EVOKED POTENTIALS GUIDES
AUDITORY EVOKED POTENTIALS OVERVIEW

AEP/CAEP

Auditory Evoked Potential (AEP) can be used to evaluate the integrity of the auditory system and are used to make inferences about hearing. AEPs encompass a series of neurologic events that travel along the entire length of the auditory pathway – from the cochlea to the auditory cortex. There have been as many as 15 AEPs identified within the first 500 ms post-stimulus onset. In order to identify the neural integrity of the auditory system, it is necessary to consider the size and latency of the response and utilize averaging and stimulus parameters to elicit and isolate the AEP interest.

Electroencephalography (EEG) is spontaneous, random electric activity generated in the central nervous system in the absence of stimulation. An evoked potential is an electric response from the nervous system following the presentation of a stimulus. This is a distinct response that is embedded in the spontaneous EEG activity that can be measured and recorded using surface electrodes that are placed on the scalp. When the stimulus is sound, the evoked potential is called an Auditory Evoked Potential.

Signal averaging is used to isolate the AEP response. It is assumed that the AEP response is synchronous with the onset of a brief acoustic stimulus; therefore, it will emerge in a predictable shape within a specific timeframe of the stimulus. When the evoked potential device averages EEG signal relative to the acoustic stimulus, the AEP response will remain constant, and the random EEG background signal will "cancel" out – leaving the desired AEP response.

The stimulus used to elicit an AEP response can be a short duration stimulus or a steady state modulated signal. When a short duration stimulus is used, the AEP is an onset response and a large number of neurons must fire at the same time, or synchronously, to identify the response. The two most common short duration stimuli are the click and the tone burst (or tone pip).

The traditional click stimulus is a 100 μs electrical pulse that has a frequency range of approximately 100 to 10,000 Hz. The broad-band nature of the click provides stimulation of a large portion of the cochlea, which causes a large number of neurons to fire simultaneously. The resulting AEP provides information on the neural synchrony of the auditory nerve.

The tone pip (also called tone burst) stimulus assists in the evaluation of frequency specific performance of the auditory system. The frequency-specific stimulus is achieved by presenting a sine wave for a brief duration. The tone pip stimulus is based on the number of cycles presented. Specifically, the rise and fall times of the stimuli are 2 cycles and the plateau is either 1 or 0 cycles. With this approach, the duration of the stimulus varies with frequency, but the energy content of stimulus is consistent for each frequency.

AABR

AABR, or automated auditory brainstem response, is used for universal newborn hearing screening. The equipment for AABR is automatic and requires no interpretation by the user. AABR uses a soft broadband stimulus to activate the baby's neurons at a level consistent with normal hearing. The equipment analyzes the response and will give a pass or refer result.

eABR

It is possible to test for evoked potentials on cochlear implant patients using the software of the CI for stimulation.

ASSR

The auditory steady-state response is an auditory evoked potential elicited in response to an on-going, modulated pure tone stimuli. The response itself is an evoked neural potential that is phase-locked to the modulation envelope of multiple pure tones, each modulated at different rates can be combined into complex stimulus allowing for testing. That is, the neural response closely follows the time course of the modulation can be used to predict hearing sensitivity in patients of all ages. The response can be detected objectively at intensity levels close to behavioral threshold.