TACSM Abstract

An Examination of Rapid Force and EMG Rise in the Morning Versus the Evening

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ABSTRACT

Diurnal biological rhythms work on 24-hour periods and are known to influence neuromuscular function. Describing how diurnal rhythms influence maximal neuromuscular function may help optimize training time. **PURPOSE**: The purpose of the present study was to examine whether the time of day influences the rate of force development (RFD) and the rate of rise (RER) of the surface electromyographic (EMG) signal during maximal isometric contractions of the knee extensors and elbow flexors. **METHODS**: Twelve healthy, college-aged participants (n = 4 males, n = 8 females) underwent three visits evaluating maximal voluntary contraction (MVC) force of the dominant limb in the morning and evening. Morning visits occurred between 0700-0900 hours while evening visits occurred between 1700-1900 hours. The first visit was randomized to either morning or evening and classified as a familiarization session where participants were familiarized with the experimental protocol. The order of the experimental visits was randomly assigned and the order of strength testing between limbs was randomized. Bipolar surface EMG sensors were applied over the vastus lateralis and biceps brachii muscles of the dominant limb. After completing a preliminary warmup, participants underwent a series of isometric contractions with both the knee extensors and elbow flexors. A series of three isometric contractions were completed to assess MVC force and determine RFD with 1-minute recovery between maximal attempts. RFD was determined from 0-50ms (RFD_{50}) and 0-100ms (RFD_{100}) of the force-time curve. The rate of EMG rise from 0-50ms (RER_{50}) was determined from the slope of the EMG-time curve. The average responses of the three attempts were retained for analysis. The statistical analysis was conducted with separate two-way (time of day × limb) repeated measures ANOVA tests. The effect size was determined with the partial eta-squared and Cohen's *d* statistic was computed for mean comparisons of interest. Alpha was set at 0.05. **RESULTS**: The ANOVA showed no effect for time of day for RFD_{50} ($p=0.725$; $\eta_p^2=0.012$) RFD_{100} ($p=0.396$; $\eta_p^2=0.066$), and RER_{50} ($p=0.714$; $\eta_p^2=0.013$). There was, however, a between limb effect seen in RFD_{50} ($p=0.003$; $\eta_p^2=0.576$), RFD_{100} ($p=0.005$; $\eta_p^2=0.521$), and RER_{50} ($p=0.018$; $\eta_p^2=.412$) showing increased rates of force development and rates of EMG rise in the lower limbs. **CONCLUSION**: The data shows that RFD_{50}, RFD_{100} and RER_{50} differ between upper and lower limbs. More data is needed to determine time of day implications on RFD and RER for upper and lower limbs but could be beneficial for future implementation of training times between each limb.