YELLEN & ASSOCIATES

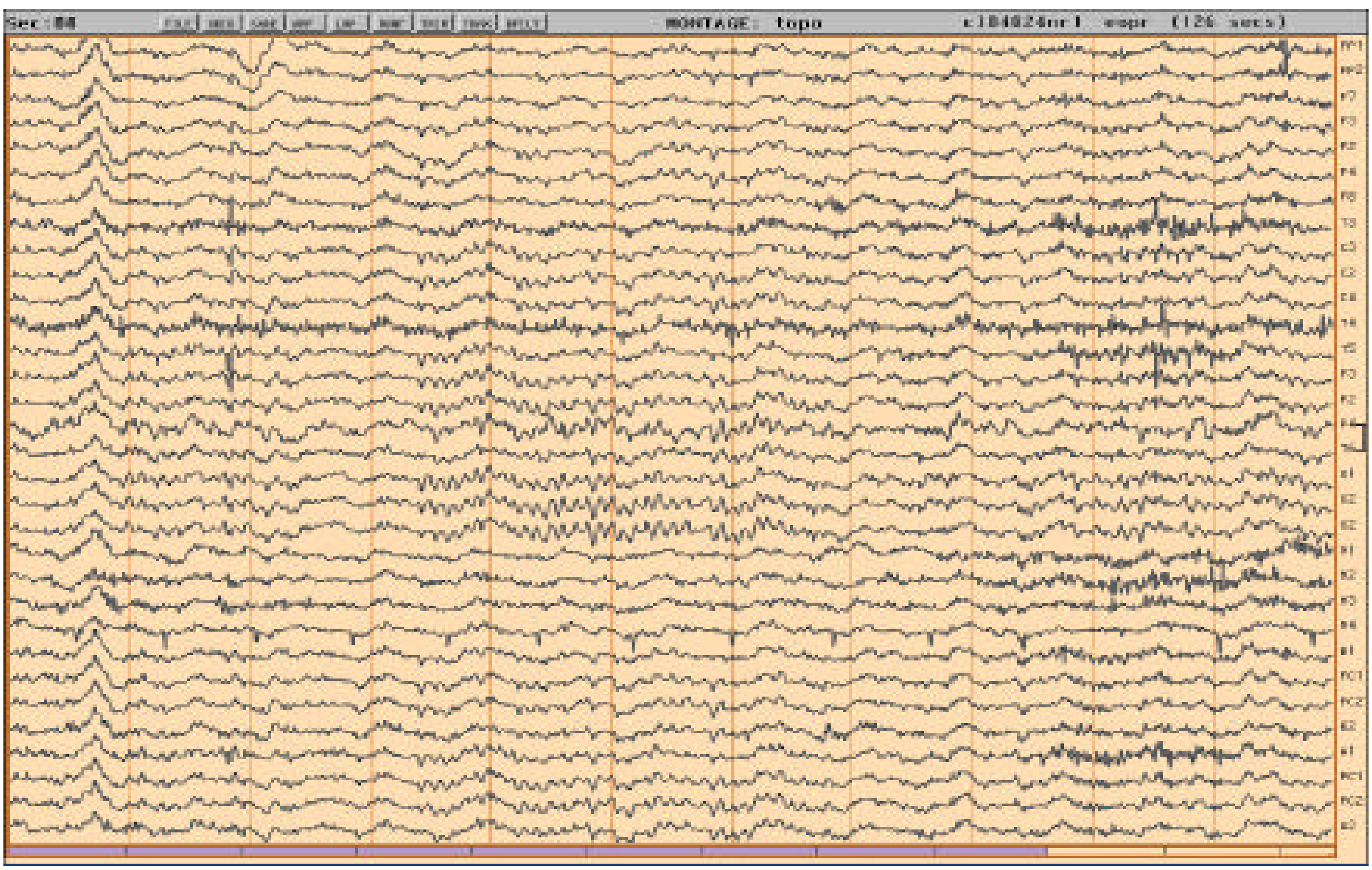
psychological, educational, and speech & language services

BASICS OF THE DESA®

DESA® is our proprietary name for the EEG based neuroelectrical evaluation system developed at Harvard Boston Children's Hospital. DESA® is an acronym for Digital Electroencephalogram Spectral Analysis. The information provided here is only to familiarize you with the DESA®. It is not intended to assist in clinical interpretation, as that can only be done by a highly skilled medical professional. The purpose of the DESA® and its constituent parts is to analyze the central nervous system, its input processes, and how information is processed and expressed. A patient's DESA® results are compared to the normative database established by Harvard Boston Children's Hospital in order to better determine the proper course of treatment. There are six elements to the DESA® and its constituent parts. Each is summarized below.

EEG

EEG is the recording of electrical patterns at the surface of the scalp, which primarily reflect electrical activity or "brainwaves." The DESA® is analyzed by creating color (spectral) representations of differences in functioning versus an individual's normal functioning. The graphs you may see are actual EEG tracings, while the multicolored mini heads represent a comparison of brainwaves from each electrode to the norm. Below are examples of each.



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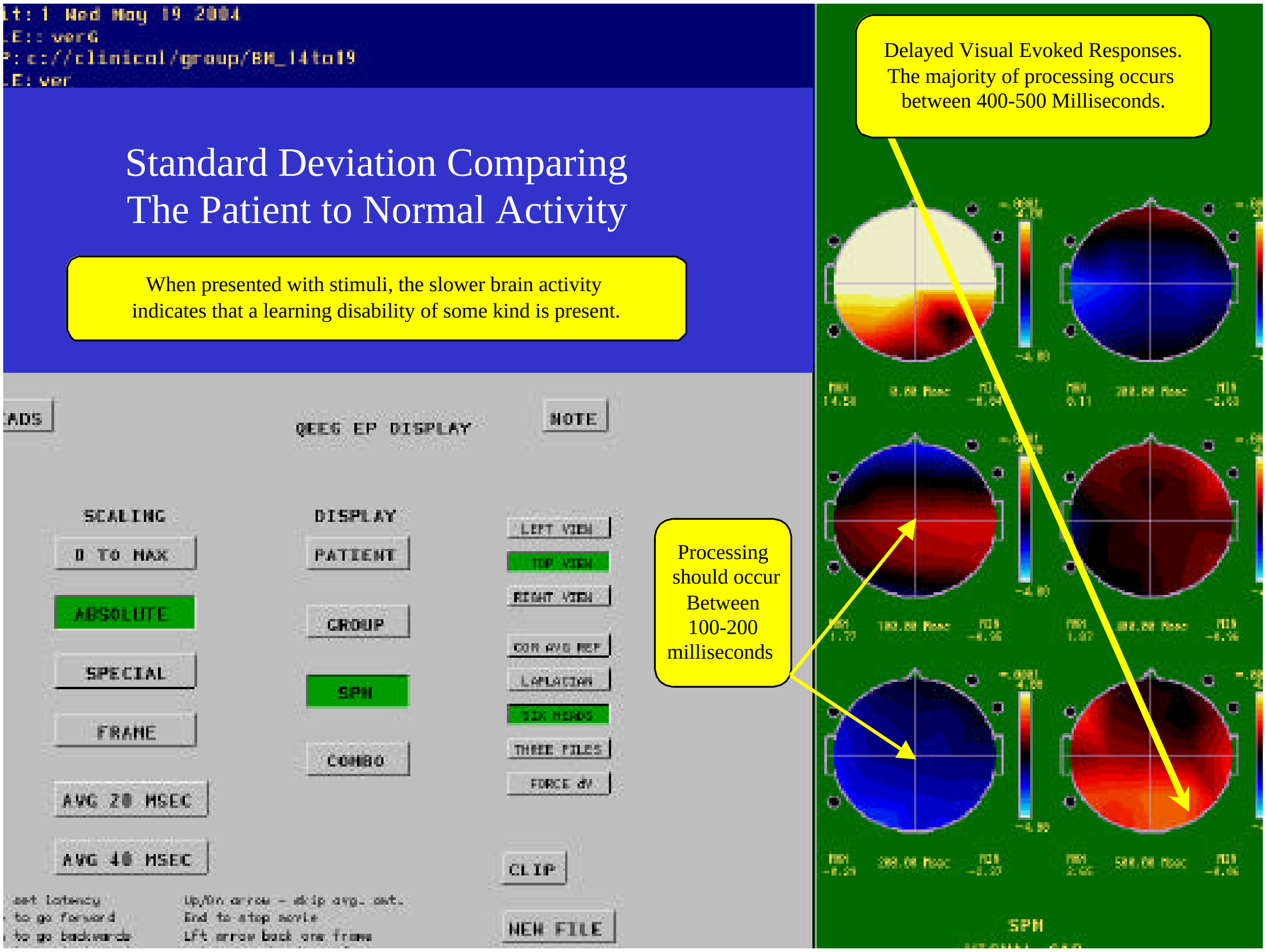

Over the last 25 years, advances in signal processing have made it possible to sample the EEG waves many times per second and to analyze them in various ways. Using this technology, we can now measure precisely the amplitude (height) and frequency (times per second) of waves of interest, be confident about the validity of the waves, and even compare a patient's presentation to a normative reference database.

The electrical waves we can record on the surface of the scalp reflect the activity of many thousands of brain cells. These waves represent the sum of waves of excitation and inhibition that are happening to the individual cells. This is a summed image of many thousands of cells being coordinated and getting almost ready to fire, then not ready at all, then almost ready again, etc., as they ride the waves up and down.

The different names given to brain waves reflect waves of different speeds or "frequencies." Brain waves occur at various frequencies. Some are quick, and some are quite slow. The classic names for these "EEG bands" are Delta, Theta, Alpha and Beta (B1, B2, B3).

Alpha (8-13 Hz) represents a sort of "idle" state, or "ready but not doing much" state and is normally fairly large over the back third of the brain when the eyes are closed and when awake. Alpha disappears when we either get mentally busy (e.g. open the eyes, start doing intense mental work even with eyes closed) or when we become drowsy. Thus the presence of Alpha can show the presence of an awake, resting state. The presence of Alpha at a fairly high voltage when the eyes are open is indicative of an inattentive state. In fact we often see this sign in adolescents and adults with attentional difficulties.

When we get mentally busy and engaged, we should see Alpha reduce significantly in size. In its place we see mostly smaller, quicker Beta waves. The Beta family of waves happen at frequencies from 16-40 Hz or higher.

Delta and Theta waves are relatively slow. Delta is usually defined as waves occurring from 1-3 times per second (1-3 Hz). Theta occurs at 4-7 Hz. During drowsiness, Alpha begins to disappear, and the size of Theta waves begins to increase. As sleep begins, Theta waves get quite large, then become mixed with and eventually give way to slower Delta waves.

The presence of Delta and Theta waves in the waking, eyes open EEG is always considered abnormal. High amplitude slow waves can be signs of various neurological and psychological problems, including epilepsy and ADHD.

VISUAL EVOKED RESPONSE / POTENTIAL (VER)

The VER looks at pathways of light from the retina to the visual center of the brain. Objective information regarding visual abnormalities allows the identification and location of abnormal processing of visual information. After a light is flashed in front of the eyes, the tracking and timing through the brain is recorded in milliseconds. One would expect to see the cognitive effects of the light starting to be processed at 100 milliseconds, fully processed at 200 milliseconds, and finished being processed by 300 milliseconds. Differences in visual processing from the normative database are recorded and scored as standard deviations.

AUDITORY EVOKED RESPONSE / POTENTIAL (AER)

This study examines the functional pathways of sound from the inner ear to its final destination. Thus, the evaluation of sound up to speech sensory input can be accurately evaluated. Any abnormalities judged to be receptive in nature could be clearly identified by this method. As with the VER, one would expect the cognitive effects of sound to begin processing at 100 milliseconds, fully processed at 200 milliseconds, and finished being processed by 300 milliseconds. The spectral analysis example on the previous page is an example of the comparison to the database when the patient's auditory response is abnormally delayed.

FREQUENCY MODULATED AUDITORY EVOKED RESPONSE (FMAER)

This modulated frequency sound creates input specific to the language portion of the brain. This test is used to foresee sensory processing speech problems. Done in pre-school children, the FMAER determines proper treatment protocols prior to being diagnosed with language problems. This becomes exceptionally important in young children since medical evidence now demonstrates the brain's plasticity in its ability to rewire neuronal pathways. Though the stimuli produced does not sound like speech in the regular sense, it mimics the frequencies associated with speech, thereby producing a sound that is described as "warbling" or quickly vibrating up and down. This allows the patient's receptive speech processing to be examined.

P300

The P300 is often referred to as the "oddball" phenomenon. The patient's response identifies random occurrences of changes in auditory and / or visual stimuli. If it is auditory, they might hear "beep-beep-bop-beep", or if it is visual, they might see "black square-black square-white square-black square", and identify them as unusual events. In this manner the brain's ability to recognize and process visual and / or auditory stimuli in a timely manner is evaluated.

The DESA® system is innovative in three important aspects. Firstly, signals are produced from 32 channels, thereby producing clearer clinically relevant information. Secondly, the constituent parts of Visual Evoked Responses and Auditory Evoked Responses, including Frequency Modulated Auditory Evoked Response and P300, are utilized in conjunction with the EEG to gather precise information. Thirdly, the patient's results of the DESA® and the Evoked Potentials are all compared to Harvard's large normative database.

The DESA® is not intended to be a stand-alone diagnostic instrument nor a substitute for other medical diagnostics. It is, however, a state-of-the-art tool that can guide prognosis and intervention. DESA® is best used as an aid in the clinical diagnosis of various dysfunctional states and not as a substitute for clinical judgment and medical opinion. The DESA® should be combined with other medical, psychological and neuropsychological data to best aid the patient.