

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 30ms from stimulation. The next peak, **Pb**, may be found 25 to 30 ms 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.

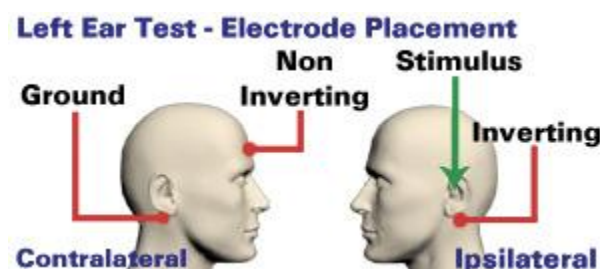
MLR testing can help determine the amount and type of hearing loss at specific frequencies, (i.e. hearing threshold), depending on the cause of hearing impairment. MLR testing can also provide information about existing acoustic neuromas that may be causing a degree of hearing loss and the presence of nervous system abnormalities, particularly referring to levels above 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. For audio MLR, Electrodes may be placed in the following configuration:

- Inverting (-) : Ipsilateral (Testing) Mastoid
- Non-Inverting (+) : Contralateral Mastoid
- Ground: Forehead



When testing both ears, in a dual channel system, place the corresponding inverting electrodes on both mastoids, and place the two inverting using one electrode and a Y-adaptor below the ground electrode. 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.

Acquiring MLRs with SmartEP

MLR acquisition is a built in function of SmartEP. A few clicks of the mouse will allow you to start MLR acquisition. Complete the following steps to acquire data:

- From the SmartEP main menu, select **Stimulus > Modality > Auditory > MLR**.

MLR acquisition using SmartEP

This option will apply the necessary settings and scales to start acquisition.

- Click on the **EEG and Amplifier** button from the SmartEP control panel and set the filters, notch filter, desired amplification and artifact rejection ratio and region for each channel, as necessary.
- 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.
- On the control panel, set the rate, phase, mode and sweeps as needed.
- 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.

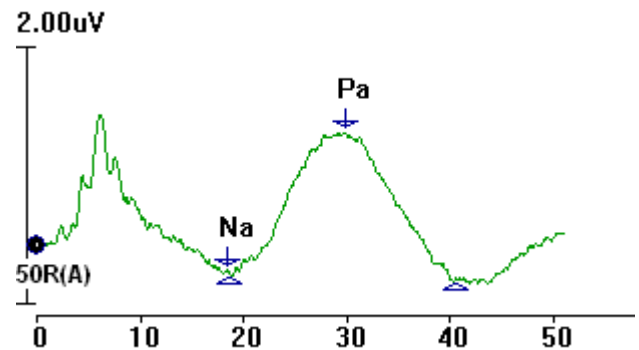
Stimulus	0.1 milliseconds Click for Neurodiagnosis and 2-1-2 Tone Burst for Audiometry
Rate	7.1/sec
Polarity	Alternating
Transducers	Insert Earphones
Intensity	70 dB HL, larger stimulation intensities may result in post-auricular muscle artifact. Lower intensities may be used for threshold evaluation.
Masking	50dB. Only if Stimulus exceeds 70 dB HL.
Filters	10-1500 Hz or 10-200 Hz
Notch Filter:	OFF
Amplification	75x
Analysis Time Window	Overall 100 msec
Sweeps	1000

Electrode Montage	Fz-A1-A2 right, auditory Fz-A2-A1 left, auditory C4-Ai-Ac right, neurological C5-Ai-Ac left, neurological
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Marking Peaks

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

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



The graph shows suggested label placing 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. 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.