Effect of Thumb Preload on Mechanomyograph Monitoring of Neuromuscular Blockade

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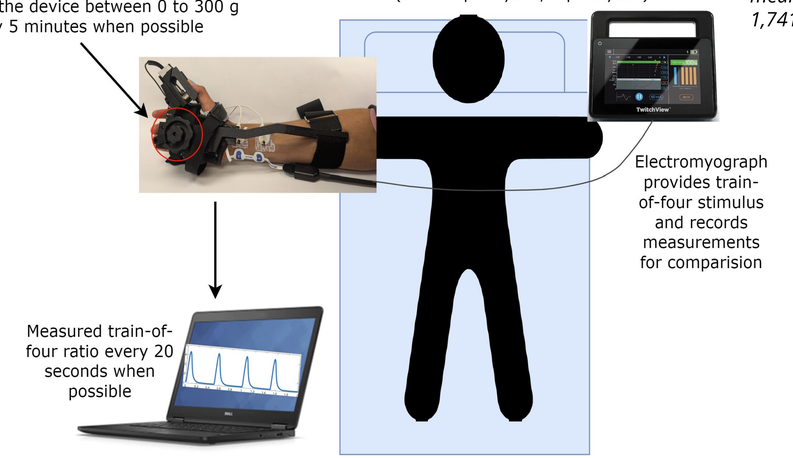
BACKGROUND

- Mechanomyography is the gold standard for neuromuscular blockade monitoring, traditionally using a 200-gram preload on the thumb[1,2] .
- Mechanomyographs are bulky devices and lack clinical applicability due to the difficulty of maintaining a consistent preload[3-5].
- Hypothesis: varying preload conditions do not significantly impact the accuracy or precision of train-of-four ratios measured using a mechanomyograph.

METHODS

Preload was randomly adjusted using this knob on the device between 0 to 300 g every 5 minutes when possible

Enrolled 19 patients without neuromuscular abnormalities undergoing elective surgeries under general anesthesia (15 non-paralyzed, 4 paralyzed)



Electromyograph provides train-of-four stimulus and records measurements for comparision

Measured train-of-four ratio every 20 seconds when possible

Figure 1. *Diagram of the study setup in the operating room, illustrating the equipment and methods used to conduct the research.*

RESULTS

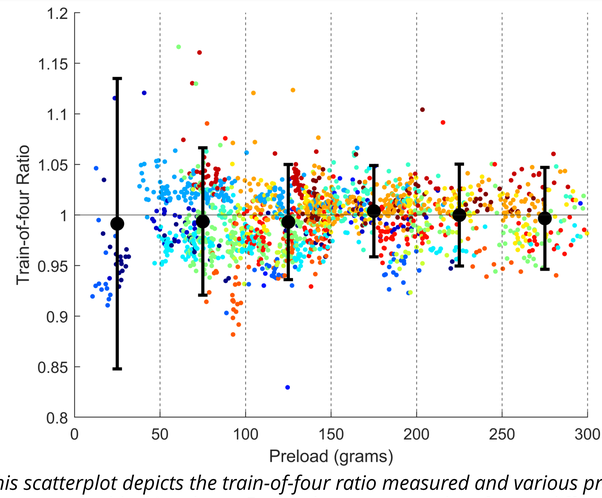


Figure 2. *This scatterplot depicts the train-of-four ratio measured and various preloads in patients with no neuromuscular blocking drugs. Each color represents data from a different patient. The mean for each 50 g preload bin is shown with error bars showing the mean ±2 standard deviations. 1,741 train-of-four ratio data points were collected for non-paralyzed patients.*

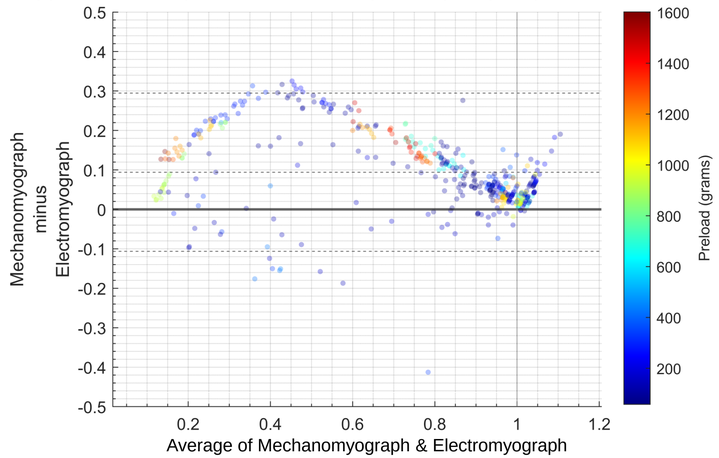


Figure 3. *Bland-Altman plot comparing clinical electromyograph readings to mechanomyography device measurements. Data points are color-coded to represent thumb preload at various train-of-four ratios. 491 train-of-four ratio data points were collected for paralyzed patients.*

DISCUSSION

- Preload conditions below 50 g showed significantly higher variability and less reliability. In contrast, all other preload conditions in unparalyzed patients demonstrated mean and standard deviation within expected ranges.
- There is no correlation between preload conditions and mechanomyography measurements when compared to electromyography.
- These findings support greater flexibility in preload settings, which is crucial because the bulk of the device is related to the need for high preloads. Reducing preload requirements could lead to smaller, less complex mechanomyograph devices, making them more practical for various surgical contexts.
- Limitations of the study include a small sample size, being conducted in a single clinical setting, no statistical significance analysis performed, and reliance on manual adjustments of thumb abduction angle, which may limit generalizability and introduce variability.

CONCLUSIONS

Preload conditions above 50 g do not affect the accuracy or precision of train-of-four ratios measured using mechanomyography.

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Plain Language Summary

This study aimed to determine whether the traditional practice of applying a specific weight (preload) of 200 grams to the mechanomyograph is necessary for accurately monitoring paralysis levels during surgery. The results showed that the accuracy of measurements from the mechanomyograph remained consistent above a preload of 50 g, indicating that the traditional preload may not be necessary. These findings suggest that mechanomyographs do not require a constant preload, which could lead to improved patient care and the development of more accessible mechanomyograph anesthesia monitoring devices.