The Special Applicability of the Low Energy Neurofeedback System Form of Neurofeedback to Traumatic Brain Injury: I. The Theory

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Each year, 1.5 million Americans suffer head injuries, and many of these injuries go untreated, while mainstream medicine uses powerful diagnostic tools and weak therapeutic ones. Neither psychopharmacology, behavioral, nor psychotherapeutic therapies hold much promise, and the symptoms of traumatic brain injury (TBI) are often misunderstood and misdiagnosed. Neurofeedback, with its EEG-based diagnostic approach and its therapies aimed at redirecting neural processing, seems ideally suited for therapy with TBI, but of the traditional neurofeedback paradigms (some going high and some low in their desired training frequencies), there is no one size that fits all. However, the flexibility bestowed by the Low Energy Neurofeedback System (LENS) form of neurofeedback breaks through entrenched maladaptive patterns and opens new possibilities for sufferers of TBI. The success of the LENS approach shows the efficiency of a specific cutting-edge technique and the efficacy of neurofeedback in general as a therapeutic modality.

It is intuitive to use electroencephalography (EEG)-based neurofeedback for brain-related traumas and their sequelae. Every year, 1.5 million people in the United States experience a traumatic brain injury (TBI). Fifty thousand die and 80,000 begin living with long-term disabilities. This is a much larger number than those dying of breast cancer, AIDS, and multiple sclerosis, for example, yet there is little public awareness of the problem or how it can be helped (Esty, 2006). Even these shocking reported numbers are probably small compared with the number of unreported concussions or the variety of bumps and other insults to the brain and/or spinal cord that may accumulate over a few years, or even the course of a lifetime.

Multiple brain injuries are not uncommon because of a number of factors. Outstanding among them is the large size of the human head, a liability from birth through the developmental years, when it is supported by a relatively weak and uncoordinated musculature. Secondary factors are incautious exploration or risk taking on the part of the child (exacerbated in hyperactivity) and an increasing dyspraxia (clumsiness) that accumulates with the injuries. This latter problem is supported by the statistic that head injuries accumulate: Those with a first injury are 3 times more likely than the average person to have a second, and after that, the increase is exponential, with 8 times the likelihood for the triply injured according to the Centers of Disease Control and Prevention (Larsen, 2006).

But TBI may be the consequence of more than simple falls and blows. Some brain trauma can be caused by physiological factors such as toxicity or malnourishment, strokes, ischemia or arterial-venous malformations, high fevers, degenerative diseases such as Parkinsonism or Alzheimer’s, viral and bacterial infections, wartime blast injuries, and even (there is strong evidence) extreme psychological trauma such as post-traumatic stress disorder (PTSD). The prevalence of these occlusions or insults to the brain has not yet led to a serious search for remediation, nor has mainstream medicine any known cures other than time and natural healing.

That people do recover in time—or with a little help from their friends (or family)—is also witnessed by amazing recoveries such as Jill Bolte Taylor (2006) describes in her inspirational book, My Stroke of Insight. Taylor’s story itself shows how indispensable a warm, nonjudgmental environment is to recovery, along with lots of stimulation and mental exercise.

The sequelae of TBI are well known to the sufferers of even mild TBI. These include sleep disturbance, extreme fatigue, mood instability, cognitive confusion, light and sound sensitivity, poor management of time, and incompletion of tasks. Not surprisingly, therefore, both neurologists and psychiatrists who are called in to treat the symptoms or sequelae of TBI rely on the usual pharmaceuticals that work in at least predictable and satisfactory...
ways on their more “normal” clients. The experience of many patients has been, however, that the medicines act unpredictably or even backfire badly with TBI patients.

This leads to another peculiarity of working with TBI, quite familiar to attuned clinicians or therapists: TBI is a kind of clinical shape shifter, a wild card that can give rise to many of the symptoms known to the Diagnostic and Statistical Manual of Mental Disorders, fourth edition (American Psychiatric Association, 2000), but without, of course a comparable etiology, because by definition, they are sequelae of the trauma. The neurological damage also makes patients more sensitive or reactive to the action of the pharmaceuticals, so they are likely to have wildly reactive responses to medicines. Psychotherapy has not proven very helpful either because simply going over or talking about a traumatic event does nothing or even reactivates the trauma, ultimately making things worse. The only other remedies are occupational and physical therapy, which are time-consuming and require great commitment.

Enter neurofeedback: Clearly, a golden opportunity awaits some heroic method in shining armor to come forth from the forests of ignorance to challenge the dragon of this rampant disorder. Neurofeedback is eminently suited to the task because it is gentle, nonaddictive, and puts no alien substance (with a known or unknown half-life) into an already compromised neurotransmitter environment. Neurofeedback offers the promise of helping to regulate that which—through injury—has become dysregulated.

Although traditional neurofeedback, based on reward and inhibit protocols, has shown some promise, the results have been, let us say, less spectacular than neurofeedback’s demonstrable results with learning disabilities or attention-deficit hyperactivity disorder or pain, seizures, anxiety. I believe the problem lies with the familiar biofeedback paradigm of rewarding/inhibiting either high or low frequencies. For example, knowledge that brain injury and seizure proneness mostly show as low-frequency brainwaves (in the delta and theta ranges) has led people such as Barry Sterman to develop his SMR antiseizure protocol (12–15 Hz). Conversely, Eugene Peniston’s alpha-theta protocol for Vietnam War PTSD searched for the unconscious roots of trauma in the slower ranges (theta 4–8 Hz). See the interesting discussion titled “Mechanism-Based EEG Therapies” in the special edition on methodology and research design in Biofeedback (Othmer, 2002).

Lester Fehmi’s work focused not on going high or low in the frequency domain but on whole-brain synchrony usually located in the centrally positioned (some say neutral on the gearshift) alpha band of 8 to 12 Hz. He suggests that trauma can also be released through achieving whole-brain synchrony. I believe this method shows good promise because it, in a sense, allows the brain to heal—synchronize—itself (Fehmi, 2007).

This leads me to the main subject of this article, which is the use of the LENS method for TBI, and the awesome ability of the brain to heal itself when given the right information.

The originator of the method that carries his name—the LENS method, or Low Energy Neurofeedback System—Len Ochs, began his career as a neurofeedback therapist in the “good ole days” of the 1960s and 1970s, alongside Elmer and Alyce Green, Joe Kamiya, Ken Tachiki, Maurice (Barry) Sterman, Eugene Peniston, Michael Tansey, Margaret Ayers, the Othmers, and others of the first generation. Ochs, a psychologist with a flair for computers, was one of the cofounders of the International Society for Neurofeedback and Research, now the major international forum for exploration in neurofeedback and research. Ochs thought that because some good clinical results could be obtained by going high and going low, a third mechanism must be involved. This he came to identify as flexibility, the ability to move smoothly among brainwave ranges as life and experience require them, moment by moment.

Although the concept of neural plasticity is not new, the modern world of neuroscience is just beginning to appreciate the vast implications of the principle. Neuroanatomist Norman Doidge (2007) has explored the theme in a popular book for the intelligent general reader, The Brain That Changes Itself. The idea that Ochs is working with is that the brain also heals itself through the flexibility that LENS neurofeedback bestows on it. The following is the theory in a nutshell.

Instead of telling the brain what to do through training to a neurological desideratum such as alpha or beta, let it see its own face in a mirror, and learn, subliminally, as it were, to regulate itself. The feedback in this paradigm is the brain’s own dominant frequency delivered back to the brain on radiowave carrier frequencies at an offset in Hertz. The feedback is so small and insignificant seeming that the conscious mind may discount it utterly, but clinicians often see the effect of the stimulus—usually just a few seconds long—on the EEG as the brain receives it. I have elsewhere gone into great detail about how this process works (Larsen, 2006), so I will not do that here. Suffice it to say that our brains seem susceptible to electromagnetic information, possibly through its own ferromagnetic materials (Soehner, 2002; 2006).
TBI is by definition something that happens to us. Once we were fine, then there is a blow, or a destabilizing influence of some kind, and then we’re, well, not so fine. The brain knows how to function, and then it goes into a kind of lockdown of defensive self-protection.

Let’s think about the idea of functional versus structural impairments and the existence of neuroprotective mechanisms. In the LENS, we believe that in the majority of TBI cases, the former impairments outweigh the latter in influence. The brain, if you will, knows it is the most vital part of the body and instantly and instinctively protects itself against the life-threatening consequences of trauma. Probably the most important response to TBI would be the danger of uncontrollable seizure activity spreading out from the locus of the worst injury. Through a variety of quarantines (vascular, glial, and inhibitory neurotransmitters), the area is isolated from the rest of the brain so that central control of the organism is protected; it can take the legendary saber tooth tiger—avoiding maneuvers without either freezing or convulsing uncontrollably (usually the life-threatening consequences of seizures).

In LENS topographic brain maps we see bullseyes of activity and their surrounding buffers of inhibitory activity (see http://www.stonemountaincenter.com or http://ochslabs.com for examples of LENS maps). These validate the functional aspect of TBI: The brain’s own neuroprotective mechanisms are quick and awesome. (Only when they become entrenched or stuck are they converted, slowly or quickly into the stuff of pathology.) In conventional quantitative EEG terms, there is either hypercoherence or hypocooherence; either the brain is kindling dangerously or shut down. The LENS showed its early efficacy, which some people thought was too good to be true, in people who were quite high functioning before a single significant injury and improvements were relatively permanent, having followed our clients for some time after their treatment. The little dominant frequency–based feedback potentials that surge from the limbic system and the thalamic nuclei below (the source of most brain rhythms). An early study showed this to be so. LENS (at the time, it went under the name Flexyx or FNS) practitioner Mary Lee Esty was able to help patients with years of post-TBI fibromyalgia to improve dramatically. This led to the first controlled study published in a peer-reviewed journal: the Journal of Head Trauma Rehabilitation (Schoenberger, Shiflett, Esty, Ochs, & Matheis, 2001). It was a landmark study that led to other grants and other studies and to enthusiasm for the clinical use of the LENS with the sequelae of TBI, postconcussive syndrome, strokes, and aneurysm.

At Stone Mountain Center, licensed in the LENS in 1996, we had an early opportunity to work with a variety of TBI cases: auto accidents, military injuries, industrial accidents, strokes, chemical insults and overdoses, and even infantile and perinatal trauma. We felt we were able to replicate Ochs’ and Esty’s success with this kind of case. As they had reported, depending on the pretrauma history, recovery could be dazzlingly quick—and relatively permanent. I presented some of these cases at a FutureHealth WinterBrain conference in Miami (Larsen, 2001), along with a theory of why the LENS worked so well with TBI. In 2002, I was able to help plan and participate in an unusual symposium at AAPB (Colorado Springs, CO, 2004) on how TBI participates in anomalous experiences. At that conference, I was also able to present our work with a young primary school teacher from Brooklyn (G.K.) who still had symptoms (and an intracranial bullet) from being shot in the head. G.K. was able to accompany us to the conference and meet another shooting victim from the Texas Panhandle (J.B.)—and in front of NBC cameras. The event was to bring the efficacy of a biofeedback procedure with serious injuries to a national audience.

By 2005, we had pretty good evidence that the results and improvements were relatively permanent, having followed our clients for some time after their treatment. Some of these cases were included in the chapter in my book published in 2006: The Healing Power of Neurofeedback, including G.K., the shooting victim, who appears right at the beginning (Larsen, 2006). The first international LENS conference was held near New Paltz, New York, the following year (2007), and there I presented some new cases that had come to our practice in the meantime. Among these were the three cases that will be summarized, with maps illustrating the LENS approach, in part II of this article in a future issue of Biofeedback (these cases were presented among the abstracts for the conference but at that time not written up in a complete form).
Conclusion
To conclude and summarize the themes of this article, head trauma, both identified and unidentified, is an epidemiological problem of great magnitude. Conventional medicine, especially prescription pharmacology or psychotherapy, has little to offer. Neurofeedback in its conventional form has shown promise in helping, but a specific form of neurofeedback, the LENS, holds the most promise for rapid and significant improvements in well-being. The LENS works as quickly and efficiently as it does because it eases functional trauma by coaxing the brain into healing itself. The architecture of sleep, the metabolic wellsprings of energy, and the exquisite choreography of the executive functions all depend on a flexible brain, one that is not locked down. Many of the sequelae of injury are consequences of neuroprotective mechanisms. The LENS procedure does not pretend to ameliorate by repairing neurons, but many functional improvements are evident nevertheless. Part II of this article will narrate three case histories that illustrate the dramatic potential for recovery with the LENS approach.

References