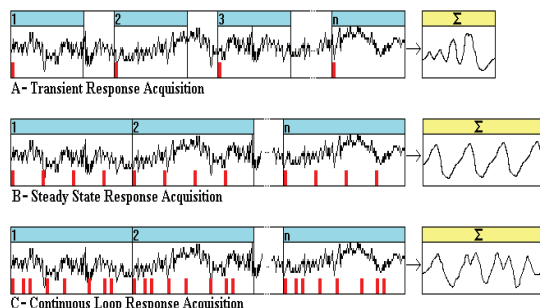


Introduction

Continuous Loop Averaging Deconvolution is a methodology that allows the acquisition of auditory evoked responses at very high stimulation rates. CLAD algorithms use arbitrary stimulus sequences to acquire averaged responses that can later be deconvolved into recognizable evoked responses. The following graph shows the difference between traditional transient stimulation, steady state stimulation and CLAD Stimulation. Note that the CLAD stimulus does not have a constant stimulus interval; it uses a special sequence to permit for the recovery of the response by the use of matrixes.



Why use CLAD?

By performing fast stimulation and acquisition, the procedure stress tests the auditory nervous system, which can help with the early identification of demyelinating diseases such as Multiple Sclerosis. ABR acquisition has been traditionally used for the detection of MS using the following guidelines for absolute and inter-peak latency values:

- Peak 1 and 2 absolute latency values using a 95%ile criteria was successful in detecting 65% of cases (Robinson & Rudge, J.Neur.Sci.,1980)
- 1-4 inter-peak latency using +2 sd was successful in detecting 83% of cases (Mogensen & Kristensen, Acta Neuro.Scan., 1979)
- Combined with visual evoked potentials, increases overall MS sensitivity to over 85%. CLAD sequences have less jitter and provide very high stimulation rates, up to 800 per second, not previously available in any system. Studies are still pending to determine the clinical usability of the technique for MS detection.

The CLAD Simulator

The CLAD simulator allows users to generate new sequences; it also allows the testing of these sequences to ensure they are feasible. To use the Simulator:

- Open CLADgen.exe.
- Enter the rate that you wish to use at the top right and press the Generate Sequence button
- Once the system generates the sequence, you may press the Simulate button to ensure that the generated matrix is usable.
- You may save the sequence to the CLADSeq folder for future use.

You must keep in mind that some stimulation rates will generate un-usable sequences; therefore the need for a simulator. There are multiple sequences that have been already generated and provided with your software.

Patient Preparation

The patient must be placed in a comfortable and quiet environment, preferably a sound booth where the patient lies down on a comfortable bed. The patient must be instructed to relax during testing. It is recommended that the patient avoid stimulants, such as caffeine, before testing. Electrodes may be placed in the following configuration:

- **Right Inverting (-):** right ear (M2) or (A2).
- **Left Inverting (-):** left ear (M1) or (A1).
- **Non-Inverting (+):** joined channels to high forehead (Fpz) or vertex (Cz).
- **Ground:** low forehead.

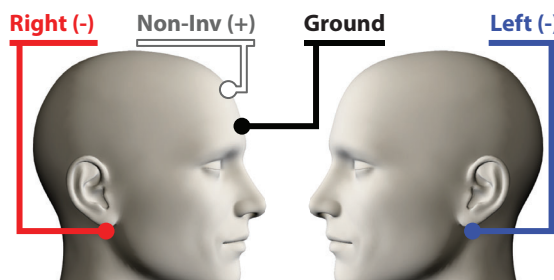


Fig.1 - Dual channel setup for Duet.

Electrode Usage

Surface electrodes are sufficient for acquiring ABR recordings. Clean and prepare electrode sites in order to reduce the impedance and acquire a clearer recording.

Setting up SmartEP

Go thru the following steps to perform a CLAD acquisition:

- Start SmartEP and enter the patient information as needed.
- Click on **[STIMULUS > MODALITY > AUDITORY – CLAD]** and select the appropriate option from the submenu (ECochG, ABR, MLR or LLR)
- From the Open File dialog box, select the sequence file to be used for stimulation, the click **[OPEN]**.
- From the new CLAD menu, make sure that **[AUTO-DECONVOLVE]** is selected (recordings may also be deconvolved later using the **[DECONVOLVE ACTIVE]** command in this menu)
- Set the stimulus, Click on Stim from the control panel and set the stimulus type, duration, frequency, window, masking and transducer, as necessary.
- Click on the **[AMPLIFIER]** button on the control panel and set the filters, notch filter, artifact rejection ratio and region and desired amplification for each channel.
- On the control panel, set rate, polarity, intensity and the number of sweeps.
- Press the Acquire button to start. Repeat acquisition 2 to 4 times.

Make sure to carefully select your filter settings in the Amplifier window. Lack of filtering may result in excessive artifact, while excessive filtering may result in waveforms that are too smooth to assess. EEG and Amplifier settings may not need to be adjusted more than once.

Suggested Acquisition Parameters

This table shows the recommended settings for CLAD acquisition, other settings depend on the type of evoked potential being acquired:

- **Stimulus:** 0.1 milliseconds click or tones.
- **Rate:** as defined by selected sequence.
- **Filters:** 100 - 3000 Hz for adults; 100 - 1500 Hz for smoother recordings; 30 - 1500 Hz for infants.
- **Notch Filter:** OFF; turn ON only when power line noise is present.
- **Amplification (gain):** 100K
- **Sweeps:** 1024.
- **Electrode Placement:** ipsilateral or contralateral array.

Marking Peaks

To accurately diagnose a condition, you may need to place the applicable labels on the recently acquired recording. Peaks may be marked when recognizable, follow these steps for each of the labels:

1. Right click at the point of the recording where the label is to be placed.
2. Select the peak to be marked
3. Once placed, drag the top marker of the labels to the top of the peak.
4. Drag the bottom marker to the valley following the peak.

Select Mark other peak to place custom label