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The experience of providing self-regulating therapy to combat-injured infantry soldiers at Madigan Army Medical Center is rich in lessons and potential benefits. “Wounded Warriors” from Operation Iraqi Freedom/Operation Enduring Freedom (OIF/OEF) deployments with prolonged somatic symptoms of chronic traumatic headache, disordered sleep, cognitive and affective deficits, and autonomic hyperarousal are assessed in the Neurology Service. The Psychophysiology Clinic is an embedded biobehavioral treatment program within the Neurology Service and provides biofeedback-assisted therapies.

Three years ago my patient referrals reflected the significant problem of unresolving mild traumatic brain injury (mTBI) in the context of posttraumatic stress disorder (PTSD). I have observed that psychophysiology offers an amazing therapeutic opportunity to address the “chronification” effects of the comorbid symptoms linked in mTBI and PTSD. Chronification here indicates that in these individuals, the acute response to both physical and emotional trauma becomes transformed into a cluster of chronic and self-maintaining conditions. The symptoms of headaches and insomnia evolve into progressive chronic patterns. This chronification process develops more readily in the presence of emotional vulnerability and autonomic nervous system (ANS) hyperreactivity. The mediating process that amplifies and perpetuates symptoms may be explained by neurologic mechanisms such as sensitization or reduced inhibitory activity. Yet it is also relevant to consider that faulty or maladaptive learning with continued stress reactivity are underlying risk factors. This article reports my clinical experiences supporting the contention that psychophysiological therapy takes the short route for the most gain in modifying the behavioral risk factors of ineffective conditioned responses.

The patient group comprises active duty male soldiers, many less than 25 years old. They have experienced multiple, traumatic combat and blast injury exposures over one or more deployments serving in Operation Iraqi Freedom/Operation Enduring Freedom (OIF/OEF) operations. They have not experienced the expected and hoped for remission of their symptoms during the first few months of their postdeployment recovery process. They have been screened and evaluated through behavioral health and TBI assessment programs and are concurrently participating in PTSD intervention programs with individual exposure therapies and cognitive behavioral therapy group processes.

Along with the recognized persistent postconcussive syndrome, these patients also represent the complexity of the comorbid presentation of mTBI and chronic PTSD. It is estimated that 43% of OIF/OEF veterans with mTBI have PTSD (Hoge et al., 2008). Rehabilitative medicine and Department of Defense and U.S. Department of Veterans Affairs researchers recognize the intertwined and interrelated aspects of OIF/OEF veterans experiencing both mTBI and chronic PTSD and the complicating factors in directing effective treatments (Hoge et al., 2008; Kennedy et al., 2007; Nampiaparampil, 2008; Schneiderman, Braver, & Kang, 2008). Amid the scientific debate and research findings, clinical rehabilitation is necessarily ongoing. The clinical experience in the Psychophysiology Clinic affirms individually based improvements in soldiers’ general anxiety management and behavioral management of chronic headache and insomnia. It may represent one facet of change that promotes further therapeutic gain in support of other treatment interventions and assists in risk reduction of further functional disability. One consistent and strong observation is that soldiers like biofeedback-assisted learning.

The affective arousal dysregulation in PTSD (Orr, Metzger, & Pitman, 2002) demonstrates up-regulated nervous system responses to stimuli linked to previous trauma. Physiologic hyperarousal, with increased heart and respiration rates, muscle tension, and ANS norepinephrine
hyperactivity, presents a relevant target for down-regulating and stabilizing control. Cortical hyperexcitability (central processes that overrespond to pain signaling) when the risk factors of stress and disrupted sleep are present promotes the chronification of traumatic headache (Rains, 2008). Research is under way that points to the potential benefits of strengthening behavioral skills that impact these maladaptive and overactive conditioned signals. Study findings support the efficacy of regulatory control of specific sensitized neural pathways or generalized nonspecific heightened autonomic arousal with underlying hypothalamic-pituitary-adrenal axis dysregulation (Frewen & Lanius, 2006). The adjunctive role for psychophysiological treatment has established professional recognition and research interest (Walton, 2009). The Association for Applied Psychophysiology and Biofeedback efficacy reviews also support the use of biofeedback for chronic headache and insomnia (Yucha & Montgomery, 2008).

The conceptual support is present for the potential benefits of the behavioral skill set that addresses chronic traumatic headache, psychophysiological insomnia, anxiety, and autonomic hyperarousal. Promoting the adaptive responses in the clinical setting requires therapeutic awareness of learning paradigms. Prior learning experiences and expectancies are important contexts to understand in order to identify the established learning that underlies maintenance of the symptoms. Redirecting the outdated, learned associations is assisted greatly by the biofeedback displays. Direct feedback offers measurement of practice effects and progress toward new learning associations. The clinician’s therapeutic awareness guides progressive changes and helps realign symbols and meanings of stimuli to greater neutrality. Soldier-patients learn to relinquish the generalized need for watchfulness and readiness. Overriding the established but no longer effective learning that is present in psychophysiological hyperreactivity also requires an ability to establish the reference point of a calm state. Soldiers often recognize their inability to easily relax. The state of relaxation is relearned and becomes the alternate choice to stress reactivity and prolonged hyperarousal states. The relaxed baseline state also creates the setting for new learning and thus the healing platform for effective practice and sustainable recovery. The professional strengths in the psychophysiological approach are described in the following six strategies.

**Look Through the Mind-Body Therapeutic Window**

Psychophysiology by definition looks at the mind-body interface and the resources of knowledge, practice skills, and ways of thinking that reside in this juncture. Practitioners of psychophysiological therapy embrace the literature from different professional points of view (e.g., psychological, neurological, sleep medicine, rehabilitation). A wide-focus perspective allows for inclusive strategies in thinking and therapeutic flexibility. This mind-body therapeutic window structures the context for learning and devises the best practice intervention. It also navigates through the biases of cognition, runaway attentional processes and fear-eliciting avoidant behaviors while teaching target-directed mind-to-body, body-to-mind observational skills and goal focus.

The attentional processes of soldier-patients with postconcussive symptoms are “hijacked.” Concentration and short-term memory are compromised by distractibility and sensory overload. The neural programming of posttraumatic stress, such as the startle response and automatic environmental scanning, occurs with an unintended automaticity. The therapeutic purpose is to move intention and attention away from anxious content and biased perceptual processing, including the anticipatory fears of not returning to full duty or full engagement in life. Holding attention to a neutral status such as a mindful focus on breath pattern begins the “tool”-making skill of managing arousal with a “how-to” technique. The concrete use of metaphors and labels of skills such as tools and how-to techniques demystifies the strategy development. Associating the attentional skills with their soldiering skills is highly useful and positively reinforcing. Finding cross-references to the familiar soldiering tasks, such as how they sustain attention or distract and intentionally target their attention while road marching, has immediate recognition. The portrayal of the heart rate variability feedback provides immediate results with a continual shaping process. Biofeedback visual displays show the successive approximations of a diaphragmatic breath modifying the heart rate variability waveform until a synchronous and matched pattern is achieved. The process elicits the relaxation response. It also verifies that attentional tracking and focus is an available skill that is “rebuilt” (strengthened) with practice effects.

**Complement the Fit With Multimodal Interventions**

Psychophysiology is “by design” and complements and fits into the therapeutic milieu of many psychotherapy approaches. It provides stabilizing skill experiences for imagery rehearsal and exposure therapy. The implicit message in the experience of biofeedback assisted relaxation and quieting is “yes you can” and establishes the
belief that there is a baseline state. In other words, soldier-patients discover and reexperience their competency in self-control and self-management in directing their mind’s activity of thoughts and feelings and their body’s activity toward a low-arousal, positive-affect state. The progressive step-wise gains help set the adaptive expectancies in the course of recovery. Coassociating successes with other therapeutic and psychoeducation experiences such as resiliency training creates the pathways for generalization effects. Interpreting experiences in other therapies such as physical therapy augment mind-to-muscle awareness. Linking the successes in physical therapy muscle reconditioning regimens with the discrimination tasks in surface electromyography (sEMG) most likely augments cognitive ability to sense muscle activity and reeducate neuromuscular pathways. Thus there is increased opportunity for mindful awareness to cue in muscle release earlier and more often and to weaken muscle guarding patterns. Tailoring methods from other professions is also an option. A useful auditory feedback enhancement is a “whisper phone” (http://www.whisper-phones.com) used in educational settings to teach reading. The whisper phone also works very well for augmenting patients’ own voice feedback for rescripting, reaffirming, and relaxation practice.

Establish New Learning Paradigms

Biofeedback therapy is orchestrated into salient applications for patients. With postconcussive symptoms, conditioning responses that will reinforce habituation and extinction processes are essential. The biofeedback advantage is its relevant time-linked mirroring of a behavioral shift, whether that occurs in muscle tension, cardiac reactivity, or skin conductance. This becomes convincing evidence of an ability to effect desired change and to stay with (trust) that change event for a 3- to 5-minute period to permit the “gear shifting” sense of release. Wessa and Flor (2007) reported findings that PTSD may be maintained by second-order conditioning. Soldiers with combat-related PTSD report the experience of trauma-relevant cues surfacing across many everyday situations along with hypervigilance, an expectation of harm, and a sense of vulnerability. The shift of attention away from the anxiety-producing stimulus or perception becomes a safety lapse that is untenable. Reappraising the shift of attention into a “safe” understanding is essential. Soldier-patients are relearning how to discriminate the familiar stimuli of everyday life from past novel stimuli associated with trauma. They are learning to experience ANS activation not as its own threatening stimulus but as a readiness for action that is no longer necessary. A focus to breathe for a short interval (3 to 7 minutes) most likely will trend respiration and heart rate activity toward a quiet baseline state. Likewise, when cognitive hyperarousal intrudes into the sleep period, choosing a response such as “decentering” or allowing one’s thoughts to “play through” can quell the overactivity and break apart maladaptive learning.

In these new learning paradigms, skills and ways of coping are taught that are “essential gear” and feel solid, like a tool gripped in the hand. A familiar activity like breathing turns into an amazing everyday resetting of focus and skill. Biofeedback works in a very specific time domain with immediate feedback capability. The focus on the present moment allows the detection of early and subtle changes and improves interoceptive awareness. Patients also learn passive attention with no attendant judgment, which can still the mind chatter—no tug of war, no arguments, just a held point of focus, grounded in the breath. A relaxation practice such as mindfulness meditation with a body scan helps discover the presence of comfort amid discomfort. The biofeedback learning process of quieting skin conductance values, easing into the rhythm of the diaphragmatic breath, and releasing muscles can expand the conscious moment and opens the mind to more options. Acceptance of the stillness of the moment with its deficits acknowledged inclines itself toward one’s intentions of stability. The biofeedback training illustrates how the painful, fearful present moment will lead to another point in time with the potential to release, soften, and quiet. The experience of the narrowing and closing in of the moment and the ability to expand it back out again with focus on breath and ANS balancing with heart rate variability training affirms a working skill. The experience of deliberately choosing to reframe the shape and size of the visual and auditory effects of the trauma-related memory is reinforced. The visual display of the effects on skin conductance of fear recalled and resettled is documented for the patient via biofeedback.

Tailor to Personal Strengths

Skills and strategies are customized for each patient such that the therapy experience is choreographed to maximize his or her personal strengths and resources. Their language and metaphors are explored and the language of recovery is shared with them. Soldier-patients discuss the personal meanings of self-agency, ownership, and accountability evident in the choices they make each day. The therapeutic process creates “room” for life-decisions and acquired skills that restore focus and establish new calm and safety. Through practice the new skills and personal strengths become part of the soldier’s ongoing repertoire.
Biofeedback therapy also folds back and exposes the layers of learning over the months of living and adapting and often learning the maladaptive response. Soldier-patients learn the job of a “body scout” to discern the relevancy and irrelevancy of body and mind data. Biofeedback processes give them the data stream—a scorecard. Heart rate variability training is a dynamic visual trail marking the influx of rumination, loss of mental focus, and the gains of quiet, peaceful feelings in the midst of the muddle. The signal-to-noise ratio is attenuated to allow the recognition of quieting ability and trust in the nondefensive posture. With the high prevalence of chronic headache (Ruff, Ruff, & Wang, 2008; Theeler & Erickson, 2009) as a consequence of mTBI in soldiers in combat operations, skills that reinterpret the pain phenomena months after the onset are essential to ensure the minimal affective and cognitive investment is made in order to avert excessive maintenance features. Psychophysiology skills provide the new learning opportunity to choose more change, better change.

Build the Behavioral Repertoire

The outcomes of psychophysiological training are the essential abilities to restore balance and flow and return to baseline. It is the middle ground on the spectrum of reactivity. Discrimination and recognition of present location on this sliding scale is highly relevant in their repertoire. Soldier-patients often present with overstriving efforts, urgency, and scant relaxation abilities (most common report is video game playing). Patients learn to accept the graduated progress of acquired learning skills when the evidence of learning resides on the computer screen in either met or unmet goals. Accurately measuring their mind/body quiescence is essential in order to have awareness of movement away from the baseline state and to make timely corrections. Many soldier-patients over estimate ANS arousal such as predicting an elevated heart rate or sEMG signal, when in fact it is near a clinically quiet baseline. Conversely, estimations also may underrate activity when the signals are elevated. These measurement predictions are corrected with biofeedback learning exposure. They also develop awareness of conservation strategies in using appropriate effort level for the task at hand. Many patients try too hard to remember details, stay alert, sleep, or escape their pain and anxiety. The practice of mind and body awareness and resetting strategies are optimized for proportionate gain when effort levels match benefits. It also helps reveal the concept of “when less is more.” Germain, Buysse, and Nofzinger (2008) report that mTBI is frequently coassociated with PTSD, depression, and anxiety and that the presence of both mTBI and PTSD may increase the incidence of sleep disorders. Ruff et al. (2008, p. 949) concluded that “disrupted nonrestorative sleep can worsen neurocognitive impairments and intensify headache pain and increase headache frequency” in this patient population. Predeployment sleep in these soldier-patients is minimal, with most reporting 4 to 6 hours of sleep and while deployed often significantly less. Postdeployment sleep reports generally indicate 2 to 4 hours of sleep with prolonged delays in sleep onset and frequent awakenings. In relationship to reestablishing sleep patterns, patients are encouraged to use their acquired relaxation skills frequently throughout the day to rebuild and refine the staging for sleep onset. Interpreting their own experience, listening to their own narrative helps them discover more ways to find the “pause or permission feature” or the “to be continued tomorrow” idea that permits emotional safety for sleep. The use of everyday language translates concepts into familiar behaviors and thus helps reduce barriers for applications within the day’s experience. Learning to pause to reset tension or urgency is competing with the sense of urgency or arousal itself. This is like slowing down for a traffic light when you’re in a hurry. The soldier-patients are learning to give permission to change the activity within the moment’s experience and tolerate the sense of interruption, change of pace, or feeling of loose ends. Embedded in these strategies is the essential idea of letting go and still feeling in control. Going with the experience of releasing intensity and overstriving efforts and adopting the stance of passive attention sets the alert conditions to lower values that are then safe enough for sleep.

Put It All Together

The final strategy of psychophysiological therapy involves integrating skills into a more unified treatment package. Fractionated responses are sometimes evident in a patient who demonstrates a technically correct diaphragmatic breath but without the concomitant expected changes in thermal or skin conductance values present in the subjective experience of relaxation. Breath changes present as “stylized” changes, in that breathing is carefully counted out and correctly performed but is not linked into the set of responses expected with a relaxation response. The quieting reflex technique includes a set of cognitive, affective, and somatic elements; this comprehensive approach helps reintegrate the breathing changes (Stroebel, 1983). Interpretively speaking, patients learn to fit with ease into their own framework, as they strengthen their sense of self-comfort and self-respect as evidenced by their ongoing diligent efforts. (Many of these soldier-patients are learning the context and connections in body to mind to spirit and self in relationship to others and life in believing that
they are mended together, changed but capable and always valuable.) Embracing their intrinsic self-worth separate from their burdening experiences or changed plans stemming from combat injury is an act of self-acceptance and acknowledgment and frees up personal resources to pull ahead. The process of biofeedback therapy works at the level of signal detection and volitional redirection. The process also validates the person and his or her courage to accept the challenges that have come along and his or her determination to make the most of the circumstances.

The strategic availability of biofeedback in the Neurology Service and the specific treatment focus of biofeedback-assisted relaxation management targeting the postconcussive overlapping symptoms of mTBI and PTSD have demonstrated effective experiential changes. Improvements observed include reduced functional impairments related to headache, augmented sleep patterning, and increased self-competence in ability to reference and use relaxation to return to baseline. It has become part of the warrior’s journey.

**Disclaimer**

The opinions and assertions are those of the author and should not be construed as representing the official position of the Department of Defense or the U.S. Army.

**References**


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