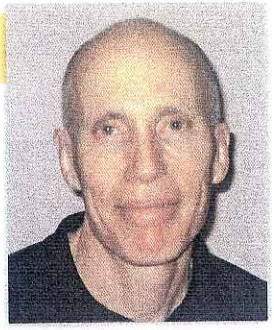


A Father Finds a Solution: Z-Score Training

Mark Smith, LCSW

He dropped like a marionette whose strings had gone slack, collapsing on the kitchen floor. Alerted to the fall by the sharp intake of breath of the adult next to me, I turned quickly but only glimpsed it out of the corner of my eye. It wasn't immediately clear what had just transpired. He bounced back up instantly, my red headed boy, and with his three year old exuberance was back at our Labor Day weekend festivities.

The adults, including myself, were left stunned trying to make sense out of what we had witnessed. This was no ordinary fall, one minute he was standing still manipulating a Sponge Bob toy, the next he was a flaccid puddle on the floor and the moment following, turgor restored, he was running to join his mates as if nothing had happened. We cautioned ourselves not to over-react, but I had seen enough to know that my world had inexorably changed.

There had been disturbing signs for two weeks. Jack's right big toe looked like hamburger from being serially stubbed. But only his right toe, his left toe was completely unscathed. Jack was born a runner and was as fast as the wind. Falling came with the territory. But the number of bruises he had collected from recent tumbles was unusual even for him. Diaper trained for a year, Jack urinated in his pants at the beginning of this holiday weekend and when asked about the wetness, seemed blissfully unaware.

The day following Jack's terrifying collapse, he could not stand for several minutes while attempting to pull up his pants. A trip to the emergency room and subsequent visits to a pediatric neurologist confirmed our worst fears. Jack had Epilepsy, Cryptogenic, Benign Rolandic Epilepsy.

Cryptogenic, the name neurologists give to the condition when they make an educated guess as to its cause. Rolandic, delineating a spike focus on the sensory motor strip. Benign, a term used in the hope that the patient will be lucky enough to maintain a less virulent form of the disorder; that it doesn't bear its life damaging teeth; and disappears quietly after several years of medication. Unfortunately, the disorder quickly became anything but benign.

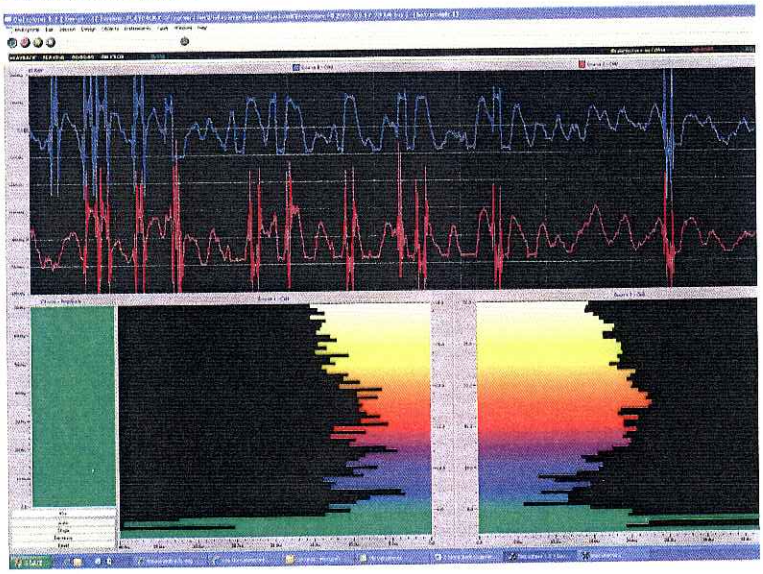
Jack was an athletically gifted child. He had exquisite timing, unusual balance and speed. "How old is that boy," adults would ask in wonder, whenever we played any ball game in Central Park. Before he was three he could unerringly kick a soccer ball that was rolled to him, taking care to take one preparatory step before using his left leg to kick the ball farther than seemed possible for a three year-old child. He could swing a bat making the kind of contact with the baseball that had his father dreaming of afternoons in Yankee stadium. Most impressive, he could catch a tennis ball with one hand over and over again.

All his physical gifts disappeared as the seizure disorder worsened. Jack's seizure frequency increased dramatically. In addition to the atonic (drop seizures), he developed myoclonic and absence expressions of the disorder. He was having many seizures each day. He could not run, kick, throw, bat or catch. He stopped trying. He became sedentary. His personality changed. Our energetic boy with the sunny disposition became by turns sullen and hostile, labile and violent. He physically attacked his mother and brother. The increased doses of anti-convulsant medication did nothing to halt the progression of the illness.

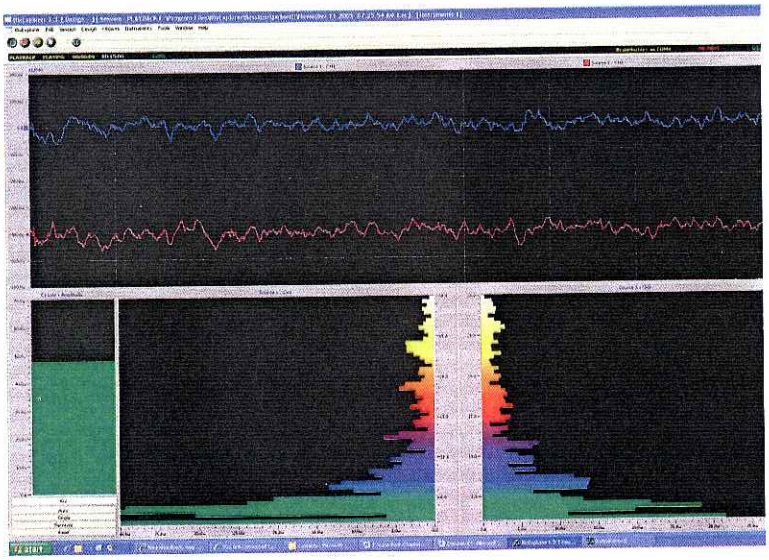
I begged my wife to allow me to train

Continued on page 24

ILLUSTRATION 1



First qEEG based training revealing 300 to four hundred microvolt inter-ictal epileptiform discharges.



The day after the first training—no inter-ictal epileptiform discharges.

Z Score Training
continued from page 22

our son with neurofeedback. With a ferocious maternal instinct, her desire to protect her wounded cub precluded any intervention. Neurofeedback with all its electronic gadgetry was difficult to understand at best and threatening at worst. She jokingly referred to me as Dr. Frankenstein and vowed her boy would never be my monster.

One day, during one of my wife's cripplingly painful bouts of monthly menstrual pain, she gave in to my pleading and allowed me to train her with neurofeedback. She was astonished that within minutes she was free of the pain that had plagued her for decades. Nothing except the most powerful narcotics had ever helped her and the medication left her unable to function. She was a convert. Neurofeedback removed the proverbial thorn from the lioness' paw. It couldn't have come at a more opportune time.

Jack had reached the dose limit of his medication for his body weight. Still seizing daily, his neurologist wanted to add a second medication. I started neurofeedback by collaborating with a more experienced clinician, eventually taking over the training myself. Jack managed to gain periods of seizure control within months. But despite several different approaches the seizures always broke through. We would train through them and find homeostasis once again. This cycle repeated it self several times. In the autumn of the year following Jack's seizure onset, we were watching football together. Jack's physical gifts had begun to return and with it the swagger of the young athlete. He was once again taking physical risks that were well within his pre-seizure abilities. Mimicking a diving tackle, Jack ran full speed toward our couch. He leapt, his body becoming horizontal in the air, a linebacker poised to spear the fluffy recesses of our couch. But instead of a soft landing on an over stuffed pillow, he smacked his head on the arm rest of the couch causing swelling and bruising in the right orbital region. The seizures returned with alarming frequency and intensity.

Nothing that had worked in the past was working now. I was observing three to four hundred microvolt spikes in the raw trace. We turned to qEEG and Jonathan Walker. Dr Walker recommended a two channel inhibit approach and I was astonished to observe an EEG without inter-ictal epileptiform discharges the day following our first training. (Illustration 1) The seizures ceased within days only to return when we began coherence training. So began a series of qEEGs and trainings, two channel inhibit protocols followed by coherence training. The cycle of control followed by seizures hued to the sequence of inhibit protocols followed by coherence training. The coherence training was making Jack worse but the inhibit training by itself did not seem to have staying power. If I just trained magnitude, Jack would eventually begin to produce inter-ictal epileptiform discharges followed shortly by seizures. The literature suggested that the combination of coherence and magnitude training was the key. But I could not train coherence for a session or two and do another qEEG. My four year old son was barely tolerating all the neurofeedback training. It was clear to me that I needed a different way to train coherence.

True to form, in the spring of 2006 the last round of coherence training had ushered in a new round of seizures. The seizure activity was generalizing, moving from a parietal focus to expressions in the central and temporal regions. Our neurologist urged an immediate change in medication. I was desperate. It was at this time that Tom Collura at Brainmaster introduced Z score training. On the first day it was available in early April, I acquired the software and began to use it with Jack.

At first I attempted to train coherence to zero. That is, the software would only reward Jack when he raised his mostly hypocoherence from negative 2 or 3 standard deviations to 0. It did not occur often

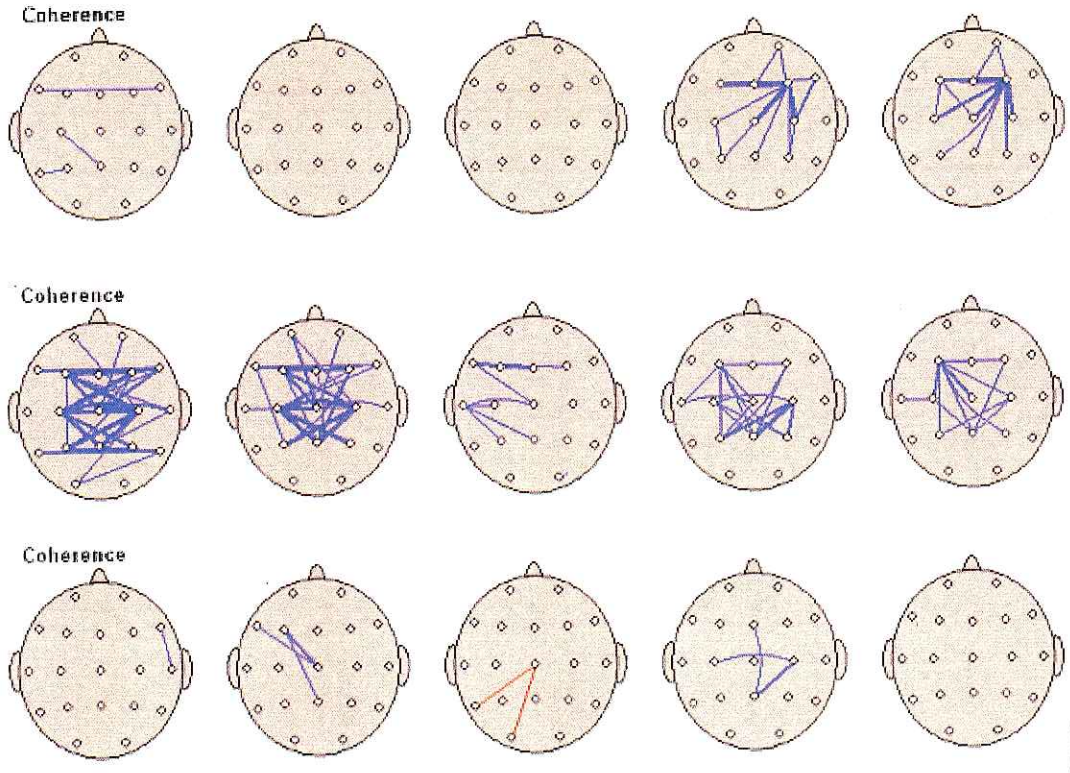


Illustration 2

First qEEG

Second qEEG. Maps reveal more hypcoherence after traditional "linear" coherence training.

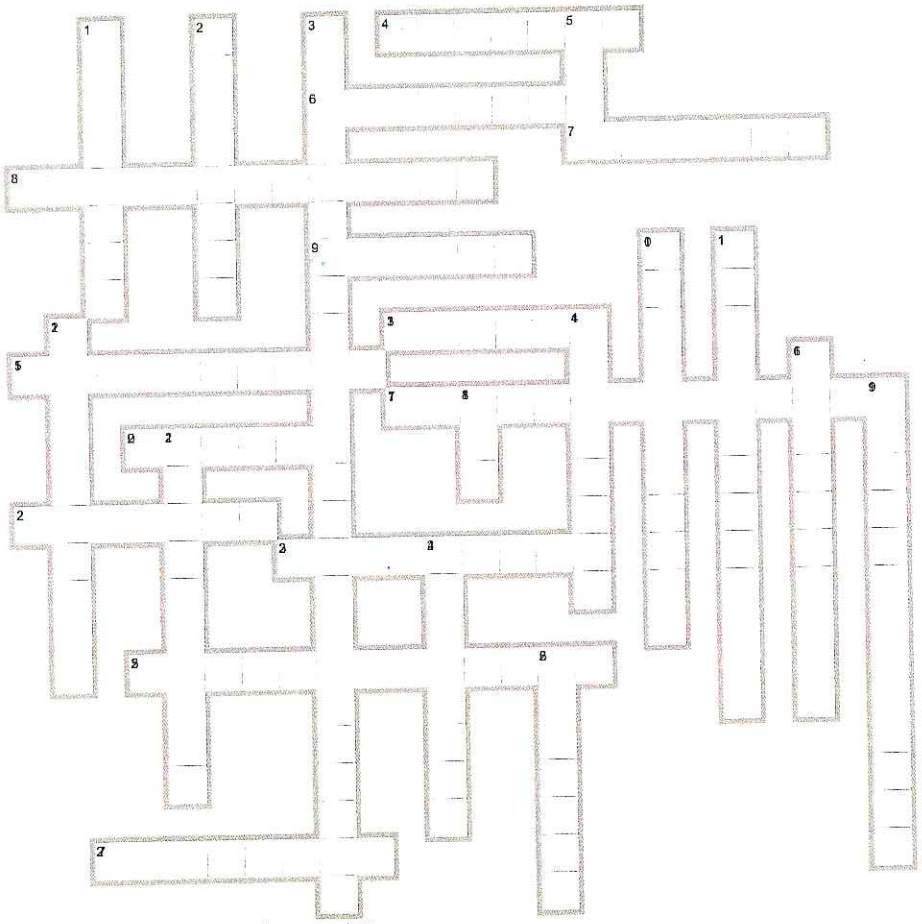
Third qEEG after Z score coherence training. Jack begins to demonstrate lasting seizure control.

enough to keep Jack interested in the feedback. More importantly, it was a close facsimile of the failed linear coherence training that had already caused such problems. It pushed coherence in one direction and the worry was that once again Jack would be moved from one coherence abnormality to another. Dr. Collura had programmed a range function into the software and I began to use it. It allowed coherence to be trained within the limits of positive and negative standard deviations, a ceiling and a floor. It exercised coherence in a range. By early May, Jack's seizures had stopped. A final qEEG confirmed the clinical results by revealing dramatic, positive changes in the connectivity maps. (Illustration 2)

Despite all the training, Jack's frequent spike activity continued. Fortunately, it no longer progressed to seizures but our concern led to a twenty-four video EEG monitoring. The test revealed that Jack was spiking about 50% of the time while he was sleeping. A review of his previous overnight monitoring revealed that his brain was discharging approximately eighty percent of the time during slow wave sleep. This was enough to meet the diagnostic criteria for Electrical Status Epilepticus during Slow Wave Sleep (ESES), a devastating disorder that causes severe cognitive deficits in 60% of children diagnosed. We were concerned, but not alarmed, as the spike activity had diminished in frequency and also in magnitude. The spikes were now about half as powerful rarely topping fifty microvolts. In fact, they might be better described presently as sharp waves rather than spikes. Most reassuring, however, was that Jack was meeting all his mental developmental milestones ahead of his cohort.

Thanks to neurofeedback, Jack is thriving today. He has been seizure free for over a year and one half. His renewed ebullience has brought many friends and much social activity. We are working on eliminating his anti-convulsant medication. Most important, Jack has not suffered cognitive decline from his disorder. He is doing well after being selected for a gifted and talented program in his school.

In the mean time, Jack's physical gifts have returned. As his soccer coach this fall, I was thrilled to watch my now six year-old son dribble the length of the field through opposing players to single-handedly bury a shot in the goal. The opposing coach sidled up to me and asked, "Is the red head your boy? He's quite a gifted athlete." He had no idea how much that meant to me.



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Across

4. Pioneer of biofeedback with spinal cord injury
6. A left intra-hemispheric function-Collura
7. JTFA Z scores are _____ in comparison to FFT Z scores-Thatcher
8. Training within the limits of positive and negative standard deviations (two words)-Smith
9. Drop seizures - Smith
13. "Mr. Coherence"
15. Skin conductance, temperature, and heart rate, to name a few-Saab
17. Training for peak performance-Collura
20. Measure of distance from the mean (two words)
22. A right intra-hemispheric function-Collura
23. Connectivity metric
25. She was first to use NF to bring individuals out of level two coma (two words)
27. Statistical distribution; the basis for Z-score training-Thatcher

Down

1. A frontal inter-hemispheric function-Collura
2. Choice of training sites should always be guided by both Z-score values and these -Thatcher
3. Multichannel, multivariable training (two words) -Collura
5. Slow wave sleep epileptic disorder (acronym)-Smith
10. New Zealand blue marlin namesake (two words)
11. Training to approximate population average values-Collura
12. A posterior inter-hemispheric function-Collura
14. z-score training developer
16. This reference should always be used when working with z-scores (two words)-Saab
18. Minimum number of channels to compute coherence-Collura
19. Has shown equivalent efficacy as Ritalin for symptoms of ADHD-Walker
21. These drugs may sensitize the brain to cocaine-Walker
24. On the sensory motor strip-Smith
26. Appetite suppression, insomnia and anxiety are common side effects of this-Walker

Crossword Puzzle Answer on Page 39