

Middle Latency Responses

using SmartEP

What is MLR?

Middle Latency Responses, also known as MLR, AMR or AMLR, are components of the auditory evoked potential response. The MLR response is found between twelve and fifty milliseconds from the time of stimulation, after the ABR and before the LLR, this period reflects the response of the auditory cortex. As with ABRs, MLRs can be acquired with the use of click or pure tone stimulation.

The recordings acquired will contain certain peaks and valleys. In an MLR recording, the peaks are given by a positive potential difference, which are labeled with a P; the valleys are given by negative potential difference, which are labeled with an N. The first peak, Pa, is commonly found at 25 to 30 milliseconds from stimulation. The next peak, Pb, may be found 25 to 30 milliseconds after the first. MLR responses are most commonly acquired using surface electrodes.

Why acquire MLR?

Middle Latency Responses may be used to diagnose certain auditory conditions. This type of testing can provide the physician with very useful information about hearing loss in a patient.

MLR testing can help determine the amount and type of hearing loss at specific frequencies, (i.e. hearing threshold), depending on the cause of hearing impairment. MLR testing can also provide information about existing acoustic neuromas that may be causing a degree of hearing loss and the presence of nervous system abnormalities, particularly referring to process areas located after the auditory brainstem.

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.

Electrode Placement

Electrodes may be connected using the following configurations as shown below. Inverting electrodes may be placed at the mastoid or ear lobe. See SmartEP manual for additional placement options.

- **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.

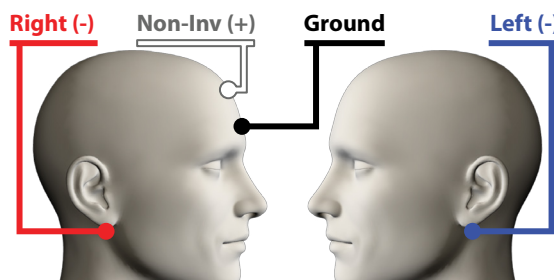


Fig.1 - Dual channel setup for Duet.

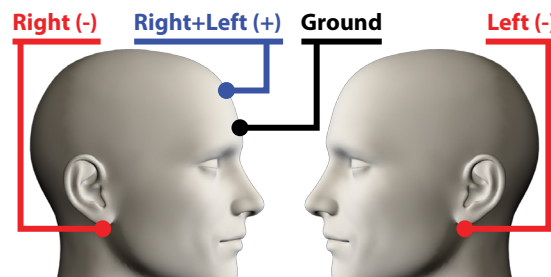


Fig.2 - Dual channel setup for USB and USBjr.

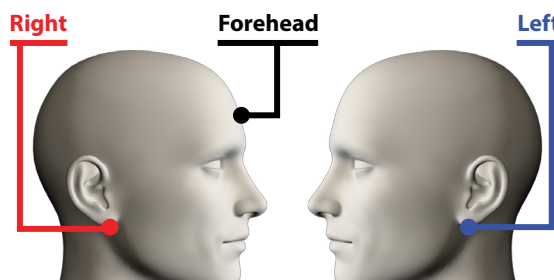


Fig.3 - Single channel setup for USBLite.

When testing for neurological MLR, it is preferred to use the C4-Ai-Ac or C5-Ai-Ac for right and left testing respectively. When testing for MLR, different electrode configurations may result in dissimilar responses.

Electrode Usage

Surface electrodes are sufficient for acquiring MLR recordings. Clean and prepare electrode pacing sites in order to reduce the impedance and acquire a clearer recording. You must use pediatric electrodes with infants. Make sure the electrodes are not expired.

Acquiring MLRs with SmartEP

MLR acquisition is a built-in standard function of SmartEP. A few clicks of the mouse will allow you to start MLR acquisition. You may load a pre-existing settings file by clicking the **[LOAD SETTINGS]** button from the control panel; or complete the following steps to set up acquisition manually:

1. From the SmartEP main menu, select **[PROTOCOL > MODALITY > AUDITORY > MLR]**. This option will apply the necessary settings and scales to start acquisition.
2. Click on the **[AMPLIFIER]** button from the SmartEP side panel and set the filters, notch filter, desired amplification and artifact rejection ratio and region for each channel, as necessary.
3. Click on the **[STIM]** button on the SmartEP control panel and select the proper stimulus and stimulation options. Click **[OK]** to set the stimulus, or save the settings for later use.
4. On the control panel, set the rate, phase, mode and sweeps as needed.
5. Click on the **[ACQUIRE]** button on the control panel to start acquiring for the selected ear.

Make sure to carefully select your filter settings in the EEG and Amplifier dialog box. 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.

Recommended Test Settings

Use these settings as a guideline for acquisition. It is recommended to run the test 2 to 4 times.

- **Stimulus:** 0.1 milliseconds Click for neuro-diagnosis; 2-1-2 Tone Burst for audiometry.
- **Rate:** 7.1 per second.
- **Polarity:** alternating.
- **Transducers:** insert earphones.
- **Intensity:** 70 dB HL, larger stimulation intensities may result in post-auricular muscle artifact. Lower intensities may be used for threshold evaluation.
- **Masking:** 50 dB. Only if stimulus exceeds 70 dB HL.
- **Filters:** 10-1500 Hz, may also show the ABR; 10-300 Hz, for smoother waveforms.
- **Notch Filter:** OFF.

- **Amplification:** 100K.
- **Analysis Time Window:** 0 to 50 milliseconds to show Pa only; 0 to 100 milliseconds to show Pa and Pb.
- **Sweeps:** 1000.

Possible electrode montages may include: Fz-A1-A2 right, auditory; Fz-A2-A1 left, auditory; C4-Ai-Ac right, neurological; C5-Ai-Ac left, neurological.

Marking Peaks

To accurately diagnose a condition, you must first place the applicable labels on the recently acquired recording:

1. Right click at the point of the recording where the label is to be placed.
2. From the popup menu, select the Mark Other Peak option.
3. On the dialog box, Select label to be placed (Po, No, Pa, Na, Pb or Nb).
4. Once placed, drag the top and bottom markers of the labels to their appropriate places.

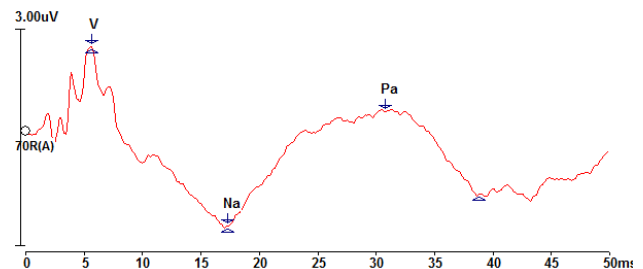


Fig.4 - Suggested labeling on MLR response.

Label placement buttons can also be found on the tool bar, just above the waveform display area; click the button, then click the desired location on the selected waveform; drag the markers into place as needed. Fig.4 shows suggested label placement for an acquired MLR.

Analysis

Select Print Pages or Print Page from the SmartEP main Menu to print a report of the currently displayed signals. Alternatively save the report or page to PDF. See the SmartEP manual for other report generation options.

Since label placement is subjective, all results must be evaluated by an audiologist or medical professional trained in MLR techniques.