

MOTOR UNIT PROPERTIES IN THE BICEPS BRACHII OF STROKE PATIENTS ASSESSED WITH SURFACE ARRAY EMG

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Abstract

1 Introduction

As a consequence of a stroke, both motor control as well as motor unit (MU) characteristics may change, e.g. MU size has been reported to increase due to reinnervation [1]. The high selectivity of array surface electromyography enables the non-invasive investigation of motor unit action potentials (MUAPs). The aim of the present study was to investigate how differences between the affected and unaffected side of hemiparetic stroke patients are reflected in surface array electromyography parameters.

2 Methods

15 hemiparetic stroke subjects participated. Their Fugl-Meyer score (upper extremity part) was assessed. They performed isometric step contractions consisting of 10 force levels of 5 to 50% of the maximal voluntary contraction (MVC) with both sides. A two-dimensional 32 channel electrode array was placed on the skin above the active biceps brachii. MUAPs were extracted using the segmentation part of the decomposition software described in [2]. RMS, mean frequency of the power spectrum (FMEAN) and MUAP Rate (the number of MUAPs per second) were calculated. RMS and mean frequency of the power spectrum of the extracted MUAP shapes was averaged across all MUAPs (RMS_{MUAP} and $FMEAN_{MUAP}$). RMS_{MUAP} is related to the MU size, $FMEAN_{MUAP}$ to the duration of the MUAPs and their recruitment threshold.

3 Results

An example of the distribution of RMS_{MUAP} of both sides is shown in Figure 1. Of the 15 subjects, 7 subjects showed larger RMS_{MUAP} values at the affected side, 5 subjects showed smaller values and 3 subjects did not show differences. Interestingly, the median FM scores were considerably higher in the group with larger RMS_{MUAP} values at the affected side (FM score 42 versus 20 out of 66). The ratio of RMS_{MUAP} of the affected side divided by that of the unaffected side correlated significantly with the FM score for the force levels from 15% to 45% (Spearman's rho between 0.6 and 0.74, $p < 0.039$). $FMEAN_{MUAP}$ was slightly smaller at the affected side ($p < 0.001$).

4 Discussion

The increased RMS_{MUAP} values at the affected

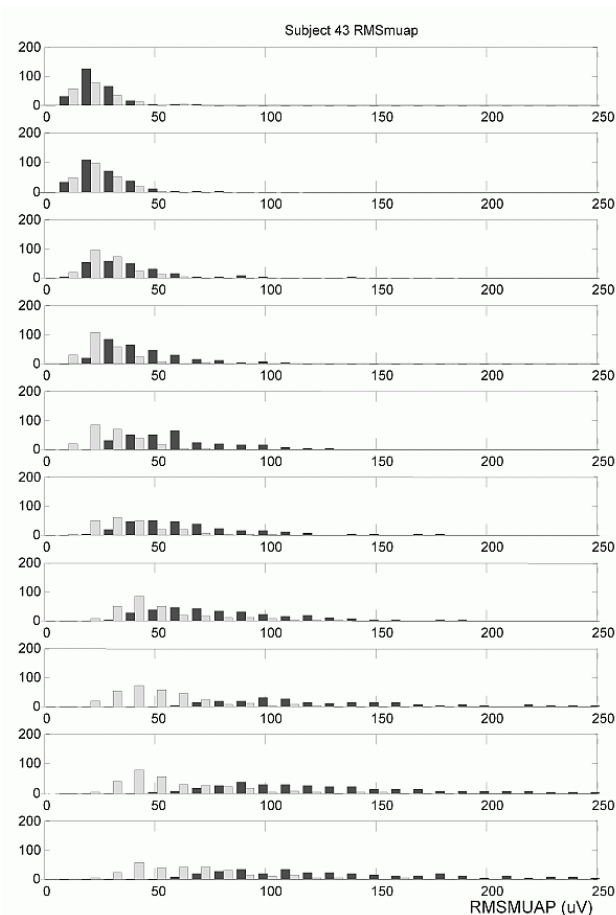


Figure 1 Example of RMS_{MUAP} distribution of one subject for the ten force levels from 5% (upper graph) to 50% MVC (lower graph). Dark bars: affected side, light bars: unaffected side.

side in the subjects with a relatively high FM score indicates an increased MU size, which could be related to the occurrence of reinnervation, resulting in enlarged MUs [1]. Reinnervation also results in a broader innervation zone, which would lead to a longer duration of the MUAPs. This might explain the lower $FMEAN_{MUAP}$ values.

References

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