the Neuroconnection News

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Connectivity-Guided Neurofeedback at The Neuroconnection for Autism

Today, over 3 million individuals live with Autism Spectrum Disorder (ASD). About 1 in 68 or 1.5% of 8-year olds are identified with ASD by the Autism and Developmental Disabilities Monitoring (ADDM) Network (CDC, 2016). Most children diagnosed with ASD indicated developmental concerns in their health and/or special education records by age 3 years. However, less than half of children with ASD received a comprehensive developmental evaluation by this same age (CDC, 2016). A lag between first concern and first comprehensive developmental evaluation directly impacts when children are being diagnosed and can strongly affect the services they will need (CDC, 2016).

The professionals at The Neuroconnection recognize both the importance of early intervention, as well as the possibilty of addressing symptoms of Autism at any age. With a special focus on helping those with ASD we utilize an innovative type of brain training called Connectivity-Guided Neurofeedback (CGNFB) to train the way the brain communicates with itself. This technique is based on the latest research of neurofeedback with Autism. To date, The Neuroconnection has mapped and trained hundreds of patients with ASD using CGNFB, achieving significant and lasting results.

In this month's newsletter we bring to you an overview of the neurophysiology of ASD, connectivity and EEG abnormalities within the Autism population, and how using CGNFB, the most advanced form of neurofeedback, we can treat these functional deficits in the brain. Evidence-based research illustrating the efficacy of neurofeedback for ASD and seizures is additionally provided. To conclude this issue, we discuss a case study demonstrating how CGNFB has provided success for a particular patient with Autism here at The Neuroconnection.

Upon reading this newsletter, if you have any questions or would like to request additional information, please feel free to contact us at (630) 858-5105.

In This Issue:

The Neuroconnection @ Home Training brings Connectivity-Guided Neurofeedback to the convenience of your home.

Call (630) 858-5105 now to find out more!

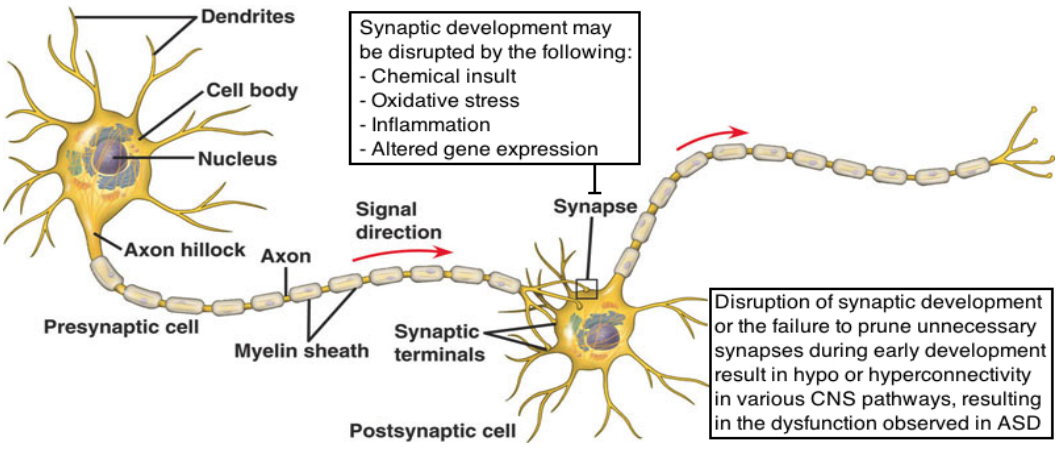
Autism Spectrum Disorder (ASD)

Autism is a neurodevelopmental disorder that impairs a child's ability to communicate and interact with others. According the latest CDC, autism affects 1 in 68 children and is five times more prevalent among boys. It is often characterized by restricted interests, repetitive behaviors, intellectual deficits, and unusual responses to sensory experiences. Symptoms can appear before the age of three and range from mild to severe. As a spectrum disorder, Autism is a single disorder that encompasses diagnoses that had previously been considered separately, including:

- **Autism**
- **Asperger's**
  - Average to above IQ
  - No language delays
  - Impairments in social interaction
- **PDD-NOS** – Pervasive Developmental Disorder, not otherwise specified
- **Childhood Disintegrative Disorder –** loss of skill following 2 years of normal development

NEUROPHYSIOLOGY

In the past 10-15 years neuroimaging studies have used functional MRI, SPECT imaging, PET scans and QEEG's to help demonstrate the correlation between symptomatic and neuropsychological dysfunction found in autism. What many of these imaging studies show is that the changes in the brain start after the child is born during the first years of life. It is believed that autism is an epigenetic phenomenon – one that environment and genetics have a role in creating. Inflammation triggered by these various external and internal factors interferes with normal neuroconnectivities in a developing brain and can affect all systems including the immune, GI and CNS.



A synaptic transmission, as shown, allows the electrical activity in a nerve cell to influence the electrical activity of a nearby neuron. This is the process of neurons communicating information to each other. The electrical signal will continue to the next neuron until the transmission has reached its destination in the brain. Neurofeedback works to influence the transmission of neurons to efficiently process communication between them.

For more information pertaining to the findings noted above, please review the references below:
Tortora, G.J., Derrickson B. (2010). Introduction to the Human Body: The Essentials of Anatomy and Physiology (8th Ed.). Hoboken, NJ: John Wiley & Sons, Inc.

Connectivity Abnormalities in the Autism Population

When an inflammatory process affects the body at an early age, expansion of the brain's grey matter causes connectivity fibers within white matter to become stuck in place in the front of the brain. Because these fibers are responsible for relaying messages to various areas of the brain, neuro-inflammation can severely inhibit a child's development of language, attention, sensory integration, and visual perception. The inhibition stems from disrupted synaptic pruning, which normally allows neuronal connections to be edited and organized to enable specialized functioning. Interference of this specialization results in areas of "hyper" or "hypo" connection in the brain that affects a child's ability to perform respective functions. In Autism specifically, Diffusion Tensor imaging studies have detected a pattern of white matter abnormalities within the frontal, temporal and occipital lobes (Padro, 2005).

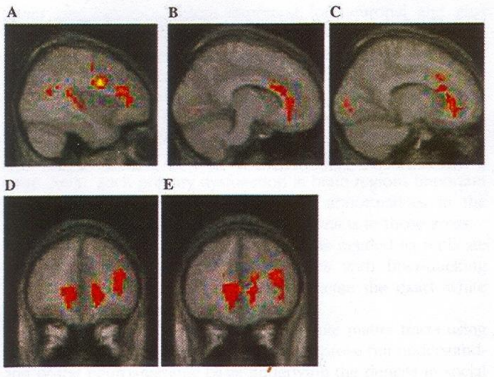
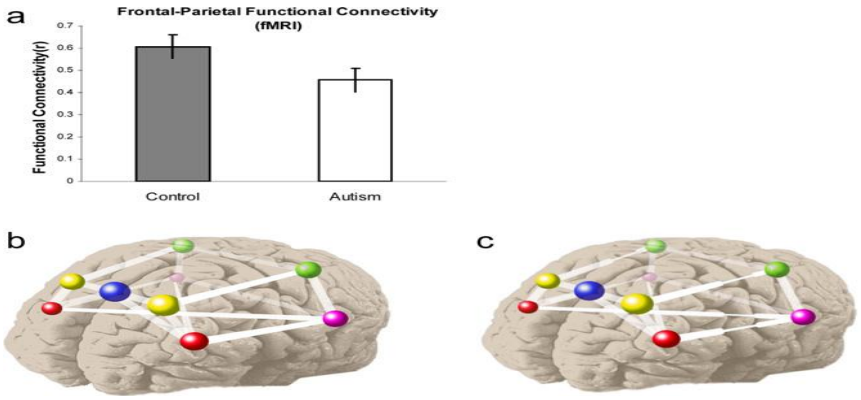


Figure 1. Voxels that showed significant reduction in white matter fractional anisotropy in patients with autism compared with control subjects, mapped onto an average T1-weighted image of control and autism brains. (**A, B, C**) Sagittal view, significant clusters shown in the ventromedial prefrontal region (**A, B**), the anterior cingulate and subgenual area (**C**), the corpus callosum (**B, C**), the superior temporal gyrus (**A**), centrum semiovale (**A**), and temporoparietal junction (**A**). (**D**) Coronal view, significant clusters shown in the ventromedial prefrontal region bilaterally and along the middle frontal sulcus (**D, E**).

With the use of fMRI, studies have also confirmed a combination of higher than normal neuronal connectivity (hyper-connection) within the frontal lobes and lower than normal connectivity (hypo-connection) between the frontal and other posterior structures (Courchesne & Pierce, 2005). Research by Just, Keller, Malave, Kana, and Varma (2011) at the Center for Cognitive Brain Imaging at Carnegie Mellon University correlated this impaired information flow between frontal and posterior areas to slower response times and deficits in executive processing on visual and spatial domains, particularly involving facial perceptions and working memory.



This image illustrates the lower synchronization found between the frontal and parietal areas during a Tower of London (TOL) problem-solving task in autism. Figure A offers a graphical representation of quantified frontal-parietal connectivity in 18 control and 18 autistic subjects. A schematic depiction of the typical systems of connectivity is shown in Figure B, while Figure C demonstrates the lower bandwidth between frontal and parietal cortical centers in autism.

For more information pertaining to the findings noted above, please review the references below:

Just MA, Keller TA, Malave VL, Kana RK and Varma S (2012) Autism as a neural systems disorder: A theory of frontal-posterior underconnectivity. *ScienceDirect. Neuroscience and Biobehavioral Reviews* 36, 1292–1313.

Pardo, C. A., Vargas, D. L., & Zimmerman, A. W. (2005). Immunity, neuroglia and neuroinflammation in autism. *International Review of Psychiatry, 17*(6), 485-495.

EEG Abnormalities in the Autism Population

EEG studies have also been useful in demonstrating the inefficiency in brain signaling for those with Autism. One such study was performed by Isler in 2010 which showed that interhemispheric functional connectivity is reduced in children with Autism during visual stimulation. During the relay of messages from the occipital lobe of the brain through to the frontal area, EEG patterns indicated an insufficient signal to get the flow of information to interpret social cues. These connectivity anomalies can be helpful when addressing Autism with methods such as neurofeedback, which can utilize measures of EEG that show signaling deficiencies to set parameters that will serve to train the brain to normalize EEG and reduce correlating symptoms (Isler et al 2010).

EEG abnormalities have contributed to the prevalence of seizures and epilepsy in Autistic samples, which is near 36% by some estimates (Danielson, Gillberg, Billstedt, Gillbegi and Olson, 2005; Hara, 2007; Hughes & Melyn, 2005; Darmeggian, et al; 2007.). The EEG abnormalities responsible for such conditions have been found in greater proportion of Autistic children who regress compared than those who do not (Hughes & Melyn, 2005). A particular abnormality, known as paroxysmal events, is present in an even greater number of children on the spectrum than those with seizures. Paroxysms are bursts of irregular activity characterized by differences from the normal background EEG. They can take the form of transient – spike and wave discharges, sharp waves, and poorly organized high amplitude events. These events are typically associated with non-epileptic seizures, as well a range of behavioral/cognitive/attention symptoms. When reviewing raw data EEG screening, it had been estimated that 20-30% of Autistics had seizures, however upon incorporating paroxysmal discharges, the prevalence expanded to anywhere from 10-74% of the Autistic population (Coben, 2009).

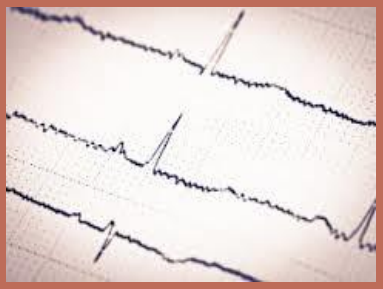
Paroxysmal discharges have been associated with underlying morphological brain abnormalities, metabolic disturbances.
(Shelley, et al. 2008; Kobayshi, et al. 2006)

Here at The Neuroconnection our professionals have a unique way of analyzing the EEG to in order to address these signaling abnormalities. This process not only involves quantifying and understanding where the irregularities are located in the brain, but also incorporates determining what symptoms they may correlate with and training over epileptiform and non-epileptiform events to initiate the necessary corrections. It is with this method that we are able to reduce the number and intensity of these events, ultimately then, leading to a decrease in symptoms.

For more information pertaining to the findings noted above, please review the references below:

Isler, J., Martien, K., Grieve, P., Stark, R., & Herbert, M. (2010). Reduced functional connectivity in visual evoked potentials in children with autism spectrum disorder. *Clinical Neurophysiology*, *121*(12), 2035-2043. doi:10.1016/j.clinph.2010.05.004

CGNFB at The Neuroconnection



With the use of Connectivity-Guided Neurofeedback (CGNFB), research has demonstrated the power of neuroplasticity to address abnormalities within the brain induced by the epigenetic factors leading to Autism. Here at **The Neuroconnection** our team utilizes quantitative EEG analysis to identify patterns of electrical activity that take into account both power and **connectivity abnormalities** between areas of the brain that contribute to symptoms of Autism. CGNFB is an advanced form of neurofeedback that measures connectivities in three dimensions over regions, which is far more accurate than traditional neurofeedback. Training functions through operant conditioning, which serves to reinforce desired changes within the brain through distinct protocols determined by a QEEG. By training connections within these affected regions with neurofeedback, we are able to exercise and strengthen brain communication, thereby decreasing correlating symptoms. Treatment is non-invasive, with no adverse side effects that one might otherwise experience with medication. Our experts also recognize the significance of individual factors contributing to the impact on patients' cognitive changes and are determined to developing a comprehensive plan applying CGNFB, while also addressing environmental contributors.

The Neuroconnection has achieved the following results, with respect to Autism:

- ✓ Ability to transition without disruption
- ✓ Improved focus
- ✓ Improvement in social skills and social pragmatics
- ✓ Increased calmness and decreased anxiety
- ✓ Improved verbal communication or expressive language
- ✓ Improved receptive language
- ✓ Fewer repetitive behaviors
- ✓ Improved processing speed

CGNFB for Autism Spectrum Disorder: Evidence-Based Research

In 2009, Dr. Robert Coben reported results of a large-scale study of 85 children in an experimental group trained used Connectivity Guided Neurofeedback which study showed a 57% decrease in Autistic symptoms. A follow up of these subjects after one year showed that these improvements held and some subjects made additional cognitive and social gains. Using this model, we have achieved very similar outcomes to the 2009 study, which included a control group. It's also not uncommon for our clients to be able to come off stimulant medication, antidepressants, and anti-anxiety medication following training.

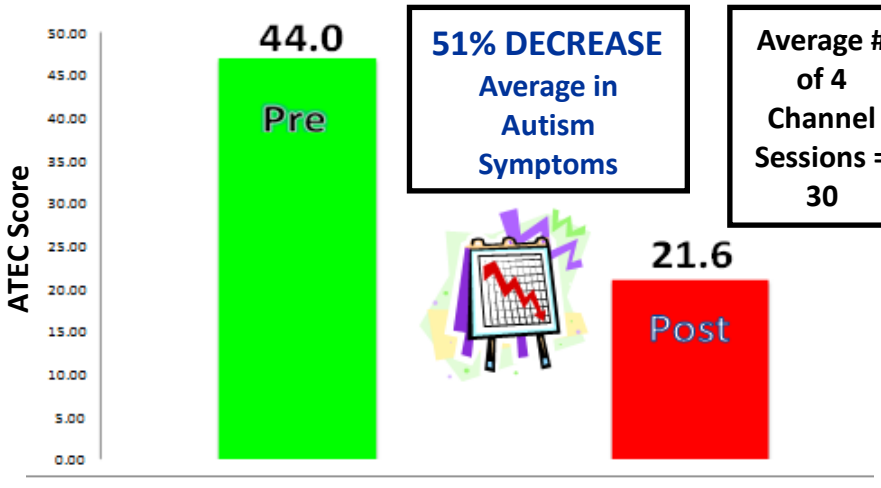
A few years later a large control study, conducted by Duffy and Als in 2012, utilized 1,304 subjects ages ranging from 1 to 18 years old, assessed with comparable EEG studies. Of the subjects who participated in this study, 463 children were diagnosed with Autism Spectrum Disorder (ASD) and 571 children were neuro-typical controls (C). The study attempts to answer the open question of coherence differences between children with ASD and neuro-typical healthy controls.

Upon care being taken to reduce the effects of EEG artifact upon coherence data, principal component analysis (PCA) identified EEG spectral coherence factors with loading patterns. It was found that classification success suggests a stable coherence loading pattern that distinguishes children with ASD from neuro-typical controls, possibly constituting an EEG coherence-based phenotype of childhood Autism (Duffy & ALS, 2012).

Duffy & ALS (2012) concluded the article by stating "It is speculated that spectral coherence data may prove useful in exploration of similarities and differences within a broader population of Autistic children and adults. Spectral coherence alone may also assist in the early detection of ASD in younger children including infants and/or it might be helpful in concert with additional techniques of EEG analysis such as "complexity" measures among them." (p. 15-16).

At The Neuroconnection, we now have 50 Autism cases that have gone through the full number of sessions that were recommended to complete training. The results included a 39% average decrease in speech and language symptoms, a 53% decrease in social ability symptoms, a 51% decrease in sensory/cognitive symptoms, and a 50% decrease in health/physical and behavioral symptoms. The overall decrease of symptoms with our 50 completed cases was 51%.

The Neuroconnection Average ATEC Scores
50 Treatment Cases - Pre & Post Training



For more information pertaining to the findings noted above, please review the references below:
Coben, R., & McKeon, K. (2009). EEG Assessment & treatment for autism spectrum disorders. The Autism File, 32, 10-47.
Duffy and Als: A stable pattern of EEG spectral coherence distinguishes children with autism from neuro-typical controls - a large case control study. BMC Medicine 2012 10:64

CGNFB for Seizures: Evidence-Based Research

The field of neurofeedback actually began with EEG 30 years ago with a NASA study to raise seizure thresholds. Below are a few of the studies showing the efficacy for using neurofeedback as a modality for this approach:

- Ayers (1995) reported successful treatment of absence epilepsy by training patients to inhibit 4-7 Hz activity and reward 15-18 Hz activity, using bipolar training at T3/C3 and T4/C4. Ten patients became and remained seizure-free for 10 years.

- Tan et al. (2009) conducted a meta-analysis of EEG biofeedback in treating epilepsy. All studies reported an overall mean decreased seizure incidence following treatment and 74% reported fewer weekly seizures in response to EEG biofeedback. Based on this analysis, EEG operant conditioning was found to produce a significant reduction on seizure frequency. This is particularly noteworthy considering the patient group was unable to control their seizures with medical treatment.

- It was found in a systematic review and expert panel on traditional and novel treatments for seizures in ASD by Frye et al. (2013) that neurofeedback can reduce seizures in a majority of patients, even in patients with otherwise uncontrolled epilepsy, supporting a Grade Overall Rating (GOR) of B. The use of neurofeedback for behavioral and cognitive symptoms of ASD received a GOR of B.

Grade of recommendation.

Grade	Description
A	At least one Level 1a study *or* two Level 1b studies
B	At least one Level 1b, 2a, or 3a study, *or* two Level 2b or 3b studies
C	At least one Level 2b or 3b study, *or* two Level 4 studies
D	Level 5 evidence, *or* troublingly inconsistent or inconclusive studies of any level,
N	No studies identified

For more information pertaining to the findings noted above, please review the references below:
Ayers, M., Long-term follow up of EEG Neurofeedback with absence seizures, Abstract, SSNR meeting, 1995.
Frye, R. (2013). A review of traditional and novel treatments for seizures in autism spectrum disorder: Findings from a systematic review and expert panel. *Frontiers in Public Health Front. Public Health, 1*.
Lantz, D. and Sterman, M.B., Neuropsychological assessment of subjects with uncontrolled epilepsy: Effects of EEG feedback training. Epilepsia 1988;29(2):163-171.
Tan, G., Thornby, J., Hammond, D. C., Strehl, U., Canady, B., Arnemann, K., & Kaiser, D. A. (2009). Meta Analysis of EEG Biofeedback in Treating Epilepsy. Clinical EEG and Neuroscience, 40(3), 173-179.

The Neuroconnection Provides Success for Patient with Autism

Since 2001, the Neuroconnection has been successful in treating Autism with Connectivity–Guided Neurofeedback (CGNFB).

One success story, in particular, began with Jake. Jake was referred to the Neuroconnection by his physician as a nonverbal 5 year old with an Autism diagnosis. After reviewing his developmental history it was confirmed Jake was a result of a healthy pregnancy. He had no complications at birth. With the exception of fine motor skills, developmental milestones were met on time. He began speaking his first words at 12 months but soon struck a turn and lost all of his language by 18 months. Jake started to withdraw socially, indicating no interest in relating to others. He demonstrated restricted interests, sensory sensitivities, emotional dysregulation, and difficulty with transitions.

At the age of 2 Jake's parents began early intervention. He was placed in speech, OT, and developmental therapies and continued treatment through his start at the Neuroconnection nearly three years later. At the time of his intake Jake arrived with a diagnosis for Autism Spectrum Disorder with accompanying language impairment, apraxia, and sensory processing disorder. Upon completing our Autism Spectrum Evaluation Checklist (ATEC) he received a total score of 68, which is considered "severe" on the Autism Spectrum.

Evaluations from his early interventions had reported Jake to be essentially non-verbal with receptive language delays in the severe range. His parents noted he did not use words to communicate and would instead point and scream to get what he wanted. After seeing a speech pathologist it was determined Jake displayed oral motor defensiveness and was complexly unable to imitate and produce words. His articulation skills were judged to be within the 9 month old range with receptive language placed between 9 to 15 months of age as well. Jake also demonstrated sensory integration problems through sensitivity to touch and sound, poor eye contact, inattention, hyperactivity and preference for solitary play. Transitions were an additional complication and often triggered Jake into long, severe tantrums upon breaking any type of routine.

Results from this first QEEG indicated areas of hypo connection on the left side from frontal to back in all frequencies of slow to fast wave. He also had paroxysmal events. While the right side also showed hypo connection we began training on the left side in order to improve Jake's speech, considering the fact his lack of frustration tolerance was due to his inability to communicate.

Following his first set of sessions, training his left side, Jake's parents reported significant improvement in his ATEC. With a drop in score from 68 to 52, Jake was now considered within a *moderate* category of the autism spectrum as opposed to *severe*. His change in ATEC was most reflective of the marked gains in verbal communication, specifically with receptive language. Not only was he able to understand what was being communicated, but he also demonstrated ability to repeat language that he heard and even began saying single words on his own instead of screaming as he did before. Jake's school reported noticeably smoother transitions and increased engagement at this time as well. In addition to these behavioral developments, a remap QEEG following his first protocol indicated significant improvements in left sided connectivity and a drop in paroxysmal events. While Jake's parents were pleased with their son's progress thus far, his brain map still revealed opportunity for further improvement.

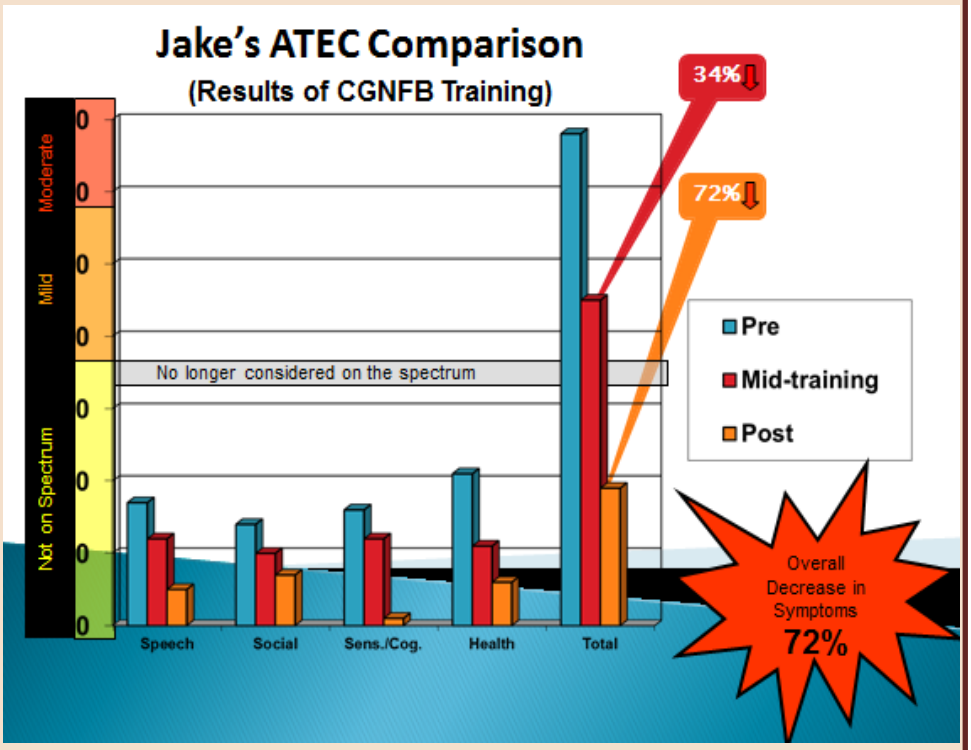
Upon completing a second protocol, Jake's ATEC continued to decrease another 18% to a score of 43, which placed him within a *mild/moderate* category of Autism. Collectively, this was a 37% drop since his start with neurofeedback. The response from Jake's parents was equally positive. According to their report, tantrums were decreasing in duration and frequency while verbal communication and engagement were progressing rapidly. Jake started using pronouns in sentences, initiated relevant speech, and demonstrated a radical increase in vocabulary. His parents also noticed transitions had become much easier and Jake had even begun making friends at school. With such evident gains, his school was prompted to modify his behavior plan since many of his prior goals had been met. Jake's remap QEEG indicated respective changes showing significant normalization across the left side along with decreases in power abnormalities. His paroxysmal events were no longer present.

The Neuroconnection Provides Success for Patient with Autism

Below are sample connectivity maps, demonstrating connectivity improvements on the left side in all frequencies, from Jake's initial QEEG and remap:

Satisfied with the considerable improvements made up to this point, Jake's parents decided to take took a short break from neurofeedback. Despite the pause in training, Jake not only maintained, but even demonstrated further advances when returning to our office after 6 months. His ATEC had continued to drop – this time down to a score of 35. Still in the *mild/moderate* range on the spectrum, Jake's parents were eager to further development with his speech and social pragmatics.

After a third protocol of ten 4-channel training sessions, Jake was now able carry on longer conversations, even those outside of his particular interests. In addition to marked language improvements, Jake's teachers noted he no longer required a behavioral plan at school. Transitions had become much easier and he began to prove his capability to follow novel directions with ease. Reaction time, focus, concentration, and eye contact were improving as well, along with regular engagement with friends in the classroom. Academically, the only subject Jake remained a grade level behind in was reading; however, with the gains made thus far, his teachers and parents held a confident outlook for his progressing ability to learn. Respective advancements on Jake's ATEC supplemented our optimism, showing a 56% decrease down to a score of 19 – a score which is no longer classified Jake on the autism spectrum.



Jake continues to excel with social and speech developments. His parents and teachers remain positive about his future and are grateful for the impact neurofeedback has had on Jake.

Names and dates have been changed to maintain confidentiality

@ Home Training through The Neuroconnection

Upon seeing such excellent results in the past 8 years with Connectivity-Guided Neurofeedback (CGNFB), we wanted to find a solution to provide the training to those outside of our area or with schedule inflexibility. As a result, The Neuroconnection provides an @ Home Training program to conduct CGNFB sessions in the convenience of your home. For the past 3 years, we have been providing our expertise and therapeutic treatment to families all around the world. The option of training daily at home has been proven successful with our clients expanding as far as Russia and India.

The @ Home Training program first starts off with an initial intake, along with a QEEG or "brain map" in the office. A custom protocol is then made for the specific needs of the client. At this time, an extended training session is set up within the office to instruct you on how to run a session. We provide you with all the necessary tools and equipment including the neurofeedback system in addition to a laptop which is pre-loaded with all the software and protocols required to conduct training sessions at home. We also provide an Atlantis amplifier, electrodes, head cap to show correct placements, and an @ Home Training manual.

Following the training, we monitor you at home via Skype to verify that you are receiving CGNFB training correctly. Once you feel conformable training with the software, you may then begin to run sessions on your own with The Neuroconnection monitoring your progress. One protocol consists of 20 sessions, with at least two sessions ran each week until completion of the set protocol. Once finished with the first protocol, you would then return to our office for a QEEG remap to allow for pre and post comparisons.

The Neuroconnection @ Home Training brings Connectivity-Guided Neurofeedback to the convenience of your home.

Call (630) 858-5105 now to find out more!

Learn more about The Neuroconnection's director:

Ann L. Rigby, MSW, LCSW, BCN has over 25 years of experience in the mental health field. She has specialized training and extensive experience in the areas of Autism, Attention Deficit Hyperactivity, Anxiety, and Mood Disorders. Ms. Rigby has been providing Neurofeedback services since 2001. She founded "The Neuroconnection", a Brain Mapping and Neurofeedback clinic that provides an advanced, research-based form of Neurofeedback known as Connectivity-Guided Neurofeedback.

Ms. Rigby is the Board Chair for the Autism Society of Illinois. She is a fellow and Board Certified member of The Biofeedback Certification International Alliance. She is also a field placement instructor for graduate students at Benedictine University and holds memberships with the International Society of Neurofeedback and Research (ISNR), the Biofeedback Certification Institute of America (BCIA), and the National Association of Social Workers (NASW).

Ms. Rigby is a frequent speaker and exhibitor at many national and regional conferences throughout the year on topics related to the benefits of Connectivity-Guided Neurofeedback. Some of her recent speaking engagements included: The 2016 American Academy of Pediatrics – 2nd Annual Autism, Behavioral and Complex Medical Needs Conference, The AutismOne 2016 Conference, The 46th Autism Society of America National Conference, The 2015 Family Time Magazine Autism and Special Needs Seminar, The Illinois Special Needs Expo, Options Center for Independent Living Annual CIL Empowerment Seminar, and Cornerstone Services Annual Mental Health Seminar.

To learn more about up and coming speaking engagements, go to our website www.theneuroconnection.com and visit our Resources tab.

Financing available with low monthly payments!

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