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Wavelet Transform Analysis of Electromyography Kung Fu Strikes Data

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ABSTRACT

In martial arts and contact sports strikes are performed at near maximum speeds. For that reason, electromyography (EMG) analysis of such movements is non-trivial. This paper has three main goals: firstly, to investigate the differences in the EMG activity of muscles during strikes performed with and without impacts; secondly, to assess the advantages of using Sum of Significant Power (SSP) values instead of root mean square (rms) values when analyzing EMG data; and lastly to introduce a new method of calculating median frequency values using wavelet transforms (WMDF). EMG data of the deltoid anterior (DA), triceps brachii (TB) and brachioradialis (BR) muscles were collected from eight Kung Fu practitioners during strikes performed with and without impacts. SSP results indicated significant higher muscle activity ($p = 0.023$) for the strikes with impact. WMDF results, on the other hand, indicated significant lower values ($p = 0.007$) for the strikes with impact. SSP results presented higher sensitivity than rms to quantify important signal differences and, at the same time, presented lower inter-subject coefficient of variations. The result of increase in SSP values and decrease in WMDF may suggest better synchronization of motor units for the strikes with impact performed by the experienced Kung Fu practitioners.

Key words: Martial arts, combat sports, Kung Fu, EMG, wavelet transform, impact

Key Points

- The results show higher muscle activity and lower electromyography median frequencies for strikes with impact compared to strikes without.
- SSP results presented higher sensitivity and lower inter-subject coefficient of variations than rms results.
- Kung Fu palm strikes with impact may present better motor units' synchronization than