

## SPECIAL ISSUE

# Integration of Neurofeedback in the Therapeutic Work With Torture and Trauma Survivors: A Case Study

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*This paper describes a case study of a 14-year-old African refugee boy who survived multiple traumas related to war, displacement, and deprivation. Traumatized from the age of 2, his presentation was primarily one of affect dysregulation. In order to address both the core hyperarousal and the unavailability of the necessary cortical and behavioral skills required to regulate affect, an approach was chosen that integrates neurofeedback (electroencephalographic biofeedback) and psychotherapy.*

*We trust that the description of the process provides others with new practice options and an enthusiasm to expand in this direction.*

### Theoretical Background

The emotional, social, physical, and hence neurological traumas presented to refugee children have a pervasive impact on their evolving minds. Too frequently, the protection and containment offered by attachment relationships are distorted by loss through death, separation, and/or the reduction of attunement as a result of parental dysregulation. The damage caused by early and sustained hyperarousal where there is no mediation is pervasive (Cozolino, 2002). In the long term, it can lead to abnormalities in those areas of the brain responsible for the regulation of affect and integration of cognitive, emotional, and behavioral responses. These abnormalities can be seen in altered quantitative electroencephalogram (QEEG) (Ito, Teicher, Glod, & Ackerman, 1998; Teicher et al., 1997) and complex behavioral profiles fundamentally driven by affect dysregulation (Frewen & Lanius, 2006).

The core symptoms of post traumatic stress disorder (PTSD) are physiologic hyperarousal, traumatic intrusions, and avoidance. They usually arise in the context of limited-incident traumas experienced in adulthood. Exposure to extreme stress (e.g., war) or trauma at developmentally vulnerable times (Ford & Kidd, 1998) is associated with sequelae that extend beyond PTSD. The formulation of complex post-traumatic stress disorder (Herman, 1997; Van der Kolk, Roth, Pelcovitz, Sunday, & Spinazzola, 2005) is seen to better describe the pervasive negative impact of

chronic trauma. It is characterized by impairments in the following:

- Affect regulation—impulsive acting out of emotion, difficulties mentalizing or thinking about emotional processes, mood swings;
- Relationships—interpersonal difficulties, including joining a peer group and forming trusting relationships;
- Somatic regulation—sleep disturbance and somatic complaints;
- Consciousness—dissociation;
- Behavior—impulse control, aggression and agitation;
- Cognition—a tendency to attribute hostility to others, decreased attention, learning difficulties, and
- Self-concept.

There are complex diagnostic considerations when working with refugee children. The presence of mood swings and overactivity frequently is regarded as signifying attention-deficit/hyperactivity disorder and/or affective disorder. However, the diagnostic controversy is not central to this paper as it is on the basis of symptoms rather than diagnosis that we plan treatment. And here lies further complexity culture, meeting the settlement needs of the refugee family, and the inevitability of loss all impact this work in ways not present in trauma work with nonrefugee children.

### The Refugee Child

The conditions in which the refugee child proceeds through developmental tasks and challenges are characterized by:

- Multiple and recurring exposure to trauma resulting in overarousal of the immature brain;
- The ongoing stress and deprivation of living in refugee camps. The long-term impact of stress on vulnerable nervous system is well documented;
- The negative impact of trauma on parental capacity to regulate their children's emotional response to the trauma as well as to "normal" emotional extremes;

- The absence of opportunities fundamental to meeting developmental challenges—for example, schooling and appropriate peer relationships;
- Deprivation in the areas of basic needs resulting from malnutrition, increased exposure to illness, and injury and lack of access to medical attention.

### *Neurophysiology*

As the frontal cortex gradually extends its range of influence to the subcortical zones, emotions become increasingly regulated and we develop automatic control over primitive drives, including rage and paralyzing fear. This occurs directly, at a neurological level as well as through the learning of behavioral and cognitive skills. Neuroimaging studies show that affective dysregulation, one of the main symptoms of complex PTSD, is a result of dysfunctional frontal-subcortical systems (Foa, Keane, & Friedman, 2000; Frewen & Lanius, 2006). Furthermore, the distractibility and impulsivity of the traumatized child reflects the reduction in the inhibitory capacity of the frontal lobes.

### *Treatment*

There is little evidence for the use of any particular technique for the treatment of the cluster of symptoms experienced by many refugee trauma survivors, including this young man (Foa et al., 2000). Clinicians have to use their own judgment based on clinical experience, consultation, and a sense of the relationship between QEEG evidence and symptoms. They also need to be attuned to the vicissitudes of the client's responses. It is this attunement that guides the pace and nature of the neurofeedback training (NFT) and is developed in the context of a therapeutic alliance, of which Van der Kolk says: "The therapeutic alliance sets the stage for emotional regulation" (Van der Kolk et al., 2006).

Several authors and practitioners, particularly Janet (1919/1925); Herman (1997); Brown (2002), and Cook, Blaustein, Spinazzola, and Van der Kolk (2005) recommend a multimodal and phased approach:

- The creation of safety. Emotional regulation is difficult to learn when chronic levels of physiological dysregulation (hyperarousal and sensitivity) maintain a system under threat (Van der Kolk et al., 2005). Relaxation techniques and NFT facilitate the conditions in which this learning can occur. Even small improvements in frontal functioning (for example, through reducing frontal alpha in NFT) can pave the way for the introduction and practice of new behaviors that do not ignore the fear, while facilitating a behavioral response that is contained and organized.

Through repetition and reinforcement, neurological pathways for this response are enhanced.

- Developing skills in self-regulation and interpersonal functioning. Developing an awareness of emotional and physiological processes is central in the course of biofeedback. Concurrent with this is the expectation that these physiological states be regulated and that emotional states will therefore be impacted. This enables the later use of appropriate skills, because the child is able to use them at the first sign of hyperarousal.
- Developing alternative ways of experiencing traumatic recollections. This might include a pairing of the above to reduce hyperarousal during verbal working through of the traumas or in the event of trigger experiences causing traumatic intrusions.
- Reconnection with a social network. This is enabled by the above through a reduction in aggressive acting out in social circumstances. These skills (e.g., walking away from conflict, challenging automatic thoughts about threat, constructive confrontation, and seeking support) are developed and practiced.

It is counterintuitive that NFT would enhance the alliance. If anything, we could assume the presence of the screen and equipment would interfere with the interpersonal relationship. It complicates the transference in that it creates a triadic relationship. Let us see how this turns out with this young man.

### **Case Introduction**

Ismat is a 14-year-old boy, a refugee from Sierra Leone. He arrived in Australia at the age of 9 with his parents and four siblings. Ismat was referred to the Service for the Treatment and Rehabilitation of Torture and Trauma Survivors (STARTTS) by his father following his suspension from school as a result of violent behavior. His father was worried that his son's current difficulties might be related to his war and refugee trauma experiences.

### *Presenting Complaints*

At intake, Ismat presented with disturbed sleep, occasional nightmares with traumatic content, fear of the dark, restlessness, and sudden mood swings. He was having frequent anger outbursts that would result in verbal abuse as well as physical violence. Ismat also had difficulties with attention, concentration and memory.

### *History*

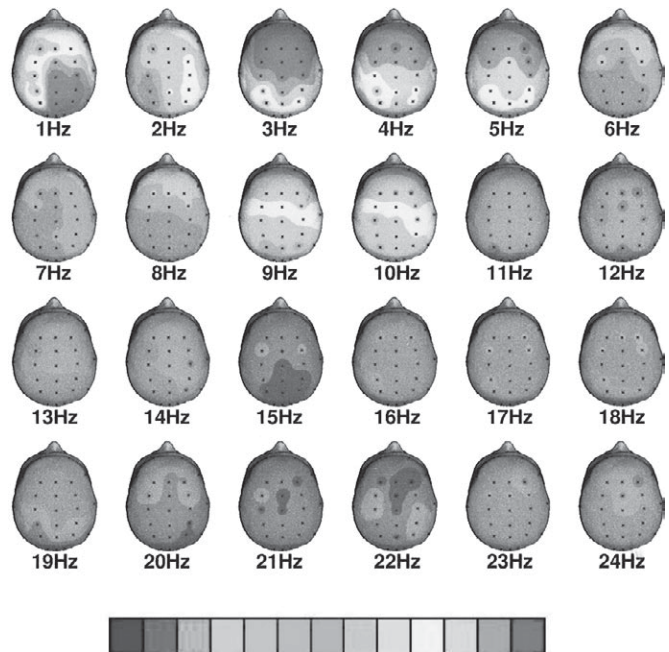
Ismat was born during the civil war in Sierra Leone. His father reported that the first 2 years of Ismat's development

were within normal limits, with no major illnesses. His exposure to trauma started at about 2 years 6 months when their farm was bombed and all the animals, including Ismat's pets, were killed. Since then he has experienced atrocities: bombing, grenade attacks, killings, running, and hiding from the enemy. When he was 5 years old, his family escaped from Sierra Leone and then spent another 3 years in a refugee camp in Guinea. Here he witnessed and experienced further violence, chaos, and deprivation. In his father's opinion, Ismat's behavior started to change significantly while they were living in the refugee camp. His behavior became increasingly violent, mimicking the behavior of other violent children and adults.

### Assessment

The following assessments were undertaken:

1. Children's PTSD inventory—confirmed that Ismat met *Diagnostic and Statistical Manual of Mental Disorders* (4th edition; *DSM-IV*) (American Psychological Association, 2004) diagnostic criteria for chronic post-traumatic stress disorder, including symptoms of reexperiencing trauma, avoidance, and increased arousal. Ismat's impulsive and aggressive behavior was consistent with the PTSD seen in young people.
2. Test of Variables of Attention (TOVA) indicated severe difficulties with impulse control, inattention, and sustained focus. In addition his response speed was faster than normal indicating anxiety.
3. Ratings on the Conner's Teacher Rating Scale (CTRS-R:L) revealed that several scores were clinically significant: Oppositional (t score of 78), Cognitive Problems/Inattention (t score 75), Hyperactivity (t score 72), Emotional Lability (t score 90), and Restless-Impulsive (t score 75) subscales. The overall profile indicates problematic general functioning with severe affect dysregulation.
4. Ismat also undertook a QEEG to assess his current brain wave activity. The results indicated the presence of excessive frontal alpha, frontal slow, and temporal alpha. This finding was consistent with Ismat's clinical symptoms of attention and concentration difficulties, emotional dysregulation and impulsivity. For a graphic representation of this data, see Figure 1.
5. A clinical interview with Ismat and his father revealed a history of exposure to war and refugee trauma. The father's main concern was related to Ismat's impulsive, danger-seeking behavior and his violence toward other children. He related this problem to his son's early childhood experiences of danger and violence.



**Figure 1.** The 24 pictures show the degree of difference from the database average in electroencephalogram (EEG) power in each of four standard bands of EEG activity: delta, theta, alpha, and beta. These types of brain electrical activity reflect the level of activation of the brain area (cerebral cortex) being monitored by the electrode. Slower EEG activity, as in the delta (1–3 Hz), theta (4–7 Hz), or alpha bands (8–11 Hz), indicates lowered blood flow and fuel (glucose) use in that part of the brain. Faster activity, as in the beta band, shows increased brain activity. The type of activity also reflects the overall level of arousal of the person: delta activity (2–4 cycles per second (cps)) accompanies deep sleep, theta (4–7 cps) states of drowsiness, alpha (8–11 cps) relaxed states, beta range (12–18 cps) activity reflects an alert attentive state. High beta range (20–24 cps) may indicate tension and anxiety. The color indicates the degree of excess or deficit from the database average. Red means that the given type of brain activity is extremely in excess; dark blue means extremely in deficit. Light green shows the database average. A color version of this figure will be posted, along with the article, at <http://www.aapb.org/magazine.html>.

### Case Formulation

The overall test results indicated that Ismat was suffering from significant symptom of chronic complex PTSD with prominent symptoms being affect dysregulation, particularly lack of impulse control, and its impact on his social functioning.

Ismat's aggressive and sometimes violent acting out of anger is likely to be a sign of his perception of threat and the fear it evokes. It largely emerges in the context of bullying (external threat) and his perception that he is being mistreated (a misattribution common in children with similar presentation). He responds impulsively to sensory stimuli that have been processed through the trauma/threat lens of the compromised amygdala. A primitive survival response (rage) is evoked and acted on, as opposed to being mediated by higher cortical (particularly frontal) functions.

The presence of frontal alpha, frontal slow, and temporal alpha in Ismat's QEEG is consistent with his behavior symptoms.

In light of this, the following intervention plan was developed: 20 twice-weekly sessions to address anger, impulsivity, and sleeping difficulties. Each session would involve 30 minutes of NFT and 30 minutes of counseling—the NFT to focus on frontal regulation. It was anticipated that this would also inhibit the temporal alpha (Johnstone, Gunkelman, & Hunt, 2005). Midline frontal beta enhancement training (reward frequencies 15–18 Hz) was suggested in combination with theta, alpha, and high beta suppression (inhibit frequencies 2–6 Hz, 8–11 Hz, and 21–36 Hz), the purpose of which would be frontal lobe activation.

## Treatment Intervention

### *Creating Safety and a Trusting Therapeutic Relationship*

At the beginning of his treatment Ismat was distrustful, withdrawn, and uncooperative. It became clear that his lack of punctuality and consistency in attending the sessions were a reflection of his life experiences in the refugee camp and during times of war. They also reflected his fear of facing his difficulties. It was therefore decided to give him as much space and time as he needed to accustom himself to his appointment times and days. In addition, his behavior indicated that he was not interested in telling his trauma history, which immediately excluded direct work on trauma at this stage of his treatment. It is interesting to note that he established a pace that would enable a more gradual trauma disclosure, perhaps reflecting an awareness of the potential for him to become emotionally overwhelmed. This is in line with the phase-oriented models of Janet (1919/1925), Herman (1992), and Cook et al. (2005), where the establishment of safety is prioritized over direct trauma work. In this context, NFT provided a perfect space for Ismat to engage in treatment without having to relive any aspect of his experience. The use of a computer game during the NFT appealed to his sense of fun and play. In addition, NFT opened the door for Ismat to get some understanding of his own brain functioning and its effect on his behavior. For the first time, he had a sense of ownership for his reactions and behavior. Psychoeducation helped Ismat understand the link between his thoughts, feelings, and behavior.

### *Development of Emotional Regulation Skills and Interpersonal Functioning*

This phase of the work was aided by the response of Ismat's school. The level of support offered included the employment of a full-time teacher's aide to attempt to deal with his aggressive and impulsive behavior. Although the incidents of violence decreased, Ismat remained unable to regulate

himself internally, and he needed an outside person to act as his "frontal lobe." In this, he spent more time outside of the classroom with the teacher's aide, and his academic achievement was affected.

One of the main contributions of NFT work with trauma survivors is opening a possibility to develop an internal locus of control. Putting a brake on the driving forces of anger and fear becomes a priority. Over the course of 10 sessions, Ismat was trained in how to increase the amplitude of the brainwaves that would activate his frontal lobe to function as this brake. As he was becoming calmer and better focused, he was able to spend time developing strategies to manage his anger, regulate his anxiety, and resolve conflict. Once he had established better affect regulation, Ismat was able to apply the skills he had learned. After the first 10 sessions Ismat found himself able to cope with his anger outbursts, something that before, he believed, was outside of his control.

Through the course of most sessions Ismat would shift from agitation on arrival to calming during the training. He left sessions retaining a sense of calm that would stay with him for 3–4 days after his training. Ismat also frequently reported sound sleep and a good appetite in the morning following his training, reflecting a settling of his biological dysregulation.

In the course of the training, Ismat revealed an incident at school where he was bullied by one of his friends. He had noticed his body becoming tense and hot. At that moment he recognized this reaction as anger and decided consciously to stop this process by thinking pleasant thoughts related to his favorite soccer game—a technique that evolved from the psychotherapy. At the same time he used a breathing exercise practiced in our sessions and was able to notice his body calming, the tension easing, and his anger subsiding. The fact that he was able to stop himself before his anger escalated into an outburst gave him an additional sense of pride.

After 10 sessions Ismat's father provided feedback that Ismat's aggressive outbursts were under control, he was managing at school, and was more engaged with his family. This appeared to be an indication that Ismat had reached a stage of emotional self-regulation where work on his traumatic memories could be introduced safely.

### *Trauma Integration*

Ismat himself initiated trauma work when he brought a documentary video related to the atrocities committed in his country of origin and violence toward child soldiers. It was his way of opening the door to work on trauma-related issues. This video had a huge impact on me—I (Askovic) was



unable to sleep, being haunted by scenes of young children being brutally tortured and murdered in front of cameras. This video represented the essence of the pain and suffering of the whole Sierra Leone community. I understood that Ismat now trusted me to bear witness to this horror and hold his traumatic memories. I was humbled by the enormity of this trust. Through the narrative that emerged, he expressed issues relating to injustice, oppression, and the sense of hopelessness and helplessness that was experienced by himself, his parents, and his community. Although the trust essential to this process emerged from the therapeutic relationship, NFT directly helped Ismat to recollect his painful memories without becoming hyperaroused and thus revert to earlier reactive behaviors.

**Social Reconnection**

Another area of concern was related to Ismat’s experiences of racism in Australia. As one of the rare African children in his neighborhood and school, Ismat was faced with racial prejudices and felt judged and rejected. It became important to link Ismat with his community and help him integrate into a mainstream society.

Ismat became involved in the Sierra Leonean youth dancing group. He was able to find pride in his heritage and strengthen his sense of belonging to his community. Paradoxically, he also began to feel more connected to Australian society and people. This partly occurred through his love of soccer. During the final stage of his therapy, Ismat created short- and long-term goals relating to his future as a soccer player. His soccer coach provided valuable feedback indicating Ismat’s rapid improvement in his accuracy, endurance, and ability to cooperate with other players. At the same time, Ismat was able to acknowledge a direct connection between his neurofeedback training and his sense of heightened energy, focus, and concentration during soccer games. At this stage of the treatment NFT had an additional purpose: It became a peak-performance tool and our therapy goals now shifted from a reduction of symptoms toward optimal functioning.

**Therapy Closure**

With Ismat’s consent, his father joined the final session. This was very important because Ismat was able to talk about his process of recovery with his father present. At the same time his father was able to share his memories of the traumatic events that, in his opinion, led to the changes in Ismat’s behavior. This process helped both Ismat and his father create a new narrative from being victims to becoming survivors. This included relocating the memories of the events into the past in order to focus on his future. Ismat reported that he

did not feel the usual distress when talking about or listening to his trauma story. His father confirmed that Ismat was far less reactive when exposed to reminders of trauma.

**Follow-up**

**Subjective Report**

During a follow-up session after 3 months, Ismat was asked what NFT meant to him. He thought deeply for few seconds and said: “I somehow became more mature and able to accept responsibility for my behavior as a grown-up man.”

**School Report**

Ratings on the Conner’s Teacher Rating Scale (CTRS-R:L) retest revealed significant reduction in all scores: Oppositional (t score of 54), Cognitive Problems/Inattention (t score 52), Hyperactivity (t score 66), Emotional Lability (t score 62), and Restless-Impulsive (t score 64) subscales. None of the scores has reached a clinical significance. The overall profile indicated normalization of Ismat’s cognitive and social functioning.

**Objective Measures**

Ismat completed the TOVA prior to and following his neurofeedback treatment (see Figure 2). Pretest shows clinically significant poor impulse control and a very fast response time. Posttest shows normalization in his impulse control and response time. These results indicated better sustained focus, better school performance, less oppositional and uncooperative behavior, and moods that are more positive and stable, which was consistent with his behavior. The comments were extracted from the clinical report of Dr. Moshe Perl, independent assessor (Perl, personal communication, 2008).

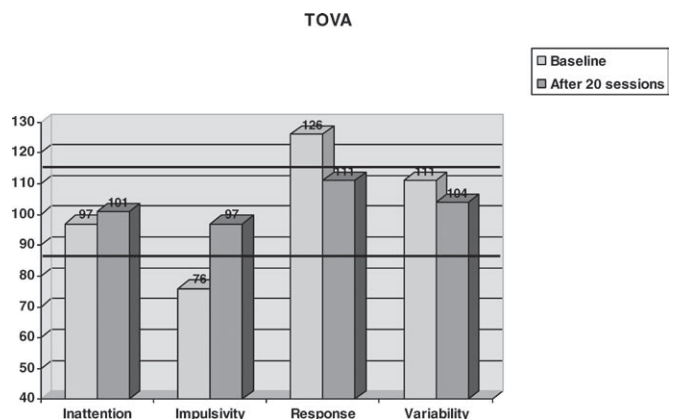
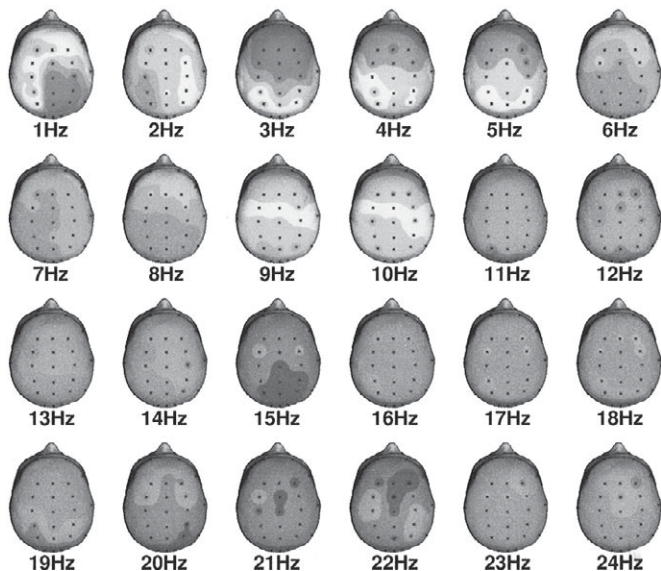


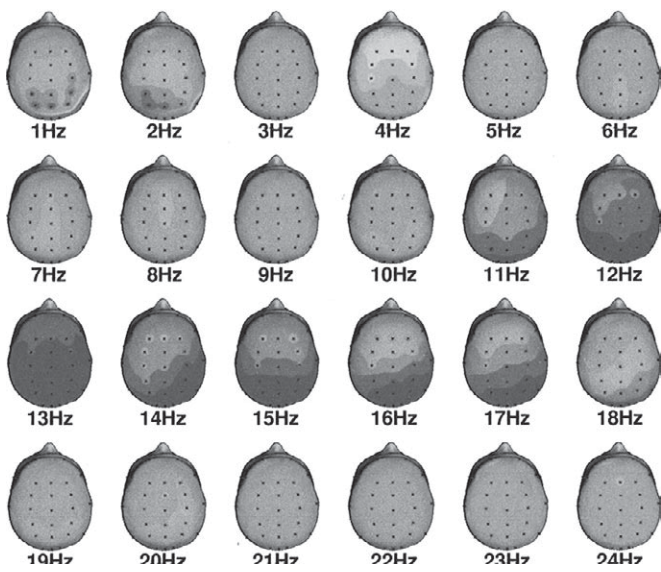
Figure 2. Pre- and posttreatment scores on the Test of Variable Attention (TOVA).



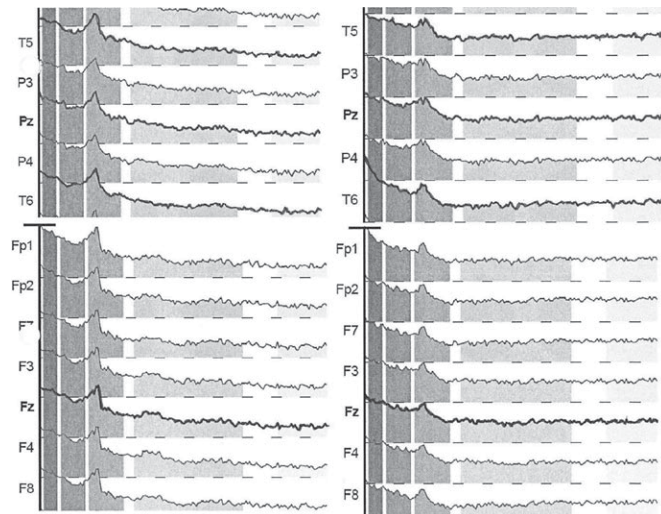
**Figure 3.** Quantitative electroencephalogram (QEEG) before the treatment. A color version of this figure will be posted, along with the article, at <http://www.aapb.org/magazine.html>.

### QEEG

After 20 neurofeedback sessions over a period of 3 months, the repeated QEEG showed that there was no longer any alpha excess present (see Figures 3 through 5). These changes indicated successful activation of the frontal cortex and normalization of activity in the temporal lobes. Less delta and low theta frontally are consistent with improvement in impulse control and sustained attention.



**Figure 4.** Quantitative electroencephalogram (QEEG) after 20 sessions. A color version of this figure will be posted, along with the article, at <http://www.aapb.org/magazine.html>.



**Figure 5.** “See pre- (left) and posttraining (right) Fast Fourier Transformation (FFTs) for Eyes Closed. Note a dramatic decrease in temporal alpha at T5 and T6; pretreatment they were the same amplitude as at Pz; posttreatment they are smaller in amplitude as compared with Pz, which is normal. Also for frontal sites the decrease in alpha power is very clear.” The comments were extracted from the clinical report of Dr. Martijn Arns, independent assessor (Arns, personal communication, 2008).

### Conclusion

Ismat’s healing was enabled by a combination of NFT and psychotherapy; the relative effects of each are impossible to quantify. We believe that this case illustrates the importance of integrating NFT into psychotherapy in trauma work. Can we do psychotherapy without neurofeedback? Of course we can. Cozolino (2002), Siegel (2007), and Fisher (2008) are convinced that there is evidence for the possibility of positive neural cellular change through talking therapies, particularly those where emotional responses are verbally mediated and mentalized (Allen, 2005). However, particularly for adolescent boys habituated to acting out in situations of perceived threat and hyperarousal, the talking part of the psychotherapy can be very difficult, as was evident in the work with this young man.

In order to be successful, psychotherapy requires that the client have a capacity to change and learn from experience—a condition facilitated by the reduction in hyperarousal offered by NFT. NFT also increased Ismat’s capacity to recruit his frontal lobes in times of stress and inhibit his impulsive and reactive behavior. He was able to focus on processing traumatic events and integrating them into his life story. Psychotherapy helped him reconstruct a sense of self and reconnect with other people. Ismat himself described it in the following way: “Comparing where I was before, this is a new phase in my life.”

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