How to... sEMG

Surface Electromyography: detection of muscular electric activity by means of electrodes placed at the surface of the skin.

PLACEMENT

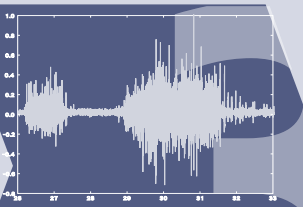
1 PREPARE

Remove hair, dead skin material and oils using a light abrasive and rubbing with alcohol at the electrodes sites.

2 CONNECT

Place the sensor on the midline of the muscle belly with an inter-electrode distance of 2cm and oriented parallel to the direction of the muscle fibers.

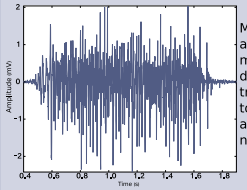
3 ACQUIRE



Make some movements. Visualize the signal on the monitor!

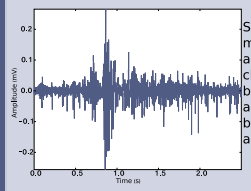
1,2,3 TESTING

maximum voluntary contraction (MVC)



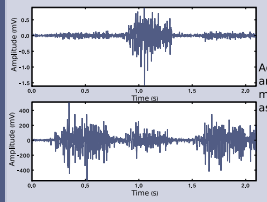
MVC acquisitions may be done during test trials in order to get amplitude normalization.

sudden movement



Sudden movements are characterized by low amplitude bursts of EMG activity.

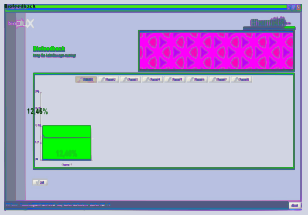
agonist/antagonist pair



Agonist and antagonist muscles are asynchronous.

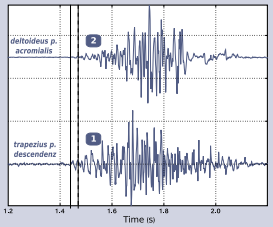
APPLICATIONS

biofeedback



Biofeedback gives the patient information on its own muscular activity. It can be used in physical therapy, rehabilitation or training.

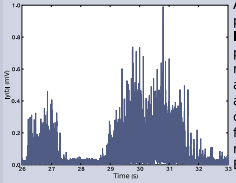
muscle activation sequence



Activation sequence of muscles can be assessed measuring EMG activity in several muscles when a given movement is performed.

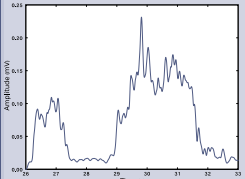
PROCESSING

ABS - full rectified wave



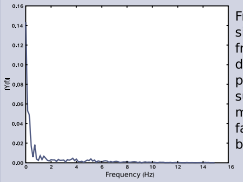
Amplitude parameters like mean, peak max/min value and area are easily computed from the full rectified EMG wave.

low pass filter



A low pass filter at 10 Hz can be used to create a linear envelope of the EMG signal.

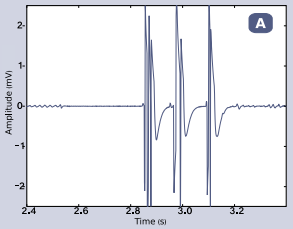
frequency sprectrum



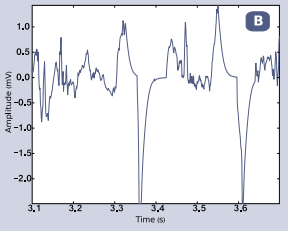
From the signal frequency distribution parameters such as muscle fatigue may be studied.

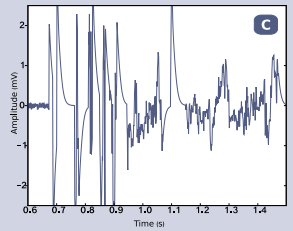
TROUBLESHOOTING

baseline shifts

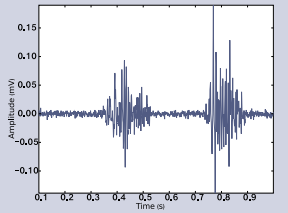


After each burst, the regular EMG signal returns to zero after few ms. Shifts greater than 5 ms usualy indicate an artifact, which may appear when the reference electrode is not being used (A), when there is malcontact between detection surfaces and the skin (B) or when the electrodes are not fixed to the skin at all (C).



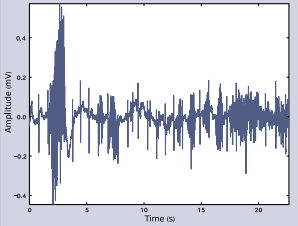


baseline noise



Increased baseline noise may when the detection surfaces touch each other. A minimum interelectrode distance of 2 cm is recomended.

ECG artifacts



When acquiring near the heart ECG bursts may contaminate the EMG signal. Better skin preparation and change of the reference electrode position may reduce this kind of noise. Signal processing techniques can filter these bursts from the EMG.