

Comparison of electromyography derived train-of-four ratios of the adductor pollicis and abductor digiti minimi muscles and their comparison to acceleromyography derived train-of-four ratios

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Background: This pilot study investigated a new electromyography (EMG)-based neuromuscular monitor, the TetraGraph™ (Senzime B.V., Uppsala, Sweden). The TG uses its own surface strip electrodes for ulnar nerve stimulation and compound muscle action potential recording from the adductor pollicis (mAP) or the abductor digiti minimi muscles (mADM).

Methods: Two TetraGraph™ devices were attached to the patient, one on each arm. One device was attached to the thenar eminence and the thumb to monitor the mAP. The other monitor was attached to the hypothenar eminence and 5th finger to monitor the mADM. This arm also served for acceleromyography (AMG) monitoring (IntelliVue NMT, Philips, Amsterdam, the Netherlands) of the thumb. After the induction of anesthesia, the three devices were calibrated to achieve supramaximal current intensities, then were started in train-of-mode (TOF) mode and ran automatically every 1 min in an alternating fashion. The EMG measurements on the two arms were performed at the same time and the AMG measurement was timed to be measured 30 sec later. We aimed to compare the correspondence of the two hand muscles' EMG TOF ratios (%), and to examine the agreement between the EMG and AMG measurements.

Results: After IRB approval and gaining informed consent, eleven patients {age: 58.1 ± 15 yr (mean \pm SD); male: n=5, female: n=6; BMI: 30.3 ± 5.7 } were enrolled. The charge in μC (defined as the product of current intensity, in mA, and pulse width, in msec) required for supramaximal stimulation was lower for mADM than for mAP (11.3 ± 4.3 vs. 13.6 ± 3.7 μC , respectively), though this did not reach statistical significance ($p=0.27$). The onset of neuromuscular block was faster in 72.7% of cases at mADM than at mAP. The medians (interquartile range) of baseline TOF ratios were similar in the EMG measurements {mAP: 99.0 (97.3-100.0) vs. mADM: 98.0 (96.0-100.0), $p=0.075$ }, yet both EMG derived mAP and mADM baseline TOF ratios were significantly lower than AMG mAP TOF ratios {112 (105-123), $p<0.001$ }. The recovery EMG TOF ratios of the two muscles showed good correlation ($R = 0.716$, $p<0.001$, Fig. 1A) with a bias of -8.36 (95% CI = -28.59 to $+11.88$, Fig. 1B); however, the correlation was weaker with AMG derived mAP TOF ratios (for mAP EMG $R=0.659$, $p<0.001$; for mADM EMG $R=0.547$, $p<0.001$).

Conclusions: The TetraGraph™ measures the neuromuscular function of the mAP and mADM. Our preliminary results are consistent with a previous investigation [1-3] that found that these two muscles cannot be used interchangeably with EMG monitoring. The mADM has a faster onset and faster recovery of neuromuscular function than mAP.

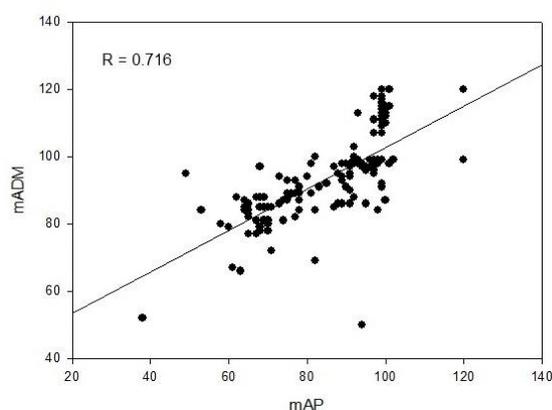


Fig. 1A – Linear regression of adductor pollicis (mAP) and abductor digiti minimi (mADM) derived recovery electromyography train-of-four ratios (%).

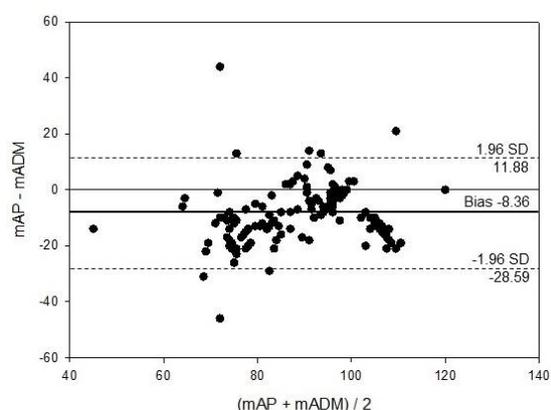


Fig. 1B – Bland-Altman plot of adductor pollicis (mAP) and abductor digiti minimi (mADM) derived recovery electromyography train-of-four ratios (%).

[1] Phillips S et al. *Anaesth Intensive Care*. 2012; 40(4):690-6.

[2] Hemmerling TM et al. *Can J Anaesth*. 2004; 51(8):795-800.

[3] Katz RL. *Br J Anaesth*. 1973; 45(8):849-59.