Visualization of multichannel surface electromyography as a map of muscle component activation.

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Introduction

Modern methods of analyzing surface electromyography (sEMG) from a matrix of electrodes allow for detailed muscle activation maps and interactions detection. While these activity maps show muscle response, they don't reveal muscle coordination during different gestures. Creating muscle component activity maps can aid in the development of rehabilitation programs and the creation of bionic prostheses by identifying signal localization in specific muscles.

Methods

The study was conducted with healthy subjects (N=5). Trigno avanti sEMG sensors (n=8) (Delsys Inc, USA) were used, arranged in a circle on the superficial muscles of the forearm. The gestures chosen for visualization were fist clenching, finger extension, and thumb elevation.

Results

When analyzing the data associated with the muscle component activation maps for the 5 subjects, it is possible to observe differences in the pattern of muscle co-activation depending on the gesture. During fist clenching (fig. 1), the largest contraction amplitude is observed in *m.extensor carpi ulnaris* and *m.palmaris longus*. For finger extension (fig. 2), the greatest activity was observed in *m.extensor carpi radialis* and *m.extensor digitorum*. Finally, for thumb elevation, *m.extensor carpi radialis longus* and *m.extensor carpi ulnaris* were most involved, and m.palmaris longus was also consistently active. The other selected muscles were not activated, indicating precise muscle coordination to perform the different gestures. It can also be noted that there was no activation of the *m.brachioradialis*, as it is not involved to perform the selected gestures.

Fig.1

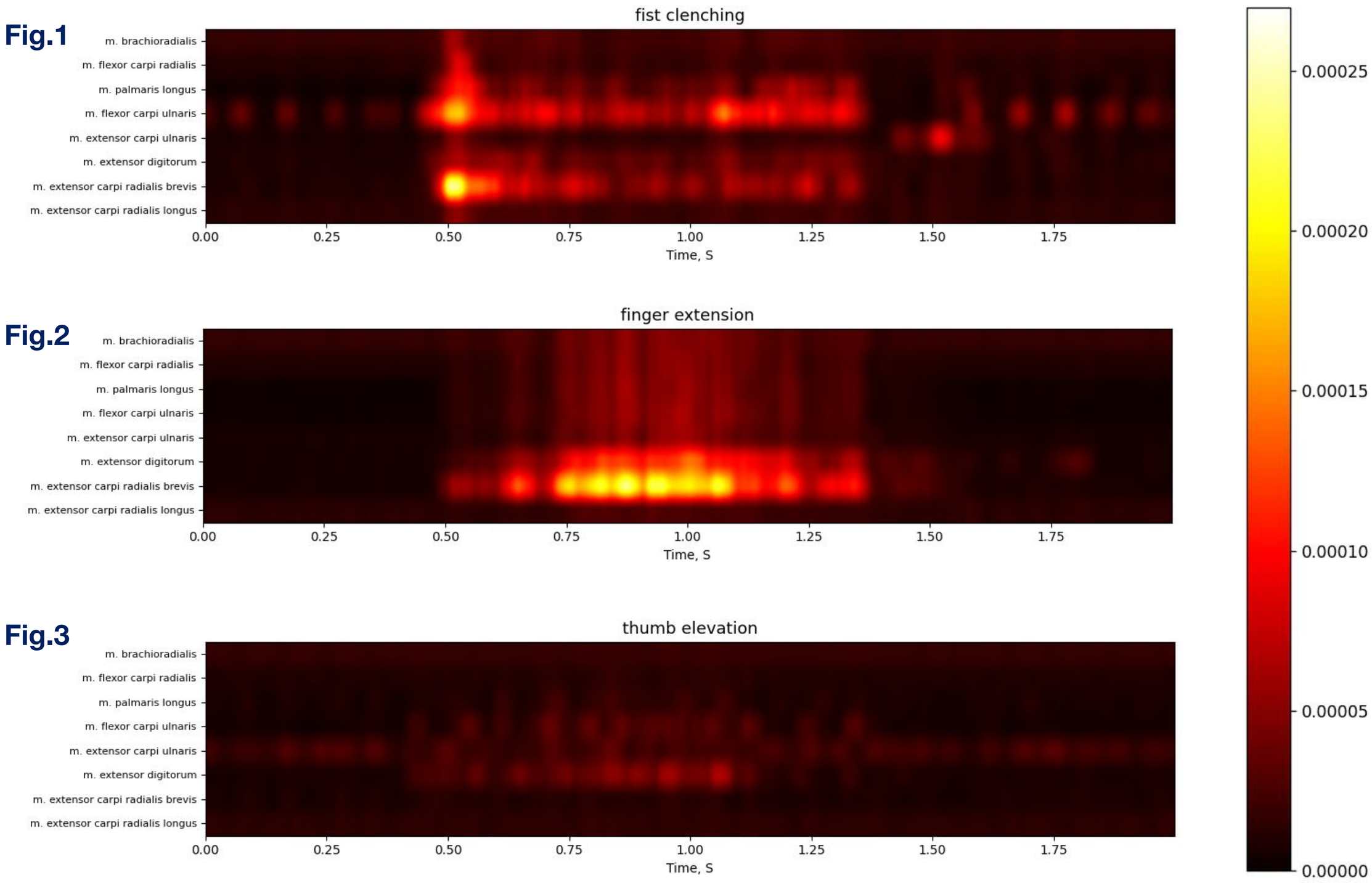

Fig.2

Fig.3

Figure 1-3 show examples of heat maps of muscle activation relative to movement time for different gestures. The images show that different muscles are involved for different gestures and not to the same extent even over time. This issue needs to be studied in more detail in the future.

Conclusions

Forearm muscles are differentially involved in muscle signal formation. Segmentation of muscle signals allows specific signal acquisition for further use in prosthetics and rehabilitation.

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