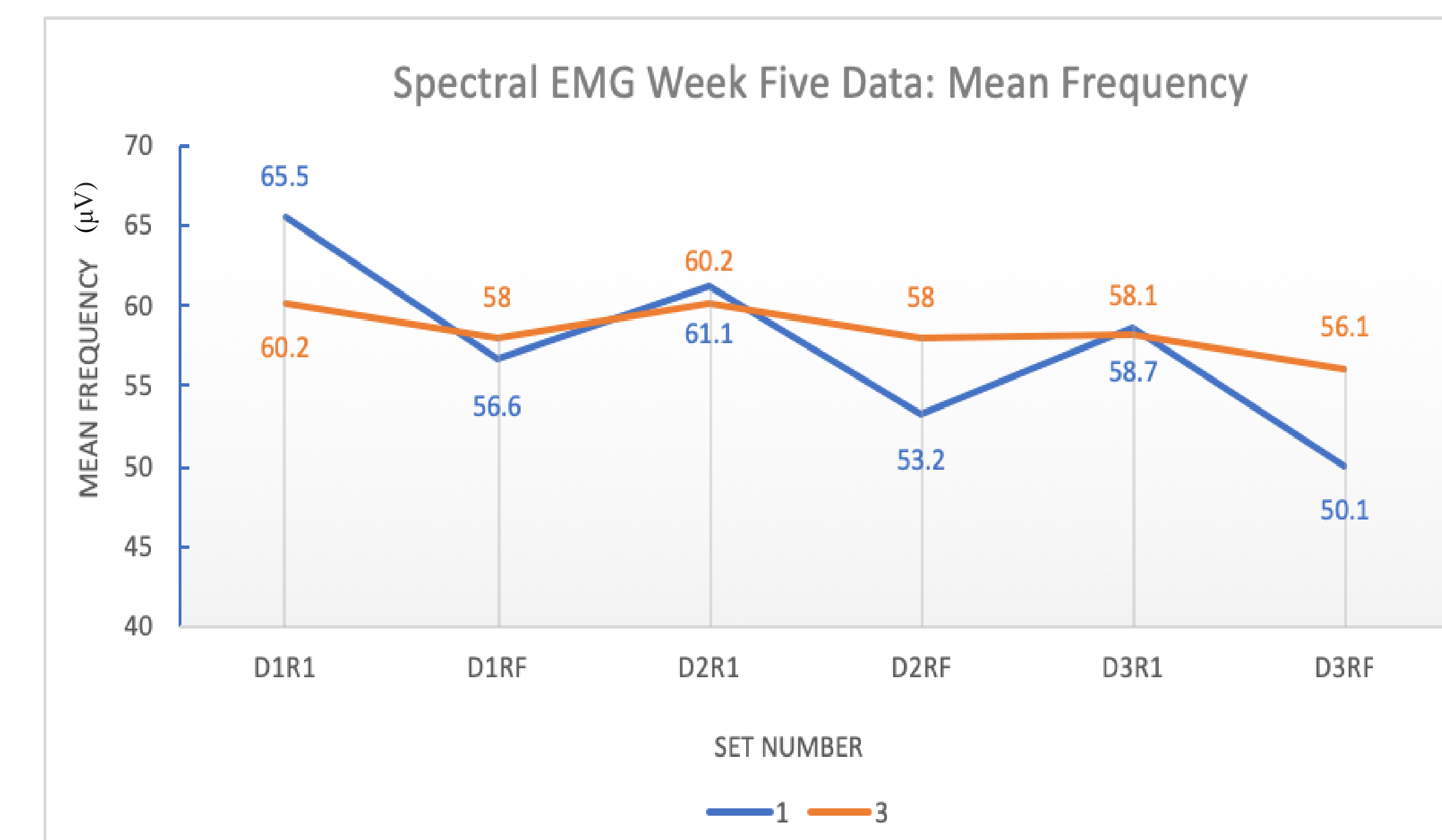
Methods

- 4 Females, 1 Male with varying resistance training experience volunteered for this study
- Anthropometric and Body Composition measurements were recorded prior to participation in the study.
- Participants completed a One Repetition Maximum (1RM) Test to use as a baseline to determine training weight.
- 75% of a participant's 1RM was used as the predetermined training weight. Drops in weight were in accordance with 10% decrease in velocity and 20% decrease in resistance.
- An Ultrasound sensor & custom-built software was used to monitor movement velocity of each repetition. When a participant's repetition resulted in a velocity lower than that of the predetermined velocity a drop in resistance occurred. Two weight drops occurred in each set and total repetitions and exercise time were also recorded.
- In one training day participants completed three sets with two minutes of rest in between each set.
- Electrodes for EMG analysis were placed on the Vastus Lateralis, Rectus Femoris and Vastus Medialis muscles on the right leg.
- Participants trained three times a week over the course of five weeks.
- At the completion of five weeks another 1RM test was administered.
- Anthropometric measures and Body Composition measurements were recorded after the completion of the study.

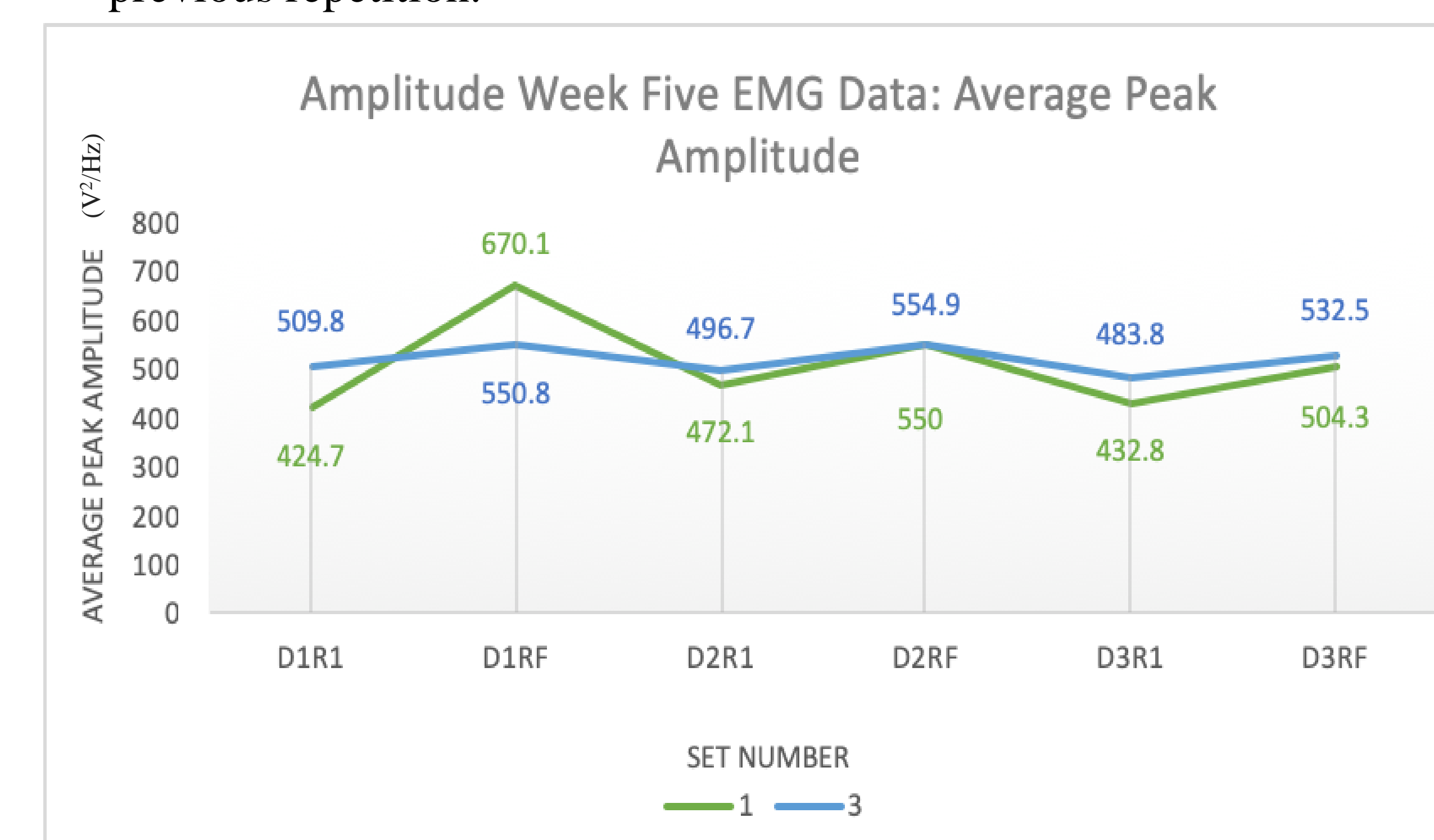
Results

Variable	Mean
Age (yrs)	19
Height (cm)	165.8
Total Leg Length (cm)	85.6
Upper Leg Length (cm)	45
Lower Leg Length (cm)	32.7

Variable	Week One Mean	Week Five Mean
Weight (kg)	67.26	66.72
BMI	22.52	22.4
Body Fat %	25.78	25.12
Lean Mass (kg)	50	49.8
One Rep Max (lbs)	151.8	180.4



- Repetition initial and repetition final significantly vary.
- The repetition initial after each drop is significantly higher than the previous repetition.



- The first and final repetitions across each drop are significantly different.
- Set one and set three are not significantly different.

Conclusions

- The data shows that both the Rectus Femoris and the Vastus Lateralis muscles of the quadriceps recover within each resistance-drop of each set.
- Muscular endurance and strength increased over the five week training period.
- The results of this study indicate that decreasing the resistance within each set of resistance training is an effective training methodology in order to minimize acute, local muscle fatigue and increase resistance training volume.