

IS ADD REALLY ADD?

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Using recently available technologies such as BrainMaster Avatar, qEEG, and LORETA Z-score training, the scope of investigating and training clients complaining of what has loosely been defined as Attention Deficit Disorder has broadened immensely.

To review, according to the DSM IV, in order to meet the criteria of an ADD Inattention diagnosis, a client must meet 6 out of 9 of the following criteria:

1. Often fails to give close attention to details or makes careless mistakes in schoolwork, work or other activities.
2. Often has difficulty sustaining attention in tasks or play activities.
3. Often does not seem to listen when spoken to directly.
4. Often does not follow through on instructions and fails to finish school-

work, chores, or duties in the workplace (not if oppositional behavior or doesn't understand instructions).

5. Often has difficulty organizing tasks and activities.
6. Often avoids, dislikes, or is reluctant to engage in tasks or activities that require sustained mental effort (such as schoolwork or homework).
7. Often loses things necessary for tasks or activities (e.g., toys, school assignments, pencils, books, or tools).
8. Often easily distracted by extraneous stimuli.
9. Often forgetful in daily activities.

Often, clients enter for neurofeedback with this diagnosis or complaining of these symptoms and a qEEG or Assessment of some type would be administered. In a majority of these cases, findings typically show elevated theta to beta ratios in the frontal/central region. Training might commence with a Cz, beta/SMR training and an estimate of 40 sessions to complete or 4- or 19- channel live Z-score training with improvement in somewhat less sessions. Results have typically been good with resolution of symptoms acceptable.

However, using Brain-

master Avatar and ANI Neuroguide with LORETA capability, dysfunction in finite Regions of Interest relating more specifically to the client's symptoms and complaints can be singled out and specifically trained, revealing there may be much more to "Inattention" than those 6 of 9 criteria.

CASE STUDY

Case in point involves a 10-year-old male who was diagnosed as ADD Inattentive by virtue of the DSM IV. The intake interview revealed teachers and peers finding him "spaced out" often having to raise their voices in order to gain his attention. He seemed to go through life lackadaisically. He was having difficulty with reading comprehension (his reading ability was 4th grade appropriate but was tested at pre-K due to poor comprehension. His math skills are grade appropriate. He suffers from low self-esteem because he feels his peers are leaving him behind. All of these symptoms and complaints were blamed on his diagnosis of ADD, Inattention Type.

The qEEG EO Z-score 1Hz Bins (Fig. 1) revealed elevated 2-6 Hz and 10-23 Hz around F7 and elevated 19-30 Hz at CzPz. The theta/beta ratio at Cz was 3.23, which is elevated, but not terribly high. LORETA (Fig. 2) revealed Brodmann Area 22 as a Region of Interest. These findings are not typical of what is seen in clients who come in with an ADD, Inattentive Diagnosis. In fact, when researching issues reflected by brain dysfunctions at Brodmann 22 one finds a greater comparisons

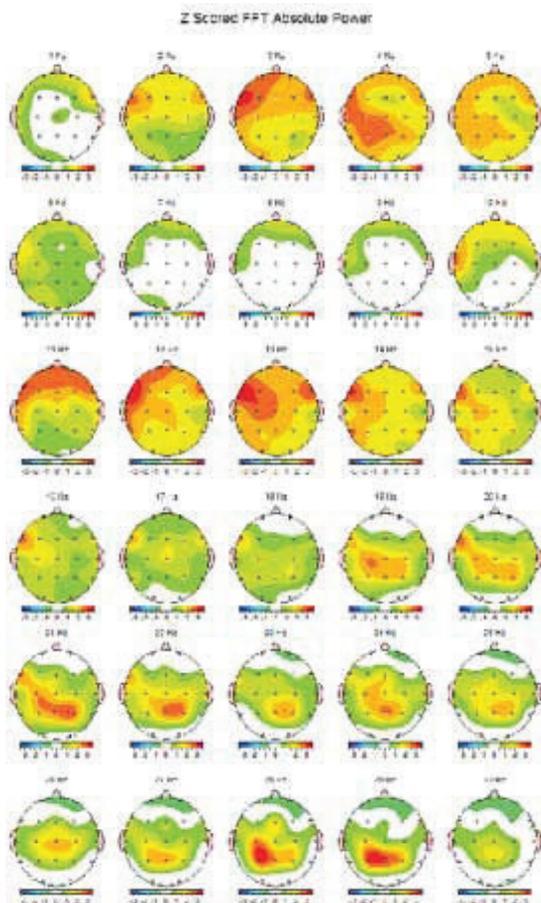


Figure 1

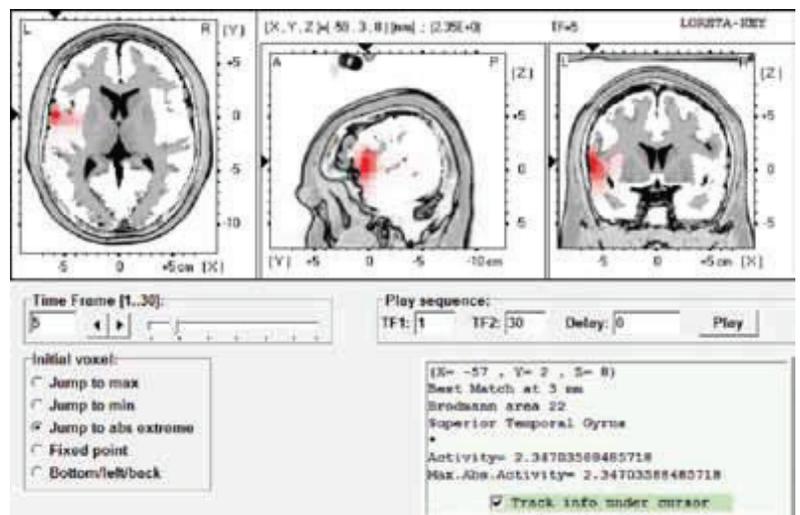


Figure 2

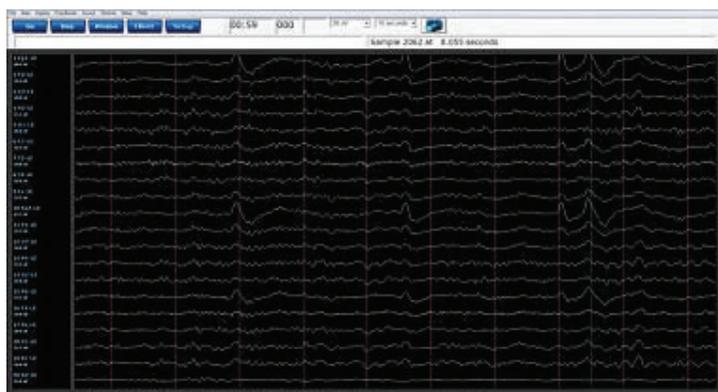


Figure 3A Acquisition

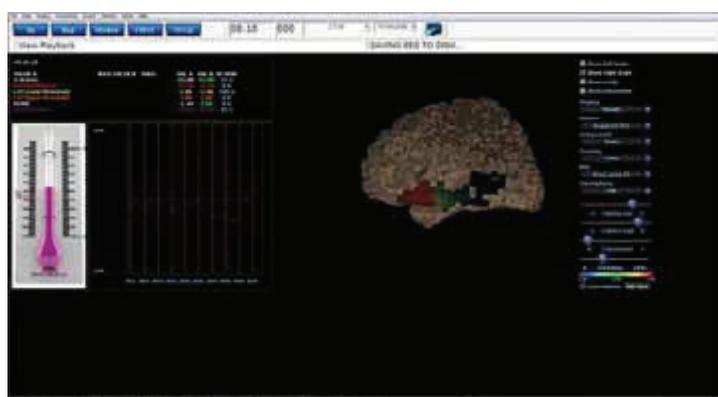


Figure 3B Region of Interest (ROI) Training



Figure 3C Z-Score Training

to the clients' symptoms and complaints involved with language processing and comprehension. These issues seemed more consistent with a sort of Wernicke's Aphasia rather than ADD, Inattention.

TRAINING

Training commenced with just a few basic Cz beta/SMR sessions using Brainmaster Avatar to indoctrinate the client to the neurofeedback process, check arousal, and confirm consistency of brain wave activity to the qEEG. Interestingly enough the client's parents reported an increase in attention.

Commencing with Session 4, a Brainmaster Avatar protocol was set up to **directly train** the Region of Interest (Brodmann Area 22 Left), a capability unavailable until this new technology. Using a 19-channel Electrocap, we were also able to concurrently perform live Z-score training (PZOK + PZMO). Feedback tones were provided when



Figure 3D Z-Score Monitor



Figure 3E Blimp Race

the client reduced theta in Brodmann 22 Left below a set threshold, and for increasing the number of Z-scores within target, while increasing the speed of a blimp across a screen, with more success in both. The client also could watch Brodmann 22 Left on the Live sLORETA Projector (LLP) and turn the elevated theta, red to green as the theta in this region reduced below threshold.

Avatar has the ability of displaying multiple tabs on two displays in order to monitor numbers of different screens according to the clinician's desire. These screens are highly customizable. In this example, on the clinician side we set up 4 tabs. Each tab is highlighted at the bottom of each figure:

1. The "Acquisition" tab is to monitor the raw waveforms (Fig. 3A). The setup of this window is pretty straightforward and is used to view artifact, electrode stability, and general integrity of the EEG.
2. The "ROI Training" tab is to monitor and train at the Region of Interest, Brodmann 22 (Fig. 3B), as well as perform live Z-score training. In order to fully understand the setup of this screen it is important to review the Event Wizard associated with this screen. BrainMaster had created and instituted what is called the Event Wizard to expand the capability of their software beyond the basic functions since version 3.0. The evolution of the Event Wizard into Avatar is seamless and has been upgraded to include all the formulas necessary to perform sLORETA and Region of Interest Training on both left and right sides separately or together.

This single screen includes many of the new capabilities of Avatar including the enhanced 3D thermometer and Live sLORETA Projector (LLP). To explain how joint Z-score training and Region of Interest training is represented in this map, first look at the text stats in the upper left-hand corner.

Z-score training is handled as it was in version 3.0 by creating an upper and lower threshold window (+1.00 and -1.00), and setting the percent of Z-scores within the window in order to receive a reward (65%). The Event Wizard Script is as follows:

Summary for Event 1: (This is the PZOK Equation)

EVENT 1 IS CURRENTLY: ENABLED

IF: EQN: $x = \text{PercentZOKUL}(\text{UTHR}, -\text{GTHR}); \text{IS GREATER THAN EQN:}$

$X = \text{CT};$

THEN: Play MIDI Sound MODE: 2 NOTE: 61 INSTR: 96 Ice Rain

STYLE: Sustained MODULATION: Ampl. and Pitch LOUDNESS: Level: 70

LOUDNESS CHANGE RATE: 3 PITCH CHANGE RATE: 1

KEY: A MODE: Major (Ionian) CHORD: 1 Note

Summary for Event 2: (This determines the percent reward with regards to Z-score training)

EVENT 2 IS CURRENTLY: ENABLED

IF: EQN: $x = \text{EIP}; // \text{percent reward IS GREATER THAN EQN: } x = \text{EIP};$

THEN: Do Nothing

Summary for Event 3: (This determines the lower Z-score window parameter)

EVENT 3 IS CURRENTLY: ENABLED

IF: Channel 1 Gamma Threshold IS GREATER THAN EQN: $x = -\text{GTHR};$

THEN: Do Nothing

Summary for Event 4: (This controls the upper Z-score window parameter)

EVENT 4 IS CURRENTLY: ENABLED

IF: Channel 1 User Threshold IS GREATER THAN EQN: $x = \text{UTHR};$

THEN: Do Nothing

Summary for Event 5: (This controls the movement of the blimp in the Flash Player)

EVENT 5 IS CURRENTLY: ENABLED

IF: EQN: $x = \text{EIF}; \text{IS GREATER THAN Value: } 0.5$

THEN: Do Nothing

Summary for Event 6: (This gives an additional reward tone for PZMO)

EVENT 6 IS CURRENTLY: ENABLED

IF: EQN: $x = \text{PZMO}(\text{I}) \text{ IS GREATER THAN Value: } 5.0$

THEN: Play WAV Sound

Below the text stats a thermometer and long-term trend graph are visible. The thermometer is set to reveal theta in Brodmann 22 Left in microvolts. In this cast a threshold is set at 50 microvolts and when the client can drop the theta below this level a tone will sound. Tracking of the theta over and threshold in a ten-second interval is viewed on the graph. The event script for these two functions is below.

Summary for Event 7: (This controls the region of interest thermometer, tones and graph)

EVENT 7 IS CURRENTLY: ENABLED

IF: EQN: $x = \text{LoretaROI}(\text{AL}(58,2)); \text{IS LESS THAN EQN: } x = \text{TTHR};$

THEN: Play MIDI Sound MODE: 2 NOTE: 44 INSTR: 14 Tubular bell

STYLE: Sustained MODULATION: Ampl. and Pitch LOUDNESS: Level:

126

LOUDNESS CHANGE RATE: 3 PITCH CHANGE RATE: 1

KEY: A MODE: Chromatic CHORD: 1 Note

The Brainmaster 3D Brain Map Projector is located to the right and displays Brodmann 22 Left. By turning the red to green or clear in this area the client will be adequately reducing theta.

3. The “Z-score Training” screen is to monitor PZOK and PZMO (Fig. 3C). This basically looks the same as the previous version; however, it now includes 3D thermometers to further enhance the training experience.

4. The “Z-score Monitor” screen is to view all the Z-scores in real time (Fig. 3D). This screen may also be used for training purposes because many clients simply want to monitor their Z-scores and alter them during the session.

On the client’s side there are two tabs, plus the ability to overlay training screens (flash games, videos, etc. Fig. 3E) over the windows.

1. The “ROI Training” tab is to monitor training at the Region of Interest, Brodmann 22 Left (Fig. 3B). This screen is the same as the clinician screen.

2. The “Z-score Training” screen is to monitor PZOK and PZMO (Fig. 3C). This screen is also the same as the clinician screen.

3. The Blimp Race—A popular BrainMaster training game.

RESULTS

After 12 sessions of combined Region of Interest and Z-score training the client showed marked improvement in both attention and reading comprehension. The child participated in Little League. Before neurofeedback training, he was stuck out in right field, where the team would have to yell at him just to get his attention to come back to the dugout. After the sessions, he boasted about winning as a pitcher and batting in winning runs.

Throughout the training, the child’s reading interest, speed, and comprehension improved session to session. It is fortunate that at our center, Providence Foundation, in Orlando, Florida, we have multidisciplinary training for learning-disabled and special needs children. After neurofeedback sessions, this child participated with Megan Hunt of our center in tutoring involving the Lindamood-Bell for Reading Comprehension program. The program involves turning the read word into pictures so that they may be more easily committed to memory as a comprehension tool. She reported that at the beginning this child was unable to picture words that had been read let alone commit them to memory. As an entering fifth-grader, he was comprehending at a pre-K level. Again, what Megan described more fit a description of Wernicke’s Aphasia, a dysregulation pattern found in Brodmann Area 22 Left than ADD, Inattentive Type. Megan has continued working with this child and now has him reading and comprehending at nearly a third-grade level prior to the beginning of the school year. A real bonus is that the child’s self-esteem has grown. He feels really good about himself and is proud that he is overcoming his problems.

CONCLUSION

In conclusion, this child came in with a diagnosis of ADD, Inattentive. If treated using conventional neurofeedback related to this diagnosis, much time and money may have been wasted without complete remediation of the problem. With the aid of ANI Neuroguide pinpointing the Region of Interest relating to the symptoms and complaints, and using BrainMaster Avatar to train this child with laser-like accuracy, little time was wasted and remediation of his issues were swift and right on target.

I would like to thank Penijeane Rutter and Robert Malicia of BrainMaster for help in designing specific Avatar screens for specific Region of Interest Training Issues.

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