INTRODUCTION

Near-infrared light therapy has been implicated as an effective ergogenic aid to delay the onset of fatigue (1; 2). The most common manifestation of fatigue is impairment in muscle function and an inability to perform work. Fatigue is typically quantified with decreased force capacity within a target muscle (3). However, no studies have directly examined the ergogenic properties of near-infrared light therapy and its ability to enhance muscle activity, delay the onset of fatigue and prevent losses in muscular strength. The purpose of this work was to determine a therapeutic dose-response to near-infrared light therapy that will increase time to task failure (TTF) and muscle activation when performing a submaximal sustained contraction.

METHODS

The design of the study was a cross-over repeated measures, where each subject serves as their own control and receives all three treatments. A commercially available FDA approved Class IV phototherapeutic device (Lite Cure, LLC., Newark, DE) was used covering the muscle belly of the first dorsal interosseous (FDI). The electromyographic (EMG) activity from the FDI was recorded throughout the fatigue task. Neural activation of the FDI was quantified as the RMS amplitude of the EMG signal. Each subject received a 4 minute treatment. Each subject received 3 different doses of phototherapy treatment (sham, 240 Joules, 480 Joules) during three separate testing sessions. Nine right hand dominant healthy collegiate aged participants (24.3 ± 4.9 yrs, 171.7 ± 7.8 cm, 71.2 ± 11.6 kg) with no current history of injury to the upper extremity, or previous history/pathology that would compromise hand function. The dependent variables were time to task failure when performing a submaximal isometric contraction following treatment with near-infrared light therapy. In addition we examined changes in muscular strength quantified as changes in 1 repetition maximum (1 RM).

RESULTS AND DISCUSSION

Time to task failure increased significantly following the 240J treatment compared with the sham treatment (391.56 ± 57.21 vs. 302.33 ± 55.93s; P<0.032; Figure 1). Although, the 480J treatment elicited a greater time to task failure it was not significantly different from sham (363.11 ± 60.61 vs. 302.33 ± 55.93s; P=0.202; Figure 1).

In addition, the treatment changed muscle activity. The EMG amplitude of the FDI was greater with the

![Figure 1. Time to task failure for a submaximal sustained contraction with the FDI. TTF was significantly (*) prolonged following a 240J treatment of near-infrared light therapy.](image-url)
240J and 480J treatments compared with the sham (Figure 2). This difference, however, did not reach statistically significant levels.

Figure 2. Change in EMG amplitude following 3 different treatments (sham, 240J, 480J) of near-infrared light therapy.

The decrease in 1RM following the sustained isometric contraction task was similar for all treatments, sham (21.2%), 240J (22.8%) and 480J (21.2%).

Our results, therefore, suggest that the 240J treatment was the most beneficial treatment to prolong time to task failure. On average, subjects sustained the submaximal isometric task 26% longer than when they received the sham. Because the 240J treatment also increased the muscle activity of the FDI, it is possible that the longer time to task failure was related to changes in the activation of the agonist muscle.

CONCLUSIONS

Our findings implicate a 240J dose of near infrared light therapy as an effective non-invasive ergogenic modality for health care providers to enhance time to task failure and potentially delay the onset of musculoskeletal fatigue. Future research studies are necessary to identify the mechanisms responsible for the prolonged time to task failure observed.

REFERENCES

