continuously distributed conduction velocities (1), found associations between the spectral properties of sEMG and motor unit recruitment strategies: changes in spectral properties were associated with the level of activation when motor units were recruited in an orderly fashion (single-task manner); however, when recurrent inhibition changed the recruitment patterns (as could happen for multi-task actions) then more pronounced changes in sEMG spectra were observed.

The evidence demonstrates that sEMG certainly can characterize MU recruitment strategies and active fiber types. However, it is likely that this will not necessarily be the case for all physiological situations and restricted recruitment tasks.

REFERENCES


James M. Wakeling
Simon Fraser University

THE MOST CONSISTENT FINDING IN SEMG IS INCONSISTENT FINDINGS

TO THE EDITOR: Our paper was cited by Farina (1) to support the lack of relationship between surface electromyographic (sEMG) spectral variables and motor unit behavior. We reported no significant increase in mean power frequency (MF) with increases in isometric elbow flexion force from 40 to 80 percent of maximal voluntary contraction (MVC) (2). However, it is possible to find other studies wherein the increase in MF is moderate but others demonstrate a large increase in MF across force levels. For example, Sbriccoli et al. (4) demonstrated a large increase in median power frequency (MDF) and muscle fiber conduction velocity during ramp increases in isometric elbow flexion force. It has been suggested that MDF increase reflects the recruitment of higher threshold motor units. It also generally accepted that firing rate characteristics dominate the lower end of the frequency spectrum between 10 and 40 Hz (3). Since the sEMG bandwidth trails off appreciably by 200 Hz, the low frequency band between 10 and 40 Hz represents a significant proportion of the total power. In the absence of changes in conduction velocity associated with fatigue, we showed that changes in firing rate characteristics can impact the MNF to an appreciable degree, causing spectral compression. Thus our experimental and modeling work is in agreement with von Tscharner and Nigg (6).

REFERENCES


David A. Gabriel
Associate Professor

THE MOST CONSISTENT FINDING IN SEMG IS INCONSISTENT FINDINGS

TO THE EDITOR: von Tscharner and Nigg (6) argue that the orderly recruitment of motor units can be revealed from the intensity pattern generated by a so-called “wavelet” analysis. However, the “wavelet” analysis of Ref. 5, which possesses none of the properties of a wavelet analysis (2), cannot resolve the subtle changes in the EMG recordings that could separate the different types of motor units. Aside from the common, but incorrect, assumption that there exist distinct types of motor units (1, 4), the interpretation of the “wavelet” coefficients defined in (4) is obfuscated by several factors. First, the “wavelet” transform has a poor time resolution. Because the wavelets are computed by taking the inverse Fourier transform of a series of overlapping bumps, the resulting functions have an infinite extent and are imprecise in the time domain. Second, the frequency resolution is poor because any frequency in the range [0:50] Hz is covered by many bumps, and an oscillatory signal, such as the surface EMG, has its energy spread across many different “wavelet” coefficients. This well-established limitation of wavelet analysis (3) is aggravated here because of the ad hoc design of the wavelets. Third, the mathematical interpretation of the so-called “intensity in time space” is completely unclear. As a result, von Tscharner and colleagues cannot assess the statistical significance of the “wavelet intensity” and have resorted to anecdotal visual inspection of the data as validation of the approach.

REFERENCES


Gary Kamen
Brock University

IT IS NOT A WAVELET ANALYSIS

TO THE EDITOR: von Tscharner and Nigg (6) argue that the orderly recruitment of motor units can be revealed from the intensity pattern generated by a so-called “wavelet” analysis. However, the “wavelet” analysis of Ref. 5, which possesses none of the properties of a wavelet analysis (2), cannot resolve the subtle changes in the EMG recordings that could separate the different types of motor units. Aside from the common, but incorrect, assumption that there exist distinct types of motor units (1, 4), the interpretation of the “wavelet” coefficients defined in (4) is obfuscated by several factors. First, the “wavelet” transform has a poor time resolution. Because the wavelets are computed by taking the inverse Fourier transform of a series of overlapping bumps, the resulting functions have an infinite extent and are imprecise in the time domain. Second, the frequency resolution is poor because any frequency in the range [0:50] Hz is covered by many bumps, and an oscillatory signal, such as the surface EMG, has its energy spread across many different “wavelet” coefficients. This well-established limitation of wavelet analysis (3) is aggravated here because of the ad hoc design of the wavelets. Third, the mathematical interpretation of the so-called “intensity in time space” is completely unclear. As a result, von Tscharner and colleagues cannot assess the statistical significance of the “wavelet intensity” and have resorted to anecdotal visual inspection of the data as validation of the approach.

REFERENCES


Francois Meyer
Associate Professor
University of Colorado at Boulder