

## 2B01 Changes of $1/f^\beta$ and total power frequency of the surface electromyogram during prolonged muscle contraction

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**Purpose:** This study was designed to appear recruitment activities of the relative Motor Units(RMU) during two exercises types of the muscle voluntary contraction(MVC) and the prolonged running(PRE) by the measure of Power Spectrum of the surface electromyogram(SEMG). **Methods:** Six athlete men volunteered to this experiment, that had practiced using the BIODEX ergometer for MVC and the treadmill for PRE, respectively. During those exercises, SEMG of the Rectus Femoris(RF) as the extensor of the knee and the Biceps Femoris(BF) as the flexor were recorded on the Data Recorder with two electrodes method, digitally. Then, these signals were processed to get  $\beta$  coefficient of  $1/f^\beta$ , Total Power Spectrum(TPS), and Mean Power Frequency(MPF) in the semi-logarithmical spectrum utilizing with Maximum Entropy Method Calculation(MEMCalc) and Fast Fierier Transform(FFT) soft program. **Results:**  $\beta$  coefficient, TPS, and MPF of RF showed higher averages during those exercises than those of BF, significantly. Furthermore, the semi-logarithmical spectrum displayed to much more increasing power frequency bands beyond 150Hz than FFT analysis, statistically. **Discussion:** Those results suggested that the faster rate and the higher frequency of RMU of the extensor would be recruited during MVC and PRE more than those of the flexor, superlatively.

**Key words:** Surface Electromyogram, Power Spectrum, Relative Motor Units, MEMCalc

## 2B02 Gender differences of the mechanomyographic responses to voluntary isometric ramp contraction of the biceps brachii

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**Purpose:** The aim of the present study was to elucidate gender differences of muscle contractile properties using the mechanomyogram (MMG) and electromyogram (EMG) during voluntary isometric ramp contractions of biceps brachii muscles. **Methods:** 10 young females (age:  $21.2 \pm 1.0$  years) and young males ( $23.6 \pm 2.0$ ) participated in this study. Each subject was asked to exert an isometric elbow flexion force from 5% to 80% maximal voluntary contraction (MVC) at a constant rate of 10% MVC/s. The short-time Fourier transform was used to analyze the MMG and EMG signal during ramp contractions. **Results:** The MVC and muscle cross-sectional area (CSA) was significantly different between two sex groups. Gender difference between two groups in the root mean squared amplitude of the MMG ( $\text{RMS}_{\text{MMG}}$ ) was maintained even when values were expressed relative to CSA, however there was no significant gender difference in the  $\text{RMS}_{\text{EMG}}/\text{CSA}$ . The  $\text{RMS}_{\text{MMG}}$  increased with force development up to 69% MVC, then decreased in both groups, although changes were smaller in the female group than in the male group. Moreover, as shown in the MPF of males, a rapid increase up to 30% MVC, a brief reduction around 50%MVC and further rapid increase above 60% MVC did not occur in females. **Discussion:** These findings suggest that these gender differences in the MMG/force relationship during ramp contraction are not only due to the effect of the subcutaneous tissues, but also the difference of MU activation strategy.

**Key words:** Gender difference, Biceps brachii muscles. Mechanomyogram, Ramp contractions, Time-frequency analysis