Introduction to the DQEMG program

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DQEMG is a program written by Daniel W. Stashuk and students. The ideas behind the program are described in the bibliography at the end of this file. The purpose of the program is to read digitally acquired EMG data and decompose it into motor-unit potential (MUP) trains. These trains then form the basic unit of analysis for characterizing muscular structure.

Data for DQEMG is most commonly acquired using a concentric needle in conjunction with a surface electrode overlying the needle. A reference electrode is placed over a related tendon with a "ground" electrode placed away from any contracting tissue (i.e.; a monopolar surface electrode arrangement). The data from the needle is termed the "micro" signal, and the related surface data is "macro." By correlating the times between the micro and macro signals, the contribution to the surface signal for a given motor unit may be obtained (Doherty and Brown, 1993, 2002).

1 Acquisition versus Review Mode

DQEMG may be run in acquisition mode, in which case it is expected that a companion program (such as AcquireEMG) is running and passing signals to DQEMG as they are obtained during a needle examination. Alternatively, DQEMG may be run in review mode, in which case signals acquired previously may be re-analyzed and potentially re-decomposed.

2 Data Organization

DQEMG expects review data to be organized in a directory hierarchy of the form:

```
operator
    patient
        muscle
```

where "`operator`" identifies the clinician obtaining the data, "`patient`" and "`muscle`" identify the subject and muscle under study. The name of the muscle is typically appended with "_l" or "_r" to indicate the side of the body studied. A "study" consists of the EMG data detected during number of contractions performed by the same muscle and acquired during the same session. Each contraction will have a "`micro`N`.dat`" and "`macro`N`.dat`" file containing the filtered samples, where "N" indicates the contraction number. Other files in the directory are the .prn file containing textual summary data, a `.dco` file containing the contraction output and a `study.txt` file with study-level summary information.

The default location for this directory hierarchy is:

`c:\DQEMG\Data`

and this is where DQEMG will look to populate the open dialogue with operator/patient/muscle information. If the data is stored elsewhere, use the "Change Data Directory" button on the open dialogue to browse to other locations. The "Default Data Directory" button on the browse dialogue will return to the default location.

3 Data Display

Once a study is open (or being acquired), contraction-level MUP information may be seen graphically on the "Decomp" screen, and textual summary is available via "Summary." Study level summary information is available on the "Results" screen, from which MUNE information as calculated in Doherty and Brown (1993, 2002) is available.

On the MUPs/SMUPs screens, the MUP templates for micro/macro signals are available. By choosing "Markers" on either of these screens, the marker editing facility is engaged, wherein the micro and macro signals are superimposed, and the onset, peaks and end locations can be viewed and modified. On these screens and the Decomp screen, MUP trains may be excluded, in which case they are not used to calculate the quantitative summary information on the Results or Summary screens. The "Raster" button on the MUP screen allows all firings of the needle MUP to be seen, rasterized in a form similar to that found on an oscilloscope.

On screens on which this is relevant, Next/Previous buttons move among contractions, and buttons are provided to adjust the scales.

When a waveform is displayed, By default, the vertical scale is set to 200μV per division of Amplitude, and the horizontal or time scale is set to 10ms per division. Note that by electrophysiological convention, the vertical scale is plotted such that a positive voltage change moves the line down, so the "negative peak" is in fact above the baseline.

The "Ensemble" average screen provides a method to inspect the raster of MUPs at a resolution sufficient to measure the inter-firing jitter Ertaş, Baslo *et al.* (2000); Stålberg (1995); Stålberg and Trontelj (1997); Stashuk (1999b, 2001).

4 Notes:

- new versions of DQEMG may automatically re-decompose files written with older versions. It is therefore important to ensure that older data is archived if the earlier decomposition is to be preserved.
- the decomposition performed varies considerably based on the configuration settings, which may be set by applying a registry file or changed manually. If updating the version of DQEMG, be sure the registry file used is appropriate.
- the version of DQEMG is available in the "About" box available on the "Help" menu. If reporting a problem with DQEMG, please be sure to note the information in the about box, in particular the "Revision" and "Commit Date."

References

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