

Application Note 261

Precision and accuracy of the TSD250 (BPS-II) VMG transducer in the assessment of isometric absolute muscle effort

Vibromyography (VMG) has distinct benefits over EMG in that the recordings much more accurately reflect absolute muscle effort up to 100% maximum voluntary contraction. Correspondingly, VMG can be used to both evaluate muscle changes over time in a given individual or to compare between two populations the muscle effort required to complete a specific task. The ability to discriminate muscle effort changes depends on the precision and accuracy of the VMG under these two scenarios, that is, the intra-assay accuracy and variability and the inter-assay accuracy and variability. Here, we address the inter-assay variability of VMG recordings in healthy adult men, focusing on isometric contraction of an upper extremity muscle.

Experimental Protocol

Subjects: 10 healthy adult men aged 21-59

Muscle: Long head of triceps brachii

Testing condition: Subjects prone, upper arm perpendicular to floor, forearm parallel to floor, elbow at 90°

Load: Free weights of 2, 4, 8, 15, 20 and 25 supported for five seconds

Analysis:

- One-second recordings obtained using BPS-II transducer (BIOPAC part number TSD250) with a BIOPAC MP150 data acquisition unit
- Samples collected at 2 KHz and converted to muscle effort utilizing BIOPAC VMG filter
- 95% confidence limit calculated over the one second recording intervals for each load condition
- Mean and standard error for ten subjects obtained for each loading condition
- Coefficient of variation calculated at each weight and averaged
- Linear regression calculated with 95% confidence intervals

Results:

Inter-assay coefficient of variation for VMG muscle force assessment was observed to be approximately 49%, for a sample of adult men, averaging across all loading conditions.

Regression analysis indicated exceptional linearity of response over the loading range investigated, with an $R^2 = 0.995$ (Figure 1). 95% confidence intervals indicate a maximum projected error of less than two pounds for a given VMG measurement, even at the highest load levels utilized.

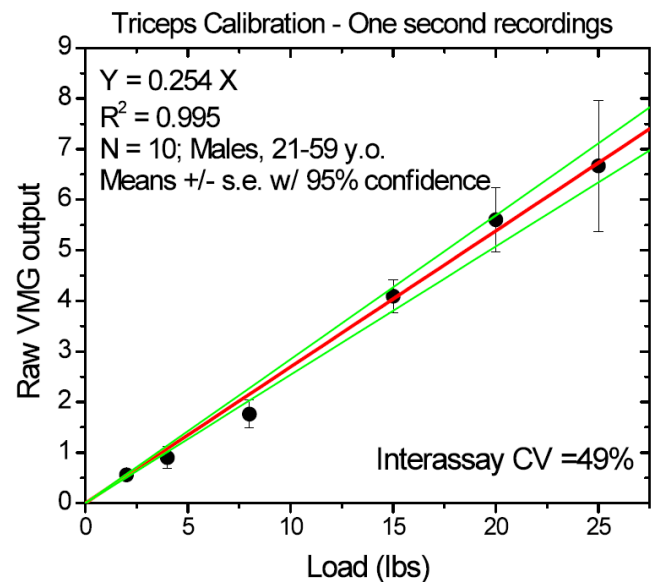


Figure 1. VMG calibration data obtained from the triceps of ten adult men (21-59 y.o.) supporting six different free weights. Accuracy of the VMG assessment is reflected in high value of the regression coefficient (0.995) and tight 95% confidence intervals.

Conclusion

VMG provides a highly accurate means for evaluating isometric muscle effort in a population of individuals, permitting comparisons to be made between groups either before and after rehabilitation or before and after undergoing other muscle training such as a sports training regimen.