Inter-Operator Reliability of Fine-Wire Electromyography in the Evaluation of Eccentric Elbow Flexor Activity

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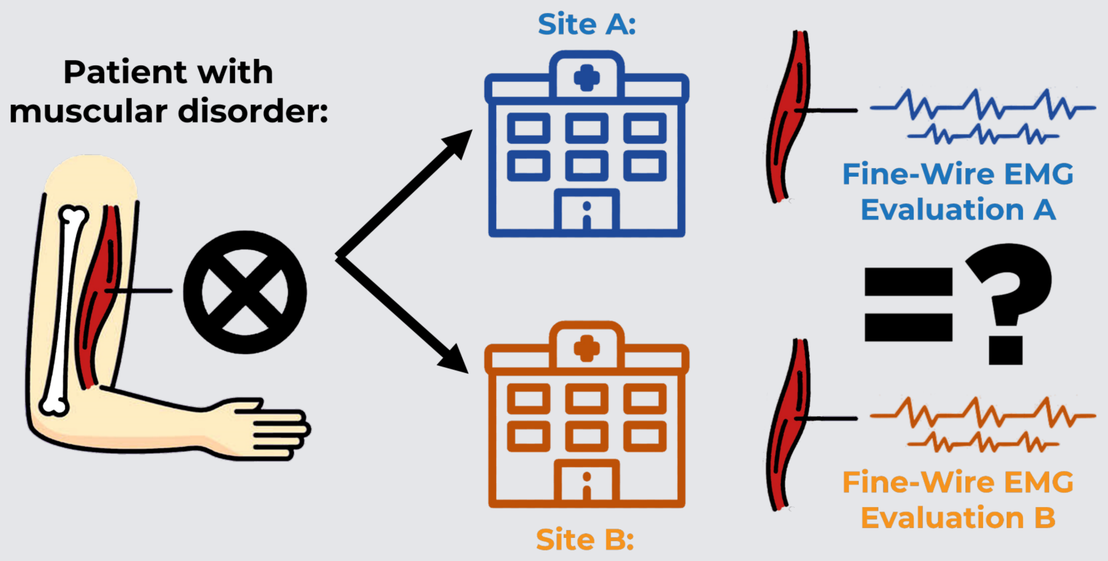
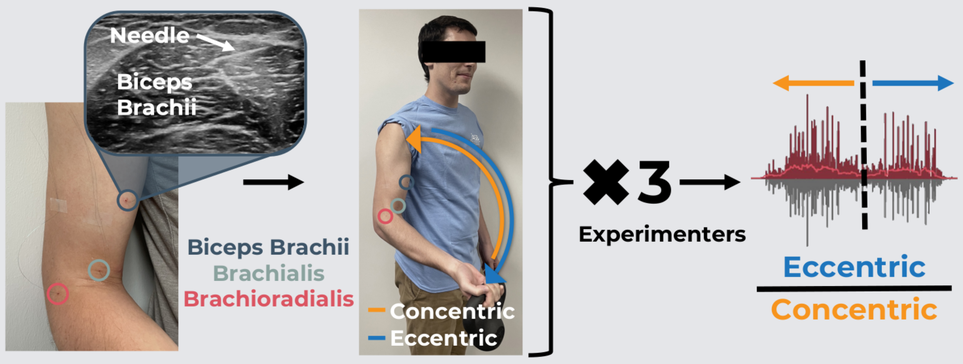
Inter-operator reliability enables cross-site comparison of data between different clinicians and/or researchers.

- Electromyography (EMG) is a useful tool in clinical practice and research studies
  - Can evaluate measures of muscle dysfunction, including weakness (amplitude) and fatigue (frequency)
- Surface EMG has good reliability,[1] but cannot be used for deep and/or small muscles
- Studies of the inter-operator reliability of fine-wire EMG are limited[2]

Objective: To assess the inter-operator reliability of fine-wire EMG amplitude parameters.





3 experimenters (1-3 years experience) inserted fine-wire EMG electrodes into each subject's (n=5) elbow flexors with ultrasound guidance.

Study Design:

- Experimenter insertion order randomized
- Previous insertions removed between experimenters

Tasks:

- 2 sets of 5 weighted (10-lb) bicep curls per experimenter
- 3 curls from each set of 5 analyzed

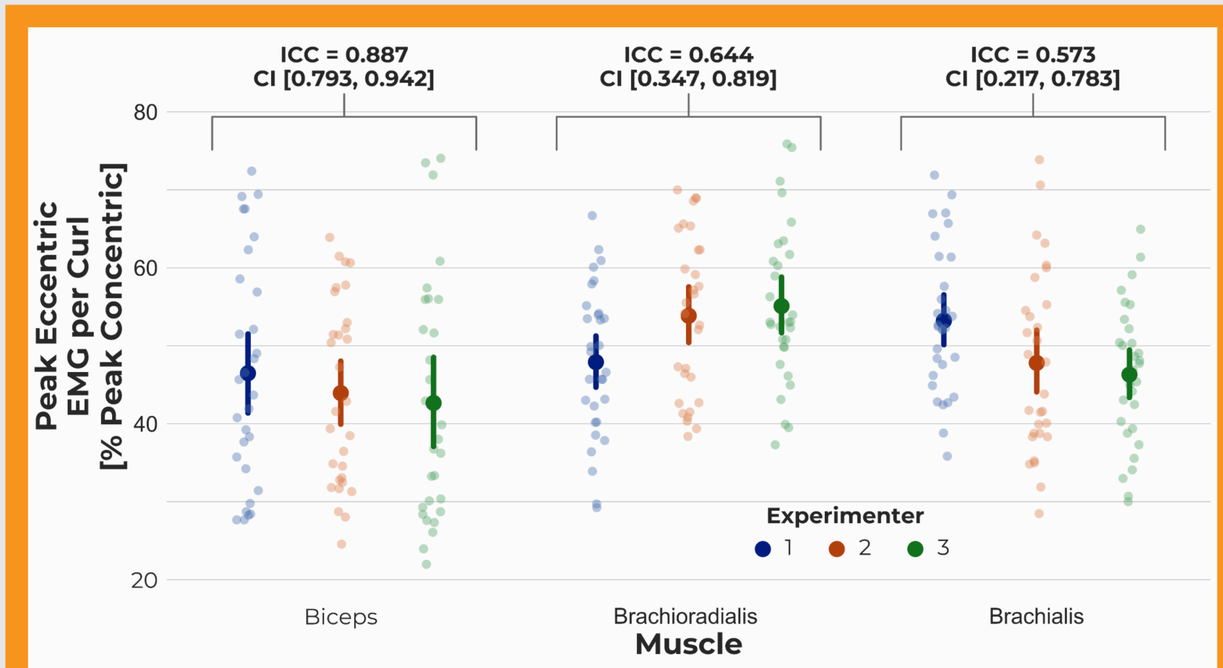
Processing[3]:

- 20-450 Hz bandpass
- Rectified
- Root-mean-squared (RMS) envelope (100-ms)
- Within-task normalization[4]

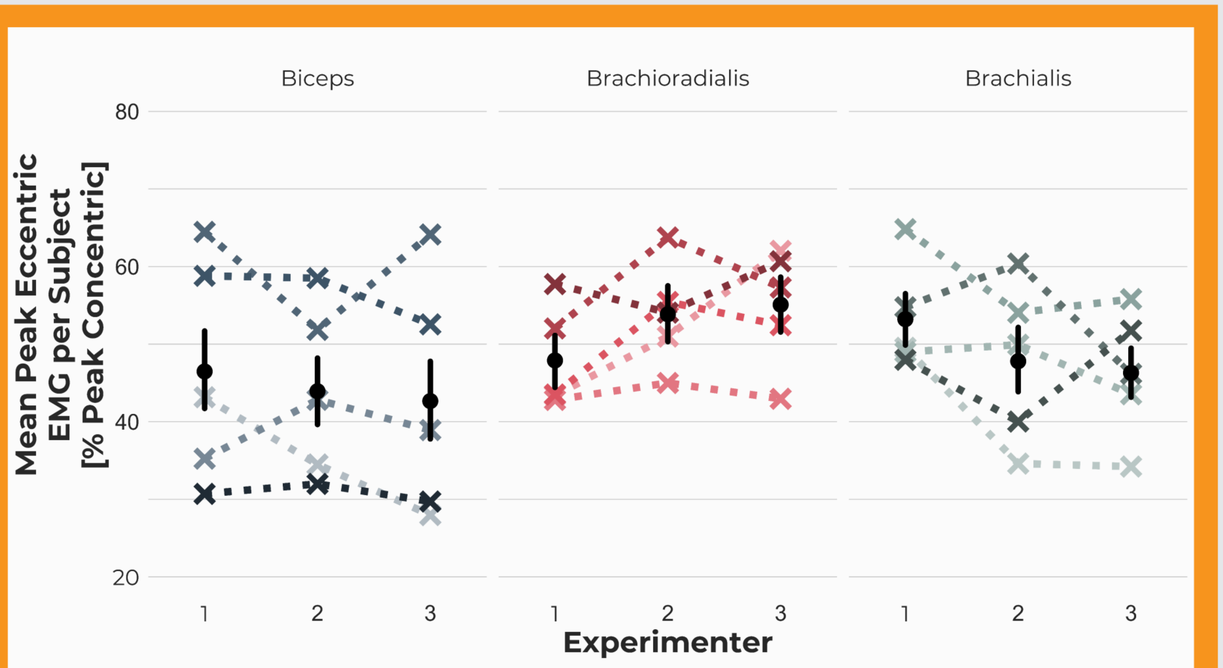
Analysis[5]:

- Calculated intra-class correlation coefficient (ICC) → two-way random effects
  - Moderate: 0.5-0.75
  - Good: 0.75-0.9
  - Excellent: >0.9

Fine-wire EMG demonstrated good reliability (ICC = 0.761, CI [0.661, 0.835]) across the elbow flexors.



Within-muscle analyses demonstrated moderate to good reliability.



Difference across experimenters in mean peak eccentric EMG was <15% for all subjects.

This study demonstrates that fine-wire EMG amplitude parameters have good inter-operator reliability across the elbow flexors, enabling cross-site comparison.

- Past surface EMG studies have demonstrated higher ICC values,[1] however fine-wire EMG is more variable within-subject with a constant electrode location.[6]
- The inter-operator reliability of fine-wire EMG frequency should be assessed across experimenters in future studies to validate cross-site evaluation of muscle fatigue.

References: 1. Danneels et al., 2001. *Man Ther.* 6(3):145-153. 2. Calder et al., 2008. *J Neurosci Methods.* 168(2):483-493. 3. Konrad, 2006. The ABC of EMG. 4. Halaki et al., 2012. Normalization of EMG Signals. 5. Koo et al., 2016. *J Chiropr Med.* 15(2):1550163. 6. Jacobson et al., 1995. *J Electromyogr Kinesiol.* 5(1):37-44.

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