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O20 FATIGUE II

O20.1 Muscle electrical activity changes over time during stair ascending until exhaustion

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BACKGROUND AND AIM Non-stop stair ascending at maximum speed is required to reach a safe refuge level from deep underground structures, such as subways and in high-rise buildings in an emergency evacuation situation. Endurance of stair climbing and identifying the time of the onset of leg's local muscle fatigue (LMF) are interests in evacuation research. The objective of this laboratory study was to investigate leg muscles' electromyography (EMG) changes over time during stair ascending until exhaustion on a stair machine.

Methods: The developed muscle activity rate change (MARC) in muscle activity interpretation square (MAIS) was used to evaluate leg LMF at constant step rates equivalent to individual 100% VO2max level. This result is used to validate the MAIS. The MAIS is based on the four assumptions of EMG muscle activity (AMP and MDF) rate change (MARC) over the ascending durations. An increase in AMP and MDF is an indication of: 1) muscle force increase. An increase in AMP and a decrease in MDF is an indication of: 2) muscle fatigue. A decrease in AMP and MDF is an indication of: 3) muscle force decrease. A decrease in AMP and an increase in MDF is an indication of: 4) fatigue recovery. MARC was observed on the both AMP and MDF values of the ten equal length divisions (10%) in the total ascending period (100%). The averages of the MDF and normalized AMP for each equally divided 10% period were calculated for all subjects to yield 1 data point, and totally 10 data points. These 10 periodical average AMP and MDF data points (10-100%) and the changes between the unit times represent the MARC for each muscle during ascension. Later, both the AMP and MDF MARC values are combined to get one final point for each tenth percentile duration and presented into the MAIS, which is used to estimate muscle fatigue.

Results: The appearances of MARC points in the MAISs showed the state of muscle activity changes over time during this predetermined and constant ascending speed at 100% of VO2max on a stair machine. Most of the muscles' MARC points at 90-100% periods were found in the muscle fatigue squares. Moreover, individual AMP and MDF analysis showed significantly increased and decreased, respectively, which supported the interpretations made by the MAIS.

Conclusions: These stair ascending EMG results supported the MARC and MAIS when interpreting muscle fatigue. They seem promising to interpret muscle activity changes per unit time during dynamic tasks over the whole working duration in different activities.