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Quantitative EEG and Treatment Response in Neuropsychological Disorders

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Quantitative analysis of the human EEG (qEEG) was accomplished as early as the1930s (Berger, 1931). With the availability of powerful desktop computers at relatively low cost, along with high speed Internet transmission of data, digital EEG with quantitative analysis is now available in clinical settings. However, results with qEEG techniques overall must be considered mixed at best. While it is clear that quantification of the EEG signal is useful in obtaining more objective and detailed information, there has been only limited success in using the procedure diagnostically. The position of the American Academy of Neurology is that the technique has "limited clinical utility," because it is not "diagnostic." The AAN panel endorsed the use of digital EEG and considered the qEEG technique promising and with additional clinical validation studies, likely to be used increasingly in clinical medicine, as with computer technology in general (Nuwer et al. 1997).

Quantitative EEG is a difficult technique in that scalp electrodes are used to measure microvolt level electrical signals in conscious, behaving humans. There are significant problems due to extracerebral artifact contaminating the EEG signal, including movement, muscle activity, eye blinks, electrodermal activity, and EKG. A well-trained technician is able to identify and minimize some of these contaminants at the time of recording. Further, there are fluctuations in level of patient arousal that are difficult to identify and quantify. In addition, most studies analyze the EEG while the patient is at rest. EEG correlates of cerebral activation accompanying cognition and affect are typically not considered. This is a particularly difficult issue, since studying EEG human performance is of great interest but often carries with it the problem of significantly increased artifact and makes factors such as drowsiness even more critical.

These are important factors, but other, more fundamental questions also must be considered. Why does the clinician use qEEG? The usual answer is to assist in diagnosis in difficult cases. The neuropsychologist may use the test in developmental disorders to evaluate a child with difficult learning or attentional problems. The psychiatrist may use the test to evaluate patients with complex schizoaffective disorders. The behavioral neurologist may use the qEEG study to evaluate concentration and memory difficulties in head trauma. However, these are all conditions defined by behavioral disturbance. The qEEG technique measures neurophysiological activity, not behavior. Complex behaviors are the final common pathway of the integrated activity of the nervous system. There are many neurological events underlying such complex behaviors and psychological processes as reading, mood lability, and mental concentration, and alterations in many aspects of neurophysiological function can cause significant disturbance of these behaviors. It is well accepted that there is not a direct correspondence between mental activity and behavior. It also is obvious that there is not a direct correspondence between neurophysiology and behavior. Therefore, it is not surprising that qEEG is of limited utility in behavioral diagnosis. How then might the clinician best use qEEG?

The qEEG technique does not substitute for neuropsychological evaluation. If the intent is to clarify a behavioral diagnosis, behavior, not

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From the President

As professionals incorporate new technologies into the services they provide, "identity" concerns may arise. For example, integrating neurofeedback "education" or "treatment" options into our practice extends our professional identity. Professional identity is an issue infrequently discussed by the society members. Several important questions come to mind:

1) Who are we as professionals?

2) What are minimum entry-level skills, and who trains, tests and supervises these skills?

3) What are the boundaries, scope and standards of our current practices?

4) How do we advertise to clients?

5) What are the legal and ethical issues related to delivery of service?

6) How are we reimbursed for our time and services?

7) What are the current laws related to our practice and do these laws need modification?

The topic of professional identity will become increasingly important as professional "income turf battles" are played out at the legislative level in many states. Laws related to your practice may change unexpectedly and maintaining ties with professional associations helps you to keep informed of legislation that might affect your income. For example, legislative issues are discussed on the website of THE BIOFEEDBACK AND BEHAVIORAL HEALTH PRACTITIONERS GUILD,

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From the Editor

On Breath, Brain, Brawn, and Belief.

You will probably be hearing more from me on this theme. I am coming to believe that Biofeedback has four B's in it. And, any true practitioner of the art should know how to do each of these. Only when you approach the patient's evaluation with an eye towards each of these aspects, do you come close to truly knowing the psychophysiological nature of their problem.

Breath. Robert Fried seems to think that it will determine the level of activation of the brain. Want to down shift to alpha, consider the breath. I, myself, believe that chronic hyperventilation syndromes lead to muscle pain and possibly fibromyalgia.

Brain. We know ourselves through our CNS. In chronic pain work, it has been shown that the cortical representation of the painful area gets larger over time. If you are working in the field of pain, maybe you need to try to shrink this as part of your therapy by using Neurofeedback. Retraining muscles, consider taking a peek at the sensory motor strip.

Brawn. Where would the world be without muscles? Moving towards a dynamic relaxation model is where things are going. Quiet the mind, quiet the breath, and then put it all in motion. Walk gently upon the earth. What a novel idea.

Belief. Biofeedback, after all, is a mind - body event. If you have forgotten to explore the thought process and the belief structure behind it, you fail in your therapy. For what is a body without a mind.

In your primary education you learned about the three Rs. In your education of your patients, consider teaching them about the 4 Bs.

Jeffrey R. Cram, Ph.D.

Applied Neurosciences Group is pleased to announce the recent affiliation of our three corporations, including Barry Sterman, Ph.D. and David Kaiser, Ph.D., of Sterman-Kaiser Imaging Laboratory, Inc. (SKIL); Jack Johnstone, Ph.D. and Meyer Proler, M.D., of Q-Metrx, Inc.; and Jay Gunkelman, QEEGT and Sarah Froggatt, SLP, of NeuroNet Neuroscience Centers, Inc. We have an extraordinary array of talent and services, including medical interpretation , functional evaluation, and professional training focused on Electroencephalography.

We have chosen to merge in order to provide the highest quality of service for the full range of neuro-diagnostic and neuro-evaluative services, from EEG/qEEG, to evoked potentials and even polysomnography. We have specific expertise in neurotherapy protocol design and consultations, providing neurotherapy based on qEEG as well as providing a teaching facility to those interested in learning this fascinating field from some of the field's key figures. Full medical-legal expert consultation and insurance billing services are also available.

For complete details and a menu of services, please contact our offices at 818-563-5409, or visit our web site at www.appliedneurosciences.com

Join Us at the Beautiful Monterey Hyatt, November 10-12, 2000

for the annual conference of

The Biofeedback Society of California (BSC) and the International Association of Interactive Imagery (IAII) in association with the Academy for Guided Imagery (AGI)

There will be many opportunities to broaden your professional knowledge by participating in short courses or general session panels with presentations by many outstanding presenters including:

General Session panels on Repetitive Strain Injury (RSI), Consciousness States, Respiratory Psychophysiology, EEG and Pain Management and Guided Imagery

Keynote Presentations

Jerry Green, JD	*Professional Identity and Licensing*
David Hubbard, MD	*Visceral Awareness*
Marty Rossman, MD	*Images of Healing, Listening to Symptoms*
Hank Wesselman, PhD	*Shared Wisdom and The Evolution Of Consciousness*
Sue Wilson, PhD	*Sustained High Performance*

A Matter of Breath

One Size Does Not Fit All

Ira Rosensenberg, MA

You've trained your client to breathe using an abdominal and a chest strain gauge. Together you watch the beautiful waveforms go by on the screen. They're slow, they're regular, they're deep. The balance between the chest and the diaphragm looks good. They're both moving together; they're both ample and synchronous. But how do you know that's the right rate and depth for that client? Just by the look? Just because the book says six per minute? One size does not fit all!

Here's how to tell:

1) Is the breath style comfortable, sustainable for a long time without gasps or sighs; is it effortless? Okay, good.

2) Now let's see if its real breathing — or is the client being inadvertently trained to push the abdominal and pectoral muscles against the strain gauge to produce a certain "look and feel" on the screen? Obviously there has to be optimal airflow along with body movement. That's why you have to teach your clients to keep a double focus on the breath: sensing both body movement and the passage of air through the nostrils, and recognizing how they coordinate with each other. Nostril following is extremely important because the breath reversals — from in to out and out to in — can only be precisely monitored from the change in airflow. When the client knows how to keep the double focus he or she has the basic ingredients for home practice of breathing.

3) Here's the clincher. IS THE HEART HAPPY WITH THE BREATH RATE AND DEPTH? That gets us to the respiratory sinus arrhythmia (RSA), the periodic change of heart rate with breath. In a seated, relaxed person it should increase on the inhale, and decrease on the exhale. Neither you nor your client can tell without displaying the beat-to-beat heart rate along with the breath, both on the same screen.

You may be surprised what you see. The RSA may be out of synch with the breath style. The heart rate changes may be jagged — going both up and down during the inhale or during the exhale. There may be irregular beats at the turns of the breath. The peak heart rate and the height of the inhalation may not coincide — they may be out of phase. If the client is breathing way too slow for his own centrally modulated autonomic controls you may even see a double RSA pattern with each breath.

The good news is that a slight slowing or speeding of the breath — a bit of change in depth or rhythm — may improve the RSA considerably. When the RSA has good amplitude, is in phase with the breath and of good quality, your client is breathing correctly for that moment, that situation, that social circumstance.

It makes sense. The breath and the heart are part of the same physiological system: the oxygen delivery, waste removal system. You shouldn't conceptually disconnect them. Think "cardiopulmonary function." Train both components — heart and breath — together. I often tell my clients "change the lead to the heart." Use the shape of the RSA waveform to time the breath reversals. You slip into a different gear. It's as if some deep brainstem nucleus briefly recognizes your voluntary control. "Hey, my person is talking to me," it seems to say.

The RSA approach to self-regulation has important consequences for home training too. You have to learn how to monitor the pulse and breath together, feeling each pulse beat and its relationship to the last beat — sensing the interbeat interval — recognizing your own idiosyncratic interactions between heart and breath — feeling the turns in the breath, sensing the changes in tonus of the smooth muscle of the radial artery at the wrist. It's alive! When you do RSA training without instruments, you're holding both reins of the autonomic nervous sytem in your hands — you feel the sympathetic raising the heart rate on the inhale, the parasympathetic lowering it on the exhale. You're getting down to the quick of life.

Next time I'll tell you more about the living pulse, because breath and vasomotor activity vary together too — it's the troika of heart, breath and vasculature.

From the President

Continued from page 3

(http://www.opeiu.org/bbhpguild/index.asp). By supporting office and professional employee unions such as this, we have an opportunity to shape our professional identity and to protect our income.

The annual conference in November will offer a presentation by Jerry Green, JD, who will address the general membership and offer a Sunday short course about the issue of professional identity. Attending the conference will give you an opportunity to find out about this and other important topics. Attending will also give you an opportunity to meet friends and colleagues from the International Association of Interactive Imagery who will join us for the first annual joint conference between our societies. I look forward to seeing you all at beautiful Monterey Hyatt November 10-12, 2000.

Quantitative EEG

Continued from page 1

neurophysiology must be studied. However, if the intent is to determine how to intervene neurophysiologically, such as by administration of centrally acting pharmaceuticals, neurophysiological measurement logically is the technique of choice. New research demonstrates medication responsivity can be improved and side effects minimized through the use of qEEG techniques to guide prescription. EEG conditioning, or neurofeedback (NFB), is a neurophysiological intervention as well (for reviews see Sterman, 1996; Evans & Abarbanel, 1999). By inference, determination of an individual's neurophysiological profile may also be useful in development of EEG conditioning strategies.

A substantial literature exists on effects of medications on the EEG (Wauquier, 1993; Bauer, 1993), and a number of reviews of methodological aspects and clinical applications of pharmaco-EEG are available (Anderer et al., 1987; Saletu, et al., 1987). Progress has been made on classification of psychotropic drugs based on effects on the EEG (Itil, et al., 1979; Herrmann, et al., 1979). In contrast, relatively little attention has been directed toward *prediction* of medication response.

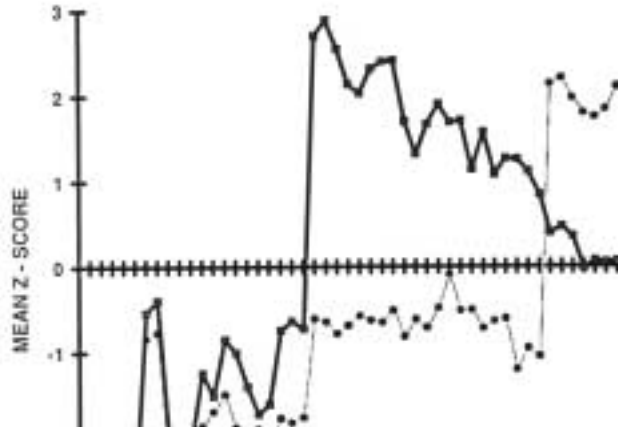
Among the non-invasive technologies for investigating brain responsivity to pharmacotherapy in psychiatric disorders, some researchers have analyzed EEG recorded as a part of polysomnographic studies (Buysse, et al., 1997; Perlis, et al. 1997). One group has reported increased relative delta power and decreased relative alpha power during sleep in depressed patients who were responsive to antidepressant treatment (Luthringer, et al., 1995). Others have studied the reactivity of the alpha rhythm in depression. Increased reactivity of EEG alpha to eye opening was reported in unmedicated depressed patients. Excess reactivity was normalized with medication (Shagass, et al., 1982).

Chabot, et al. (1996) studied qEEG profiles in children with attention deficit disorder and specific learning disability. They report that pre-treatment qEEG could be utilized to distinguish ADD children responsive to dextroamphetamine from those responsive to methylphenidate with a high level of accuracy. These results confirm and extend other reports in the literature (McIntyre, et al., 1981; Prichep & John, 1990; Steinhausen, et al. 1984).

An association with qEEG alpha frequency excess and therapeutic response to antidepressant agents was reported in obsessive compulsive disorder. In contrast, OCD patients with theta excess were not responsive to antidepressants (Prichep et al., 1993). Increased interhemispheric coherence has been noted in psychotic patients who failed to respond to haloperidal (Czobor & Volavka, 1991).

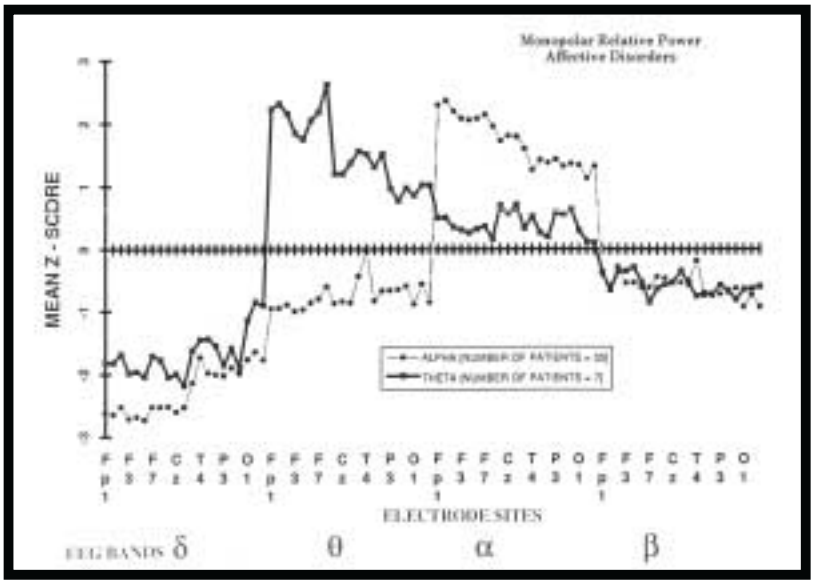
Psychotropic medications can be classified by effects on the EEG. Benzodiazepines can produce an increase in 20-40 cycle per second EEG/qEEG ac-

Figure 1: Profiles of EEG relative power deviations from normal database in two subgroups of patients with attentional disorders.



(From: Suffin, S.C. & Emory, W.H. Neurometric subgroups in attentional and affective disorders and their association with pharmacotherapeutic outcome. Clinical Electroencephalography, 1995, 26:76-83.)

Figure 2: Profiles of EEG relative power deviations from normal database in two subgroups of patients with affective disorders.



(From: Suffin, S.C. & Emory, W.H. Neurometric subgroups in attentional and affective disorders and their association with pharmacotherapeutic outcome. Clinical Electroencephalography, 1995, 26:76-83.)

tivity. Three types of antidepressant induced EEG/qEEG effects are observed: 1) initial alpha amplitude reduction with increased slow and fast activities, 2) initial alpha amplitude increase with attenuation of slow and fast activities and 3) changes similar to those found with stimulants. Neuroleptics can decrease fast and increase slow activity. Stimulants can decrease EEG slowing and increase fast activity.

In 1995, two physicians, Stephen C. Suffin and W. Hamlin Emory, reported a retrospective qEEG study of patients with DSM categorized attentional and mood disorders seen in their private practice (Suffin & Emory, 1995). Each DSM group was found to contain subgroups of patients with characteristic neurophysiological profiles. Figure 1 shows relative power profiles for two subgroups of patients with attentional disorders. Figure 2 shows relative power profiles for two subgroups of patients with affective disorders. Note the similarity of the profile for each subgroup within each DSM defined group. Patterns of each subgroup are nearly identical.

The presence of specific qEEG features predicted medication response. There was a robust correlation between a patient's pretreatment qEEG feature(s) and medication outcome, **without regard to DSM disorder**. The subgroups with features including *alpha frequency excess* responded favorably to antidepressants, the subgroups with features including *theta frequency excess* responded favorably to stimulants and the subgroups with features including *EEG coherence deviations* responded favorably to lithium or anticonvulsants.

Suffin and Emory subsequently reported that similar qEEG markers are present across the range of DSM disorders, and that different qEEG markers are found within the same DSM disorder (Suffin & Emory, 1996). These findings suggest a new approach to pharmacotherapy: 1) identify pretreatment qEEG feature(s), 2) assess the similarity of the individual case to qEEG features from patients with known outcomes, and 3) prescribe based on a match of the individual to qEEGs with known responsivity to specific agents. This approach does not require explanation of the complex relationship between brain disturbance and symptomatic behavior.

Suffin and Emory have constructed and described a database that contains the pretreatment qEEGs of greater than 1,600 patients with a variety of DSM disorders. qEEG features predicted favorable clinical outcomes with antidepressant, stimulant and anticonvulsant medications in training and validation set analyses, demonstrating that qEEG data contain sufficient information to classify patient populations into medication response groups (Suffin, et al., 1997). In addition, predictions could be made that individual patients would require a combination of agents from more than one category, e.g. a stimulant *and* an anticonvulsant.

A follow-up study by Suffin et al. (submitted, 2000) used a random assignment of patients with chronic, refractory major depression into two treatment groups. These patients had major depression without improvement over an average of 16 years, despite multiple treatment attempts. One group received medications prescribed based on standard procedures and one group received medications prescribed based on results of qEEG analysis. Clinicians blind to the method of prescription evaluated patient outcome using a clinical global improvement scale (CGI). There was significant improvement in the group treated based on qEEG profiles and little or no improvement in the group receiving treatment according to current standards of practice.

Prescriptions based on qEEG results differed markedly from those based on standard clinical evaluation. QEEG data suggested use of more anticonvulsant/anticyclic agents and stimulants. With behavioral based medication selection, combination pharmacotherapy is recommended for in major depressive disorder only after failures of antidepressant class agents.

These findings are preliminary and require further replication and validation. However, the implication is clear: assessment of neurophysiological profiles using qEEG is useful in guiding medication selection across a wide range of DSM disorders. The development of a longitudinal database of psychiatric patients including patient outcome data provided the basis for development of predictive algorithms. Medication response prediction may now be extended to patients already taking medication and those with neurological disorders such as stroke, epilepsy, and head trauma.

The important role of behavioral evaluation must be understood in context. Behavioral disturbance is usually the precipitating factor that leads a patient to seek treatment. In addition, it is behavioral evaluation that provides the critical measure of clinical outcome. It would not be useful to normalize the EEG without behavioral improvement.

In contrast to medication response studies, no such database or predictive algorithms are currently available in neurofeedback. At this time, recommendations for use of specific NFB protocols are made based on the experience of expert clinicians. Frank H. Duffy, a physician well known for his use of quantitative EEG methods, notes that NFB is a promising treatment modality but, there is not general agreement on how to determine which EEG signal to use for feedback purposes (Duffy, 2000). Development of qEEG databases with outcome data and predictive algorithms similar to those used with medication response studies will likely help in selecting treatment protocols and increase the clinical efficacy of neurofeedback.

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Quantitative EEG

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News Release, April 13, 2000

New Foundation Started to Support Training and Research in Behavioral Medicine

The non-profit "Behavioral Medicine Research and Training Foundation" was founded this January to promote research and education in clinical behavioral medicine.

Effective incorporation of behavioral medicine techniques into the treatment of a wide variety of clinical problems has been stymied by the lack of appropriate training in these techniques among health care providers as well as the frequent poor design and small sample sizes utilized in studies supporting these applications. Even those techniques which have been well documented enough to be acceptable to the health care community, such as behavioral treatment of headache and biofeedback for fecal incontinence, have not been widely used because few health care providers are trained to apply them effectively.

This unfortunate cycle is being broken at the Behavioral Medicine Research and Training Foundation. This new, unique facility is bridging the gap between behavioral and traditional medicine through providing a combination of education of the health care community and support for high quality research in the field.

The Foundation supports continuing education of licensed/certified clinicians from all health care fields, such as medicine, nursing, psychology/counseling, physical therapy occupational therapy, and social work in order to assist these clinicians in incorporating behavioral medicine techniques into their practices. For clinicians who want to learn about specific areas of behavioral medicine, the foundation offers individual, two day continuing education courses in such areas as "Psychophysiology of pain," "Behavioral interventions for headache," "Pediatric applications in behavioral medicine," and "Behavioral interventions for pelvic floor disorders." For those who want a broad education in behavioral medicine, the Foundation offers courses leading to doctorates in behavioral medicine and psychology-behavioral medicine emphasis.

Instructors for upcoming courses include such luminaries as Dick Givertz, Wes Sime, Don Moss, Suzanne Woodward, and Seb Striefel.

A full schedule of continuing education courses and the doctoral program catalog can be found on the Foundation's Web site, which is *behavmedfoundation.org*. For questions, please contact the Foundation's director, Dr. Rich Sherman at or (360) 598-3853.

Electrode Atlas For sEMG

Jeffrey R Cram, Ph.D.

Placements for ancillary muscles of respiration

Respiratory dysregulation can result in musculoskeletal problems of the neck, shoulder and arms. For example, Thoracic Outlet Syndrome (TOS) type symptoms and even Repetitive Strain Injuries (RSI) may be related to inappropriate recruitment of scalene muscle associated with improper breathing. Neck, shoulder and occipital headache, like wise, may be associated with the inappropriate use of these ancillary muscles of respiration. In this article, I will look at two types of electrode placements which may be used to assess the sEMG breath — connection, along with a few sample tracings of recruitment patterns.

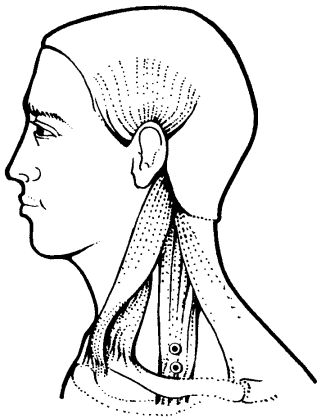

Figure 1. Electrode placement for monitoring of scalene muscle.

Scalene (Anterior) Placement. This placement is considered to yield specific recordings from the scalene muscle. In addition to its actions of lateral cervical flexion, assistance in forward flexion and general stabilization of the cervical region, it plays a role as an accessory muscle of respiration. The anterior scalene arises from the anterior tubercle of C3, C4, and C5 and inserts into the scalene tubercle of the first rib. It is innervated by the motor branch of the spinal nerves C2 to C7, depending upon location of attachment.

Electrode Placement. Palpate the SCM just lateral and above its attachment to the clavicle. Move posterior towards the outer superior edge of upper trapezius. Find the hollow triangle which lies just posterior to the SCM, just above the clavicle and just anterior of the upper trapezius. Isolation of scalene is better when the electrodes are placed in the hollow by the clavicle than when placed higher up on the neck. Two active electrodes (2 cm apart)

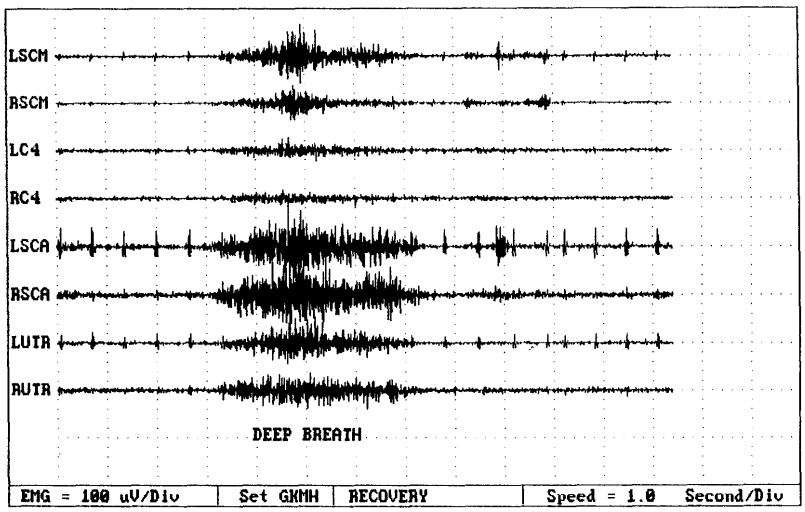

Figure 2. SCM, mid cervical paraspinals at C4, scalene and upper trapezius are presented showing a normal pattern of recruitment during deep inspiration. As can be seen, there is no spontaneous respiratory recruitment at rest, and three out of the four muscle groups participate during the deep inspiration movement.

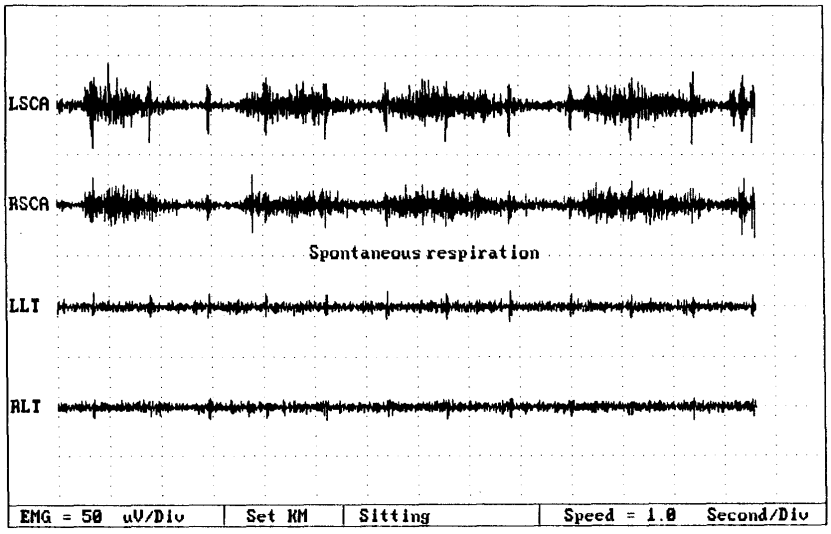

Figure 3. Surface EMG recordings from scalene (SCA) and lower trapezius (LT) during quiet sitting. Note the pattern of rhythmic activation in scalenes associated with respiration. This is considered an inappropriate use of the ancillary muscles of respiration.

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Electrode Atlas

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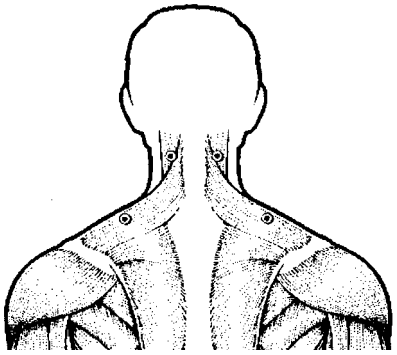

Figure 4. Electrode placement for the cervical — upper trapezius site.

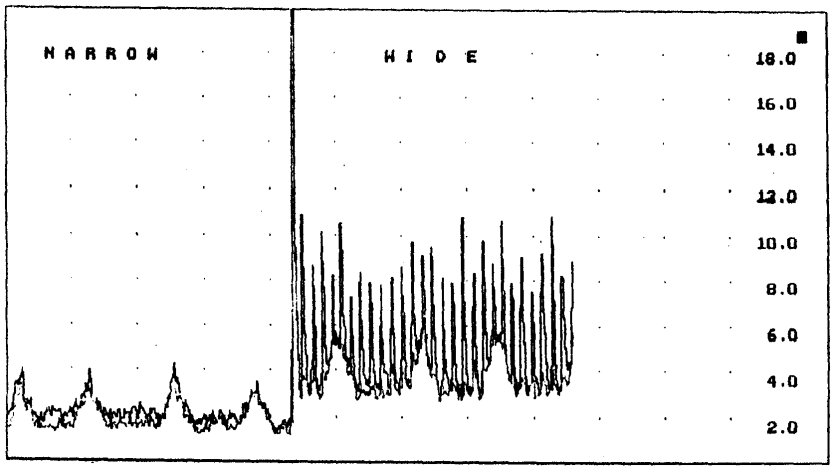

Figure 5. sEMG recordings from cervical trapezius during at rest. The right aspect of the tracing was conducted using a wide (25-1000 Hz) filter, while the left aspect of the tracing was conducted using a narrow (100-200 Hz) filter. Notice how the 100-200 Hz filter eliminates the ECG artifact, while the left aspect of the cervical trapezius leads shows a striking ECG artifact. Also note that the dysfunctional pattern of respiration may be seen with both types of filtering.

are placed on a slightly oblique angle just above the clavicle in the "hollow triangle," such that they parallel the muscle fibers. See Figure 1.

Cervical Trapezius (Wide) Placement. This site is known as a general placement strategy. It will monitor general muscle activity from the upper back and neck (upper trapezius, levator scapula, scalene, etc), while assessing right and left side differences.

Electrode Placement: Two sets of electrodes are used. One for the right aspect and one for the left. For each side, one electrode is placed in the middle cervical area (approx. C4) and about 1 cm lateral from midline over the muscle mass. Palpate to locate the muscle mass which parallels the spine. The second electrode is placed over the upper fibers of trapezius, along the ridge of the shoulder, approximately half the distance between the cervical vertebra at C7 and the acromion. Palpate the muscle mass and place slightly lateral to that center point. See Figure 4.

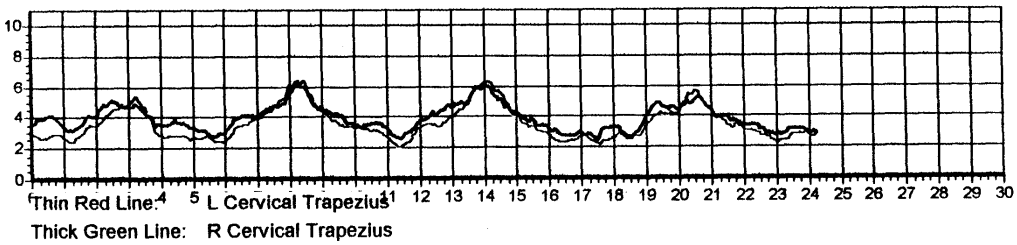

Figure 6. Cervical trapezius recording in a patient who tends to be a chest breather. The ancillary use of these muscles can be clearly seen in the four undulations.

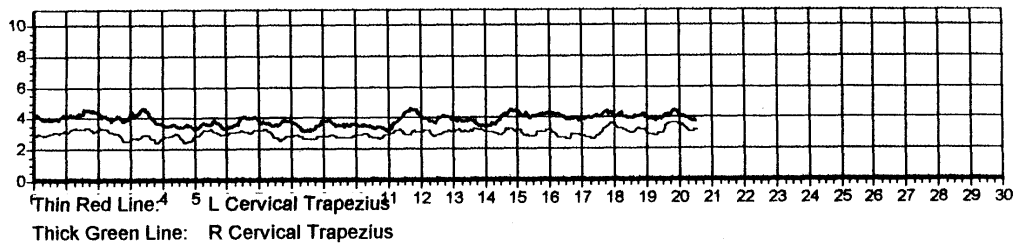

Figure 7. Cervical trapezius recording in the same patient following training in how to breathe abdominally.

Jeffrey R Cram, Ph.D. is the clinical director of the Sierra Health Institute in Nevada City, California where he treats patients and teaches workshops on surface EMG. He is the co-author of three books on surface EMG. The contents of this article have been abstracted from *Introduction to Surface EMG* by Aspen Publications. For more information visit his Web site at www.semg.org.

Neurofeedback

Training Nonverbal Clients: Very Young, Brain Injured or Developmentally Delayed

Susan Othmer

I am frequently asked how old a child must be in order to train successfully. Or whether we can train a severely brain injured person who cannot follow verbal instructions. And what about low IQ clients? We usually rely strongly on verbal communication with our clients about how they feel and what they notice about their internal state as they train. Can we succeed without this verbal communication?

It is helpful to remember that beta/SMR training began with Barry Sterman's research, teaching cats to produce SMR spindles for a reward of milk and gravy. This operant conditioning worked by catching the cats spontaneously doing "the right thing" and immediately rewarding them. The behavior increased even though the cats did not receive an explanation of what they should do. And, being cats, they probably had no interest in communicating with the investigator.

Neurofeedback training rewards the subject (client or cat) for shifting and maintaining brain state. Ultimately the subject learns the skill of managing brain state appropriately and easily. We want an automatic capability rather than a conscious strategy. Conscious effort is a limited resource. If we expend it managing our physiological state, then we have less available for thinking and learning and doing in our lives.

The question is whether we can provide nonverbal clients with feedback on their brain state that is sufficiently engaging and rewarding, that they will learn from the experience. The clear results from our clinical work indicate that it is possible to train young children of any age, and it is possible to train brain injured or developmentally delayed people who are unable to speak or understand verbal instructions.

Feedback for all of us needs to be

engaging and easy to understand. We are all rewarded by stimuli that are changing, moving, exciting or entertaining. When the feedback loses color, sound and movement, it becomes boring and thereby less rewarding. For nonverbal clients it becomes even more important to provide feedback clearly and compellingly. Visual feedback can be enhanced by moving the feedback display closer to the client, thereby filling the visual field. Even autistic children, who sometimes look away from the screen, are taking in the visual information during their brief glances. Auditory information is especially important when the client is unable or unwilling to look at the visual display. Headphones, or small earphones, can be used to help screen out extraneous auditory input. Tactile feedback is also helpful for some clients in providing direct somatosensory feedback on the amplitude of the reward frequency. This engages another sensory channel, which may increase the power of the feedback, especially when other sensory channels are impaired.

Nonverbal feedback and support from the neurofeedback clinician are always an important part of training. When we are unable to explain the rules of the game and the reward structure, this becomes critical. Young children can sit on a parent's lap. Parents know how to communicate encouragement and pleasure with accomplishment to their child. And they can help direct a child's attention to the visual and auditory feedback. With a severely impaired brain injured patient, one might reinforce the scoring (when training criteria are met) with an encouraging smile or touch or an emphatic "good" or "yes."

A good example of working with a nonverbal client involves a severely brain injured two-year old who nearly drowned in a swimming pool. When he first came to training, he was rigid, agitated, in physical pain, and barely conscious. At first his mother or father held him during the session. It was not clear whether he could see at all. We brought the feedback screen up close in case he could see it. Over time his mother discovered that he did better with a small earphone to help him focus on the auditory feedback. Sometimes he likes the tactile feedback, sometimes he doesn't want it. He has improved dramatically with training, although he is still significantly impaired. His body is now appropriately relaxed and loose. He sometimes sits in the chair by himself, propped up with pillows. He is more alert and aware of his surroundings. And he is starting to vocalize again and express his pleasure or displeasure with what is going on.

As neurofeedback finds its way into treatment centers for young children with neurological disorders and adults with severe acquired brain injury, we can expect some interesting developments in instrumentation as well as therapeutic technique. We can imagine specialized displays of emotionally powerful images that could enhance engagement and reward during neurofeedback training. We know this training is worth doing. We will surely find ways to do it more efficiently.

Two Medicare Panels Agree: No Science Supports Biofeedback

John D. Perry, PhD

When the Health Care Financing Administration (HCFA) announced last summer that it was going to review the use of biofeedback and electrical stimulation in the treatment of urinary incontinence, practitioners were delighted with the prospect of finally "getting our day in court". None of us were prepared for the massacre that lay ahead.

Biofeedback practitioners expected HCFA to review the published evidence supporting the efficacy of biofeedback treatment, and to conclude that a uniform national reimbursement policy (rather than the current varying regional options) should be established. After all, two federal panels under the Agency for Health Care Policy and Research (1992 and 1996) had vigorously affirmed the value of biofeedback in clinical practice. Now we expected HCFA to back this up with solid reimbursement schedules. It didn't happen the way we expected, and the future does not look rosy.

In between the decision to review biofeedback and two recent public hearings was a separate policy-level decision to revamp the way HCFA goes about reviewing medical treatments. HCFA, they announced, was switching to "evidence-based-medicine," the current politically correct way to evaluate medical practices.

During the fall of 1999 many major medical organizations, from the AMA to the AAPB, national nursing groups, and individuals, as well as several instrument manufacturers submitted "scientific" documentation in support of biofeedback (and most in support of electrical stimulation). After we had met a December 8 submission deadline, HCFA suddenly announced that the January 15 hearings would be postponed until mid-April. No one knew why, but there was rampant speculation that HCFA was overwhelmed with the sheer volume of our submissions.

But it wasn't until late March that we learned the real reason for the delay — HCFA had commissioned an "independent technology assessment" from none other than our old "friend", BlueCross/BlueShield Association's Technology Evaluation Center (TEC). TEC was already famous for issuing a difficult-to-obtain report condemning biofeedback in 1997. (I've had a Freedom of Information Act request pending for nearly two years, but they still claim not to be able to locate it.)

The TEC evaluations — nearly 100 very packed pages — were posted to the HCFA website just two weeks before the public hearings. The documentation which each organization had each worked so hard to prepare was not presented to the Panel members, after all. (We were assured that HCFA staff members would consider it, of course.) Finally, HCFA also posted a narrow list of Acceptable Questions that could be addressed in the public hearings.

The April 12th hearing before the Medical-Surgical Procedures Panel in Baltimore was an historic event. Representatives of almost all relevant professional health organizations spoke in support of biofeedback treatment for incontinence. Not necessarily obvious was that most of the presenters had been communicating among themselves before the meeting on the Internet. (HCFA had sent email to all presenters, with all their email addresses exposed!)

But only a few presenters managed to change their long-planned presentations to address the limited questions that were allowed, and much of their testimony was simply disregarded. In the end, Panelists were forced by HCFA to address only the one question presented in the BC/BS TEC report: "Is there convincing scientific evidence that Biofeedback is superior to 'Pelvic Muscle Exercises alone." All seven male physicians voted "No," while two female physicians voted "Yes." A similar vote the next day on Electrical Stimulation was 7-1 against.

Most outside experts and several panel members were vocally upset at the procedures followed in the hearing. The first formal protest came two weeks later when the non-voting Consumer Representative, Phyllis Greenberger, sent an angry letter to HCFA. Other protests soon followed, including one from the AMA, which had not been present in the first hearing.

On June 6 the Executive Committee of the Medicare Coverage Advisory Committee met to "ratify or reject" the Panel's negative report. Although many professional organizations again testified in support of biofeedback, the committee unanimously ratified the negative report. The next step — due in early September — is for HCFA staff members to formulate policy for Medicare reimbursement for biofeedback. Based on the official "rules," however, HCFA is *not* bound by the Panel's finding. They can decide Yes, No, or literally anything in between, such as providing coverage but only two visits in a lifetime. No one is taking any bets.

What are the issues?

1. Process Issues. HCFA failed to follow key elements of their announced procedures. For instance, public announcements of deadlines were posted after the deadline passed. The procedures call for a review of the technology assessment report by up to 6 "outside experts" familiar with the technology — but HCFA didn't have time to do that. At the June meeting HCFA refused to hear criticism of past actions, and allowed only "future" suggestions.
2. "Science" Issues. Every professional group from the giant American Medical Association on down agrees with AMA that limiting "science" to "randomized con-

trolled studies of sufficient size" is overly narrow and restrictive. AMA notes that there is hardly any branch of medicine that would survive such a test, and they argued for the inclusion of appropriate clinical series and expert opinion. HCFA refused to hear criticism of this issue in June.

3. "Evidence" Issues. It wasn't until several weeks *after* the April hearings that researchers began to notice several factual errors in the BC/BS TEC report. For instance, the one "acceptable" study of biofeedback for urge incontinence (Burton, 1988) did *not* use "PME Alone" in the control group for urge patients, and the one "acceptable" study of post-prostate surgery incontinence (Franke, 2000) did *not* use "PME Alone" in their control group. HCFA refused to hear any discussion of these errors after the April 12 hearings.

What lies ahead?

At least one organization has taken the position that we should wait until HCFA rules, and then sue them in court. But that could take years; most professional organizations think it is time to seek congressional intervention, and several members of congress have already indicated they are concerned about the situation. Many of the biofeedback-for-incontinence instrument manufacturers are small businesses that would go out of business during a protracted legal battle. The same is true of most "Continence Clinics" in the country.

Most national nursing, physical therapy, and biofeedback organizations (among others) will be working hard in the coming weeks to attract grass-roots support and congressional and media attention to the problem. While Medicare decisions directly effect the elderly, in practice many private insurance providers adopt Medicare coverage policies for all ages.

Where to find information

Up to date news about the Medicare biofeedback battle is posted at *http://www.incontinent.com/home.htm#protests*. In addition, the presentations, protest letters, and other documents from many professional organizations are either posted there, or links are provided to their sites.

The Mind-Body Connection

Insomnia, Biofeedback and Stress Management

Marjorie K. Toomim, Ph.D.

Biofeedback training is generally recommended for treating insomnia. However, insomnia is a complex disorder and can be more effectively treated if we understand the factors underlying each case.

Insomnia is a condition in which individuals complain of difficulty initiating and/or maintaining sleep and/or of nonrestorative sleep. The condition must last at least one month and significantly interfere with social, occupational or other important areas of function. According to the DSM- IV (1994, pg. 554) 30%-40% of the general adult population suffers from primary insomnia (does not occur exclusively during the course of another sleep disorder or mental disorder, and is not due to the direct physiological effects of a substance or a general medical condition).

Insomnia often occurs in relation to another mental disorder. It may precede a clear depressive episode, accompany the depression, and persist long after the depression is resolved. Depressed people often waken early in the morning. Serotonin is an important factor in sleep and in depression. A serotonergic antidepressant may produce the amount of serotonin needed for sleep.

Insomnia is a common symptom of generalized anxiety disorder, especially among chronic worriers. People with panic disorder may be awakened by panic states which occur while sleeping. It is a major symptom of post traumatic stress disorder. Many traumatized people fear losing control and relaxing their vigilance with sleep. People who have been abused as children often fear sleep because it is associated with sexual assault. Anxiolytic medications may reduce anxiety enough to allow sleep.

Alcohol consumption at night produces a fragmented sleep pattern about four hours after drinking. Many people drink alcohol to induce sleep, and then waken four hours later.

Sleep patterns are highly conditionable. This factor is especially significant among those who worry about their physiological states, believe they must get a certain amount of sleep

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Neurofeedback

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every night to maintain their health, and those who generally function with hyperaroused autonomic nervous systems or increased muscle tension.

People who have trouble sleeping because they are physiologically hyperaroused do well with biofeedback training. Here the psychophysiological evaluation generally reveals a hyperreactive SCR/EDR that fails to recover or takes a long time to recover after stimulation. Peripheral temperature may also be labile. In this case, the individual will usually report taking a long time to unwind after their workday. They may take as long as two hours to quiet, and will be very sensitive to emotional disturbance during or after dinner. They may be sensitive to noise, light and other environmental factors.

Here it is important to (1) lower the general arousal level so less stimulating stress hormones are produced, and (2) develop attitudes which allow the person to be more accepting of disturbing environmental and emotional stimuli. This may be accomplished by a combination of deep relaxation training and cognitive behavior modification techniques designed to alter perceptions and attitudes. Imagery and suggestions developed during deep relaxation are particularly valuable. To down train arousal levels, the individual must take 5 to 10 five-minute relaxation breaks during the day, and deeply relax 15 to 20 minutes before sleep. The use of a sleep inducing relaxation tape is important.

Titrate patients off sleeping medications by first training relaxation while using the full medication dose. When the relaxation response is learned, then gradually reduce both the physiological and psychological dependence on medication. It may take several months to complete the process.

People who are muscularly tense do well with EMG training. Here I use a wrist-to-wrist placement where each live electrode on a lead is placed on each wrist and an ankle-to- ankle placement where each live electrode on a lead is placed on each ankle. I use an SCR/EDR and a Thermal instrument in the other two of my four channels. I train to a criterion of less than 3 microvolts wrist-to-wrist and 1.5 microvolts ankle-to-ankle, to be maintained when stressed. SCR/EDR should rise with a deep breath or emotional stimulus and immediately return to baseline. I train finger temperature to a criterion of 93-95 degrees F., to be maintained in the presence of emotional stimulation. Pat Norris suggests the criterion level be 98 degrees F.

General relaxation is less effective when people cannot quiet mentally. EEG training has proven useful in treating insomnia. Training SMR in the central motor strip probably relaxes muscles and is associated with mental quieting. No studies have been reported which monitor associated autonomic and muscular changes. I also use occipital alpha and alpha/theta training and brain balancing for mental quieting. These states must be maintained with mental/emotional stimulation.

Cognitive Behavior Modification techniques are useful to gain control of mental function. For chronic worriers, a 30-minute "worry time" should be firmly established. *ALL* worrying must be restricted to this 30-minute time period and must do nothing during this time *BUT* worry. After a month of this, one of my patients remarked, "I can't think of enough things to worry about to occupy the whole half hour. It is very boring. Is it OK if I think of something else at this time?" As long as the patient worries, it is better to keep a defined worry time, though the time may be reduced.

A second technique is to turn worry into problem solving. Worriers constantly restate problems or add problems to any possible solution. In this technique, worriers must do one bit of behavior that would move them toward a positive resolution of a problem. For example, an individual who worries about a work relationship must make a phone call, write a memo, or plan a conversation which might improve the relationship and commit to a time to do it. This process may be monitored with instruments to ensure emotional openness and aliveness.

A third technique is to list each worry on one side of a page and make a check next to the worry every time it comes to mind. The individual thus realizes the list of worries is limited, but each is repeated so often it feels like a lot more. Then the individual writes a positive statement to counter each negative statement. For example, if the worry is, "I can't quit my job because I will never get another," the countering statement might be, "I have a number of valuable work skills (list them) and personal attributes (list them). Other opportunities will be open to me when I am ready to accept them."

Imagery and metaphors, which involve feelings of security, strength, power, acceptance of self and others, acceptance by others are very useful, as is assertiveness training. Teaching sleep hygiene principles is important.

Reference:

American Psychiatric Association: DIAGNOSTIC AND STATISTICAL MANUAL OF MENTAL DISORDERS, Fourth Edition. Washington, DC: American Psychiatric Association, 1994.

BOOK REVIEW by Rick Harvey, President, BSC

Healthy Computing with Muscle Biofeedback: A Practical Manual for Preventing Repetitive Motion Injury*

Professor Erik Peper and Katherine Hughes-Gibney, professional colleagues and friends, have performed several research studies, authored several articles and presented many workshops about staying healthy while working at the computer. With many cheers from health care practitioners, their thorough guide to ***Healthy Computing with Muscle Biofeedback: A Practical Manual for Preventing Repetitive Motion Injury*** accumulates in one text a compendium of knowledge rich in fundamental and advanced insights that address an epidemic problem of computer-related disorders. The book is essential reading for any professional interested in hands-on, practical methods for preventing or mitigating the effects of computer-related disorders. Peper and Hughes-Gibney debunk the myth of "repetitive" injury with insight gained from research, observation and working with clients and corporations. The *Seven Components of Healthy Computing* described in this useful handbook help all to understand this complex problem.

Healthy Computing with Muscle Biofeedback provides some alarming statistics. The Center for Disease Control estimates that 15-20% of computer users, (around 40 million people or more), are at risk for repetitive strain injuries and musculoskeletal pain disorders. These disorders include various forms of tendonitis or "Carpal Tunnel Syndrome" and, not surprisingly, reports of all types of computer-related disorders (CRDs) are skyrocketing in North America and around the world. According to estimates of the Department of Labor, the direct or indirect costs to industry range between $7-25 billion annually for injury claims, lost productivity, and retraining of replacement workers. The Department of labor estimates that various types of injury claims cost employers between $8,000-$34,000 on average. The National Institute for Occupational Safety and Health made several recommendations to Congress related to ergonomic standards in the workplace, but these standards are only slowly being implemented. So what do we do about the problem pain and other disorders of unhealthy computer use?

Healthy Computing with Muscle Biofeedback provides a systematic approach to understanding and preventing CRDs. This helpful manual methodically outlines training modules for working with employees and clients. The beginning sections of the text focus on assessment and measurement of upper extremity (arms, neck and shoulder) musculoskeletal stress. The techniques and instructions described include very practical advice for using portable electromyography at worksite locations to assess and reduce CRDs.

The next section of the book describes techniques for monitoring responses to a set of standardized biofeedback exercises. These protocols are designed to increase muscle awareness during computer use. Here, the biofeedback field owes a debt of gratitude to Peper and Hughes-Gibney; developing standardized protocols for assessing and monitoring computer-related muscle awareness is a time consuming task and we benefit from their accumulated effort. Having a standard of comparison also makes our jobs easier since a lack of standards of comparison makes the goal of eliminating CRDs more difficult.

Biofeedback follows a "measure, monitor, modify" sequence when assessing and training awareness. Developing recommendations for modifying computing behavior depends on setting. The authors suggest several approaches for replacing old computing habits with healthy ones. These include recommendations for ergonomic evaluations as well as personal guidelines for practicing healthy computing. Practice is the key to modifying behavior, and the exercises described in this manual are designed for successful integration into everyday work routines.

The text flows logically and reads easily, with clear illustrations on electrode placement. This book will find a natural audience among ergonomists, physical and occupational therapists, psychologists, physicians and osteopaths, chiropractors, body workers, and other health practitioners that deal with somatic disorders. I highly recommend adding ***Healthy Computing with Muscle Biofeedback*** to your working library. It is an indispensable guide to preventing pain associated with computer use and your clients, patients and staff will thank you.

Healthy Computing with Muscle Biofeedback* is published by the Biofeedback Foundation of Europe and available in the United States from Work Solutions USA, 2236 Derby Street, Berkeley, CA 94705; email worksolusa@aol.com

Unlearning Test Anxiety Using Capnometry and Biofeedback: A New Course at UC Berkeley

Anita Bhat, Julie Shieh, Naras Bhat,

Introduction

Test anxiety, the fear of being judged, has three components: emotionality, worry and stress reactivity. Test anxiety contributes to stop-out, dropout, or burnout of students. The anxiety sensitivity pervades in all evaluative situations of life. At UC Berkeley we have developed a new academic course to unlearn test anxiety. The key feature of the program is to shift the students' attention from task irrelevant interoception of anxiety arousal to the self-efficacy of refocusing on the test questions. Capnometry and biofeedback was helpful to reverse this learned helplessness of students.

Subjects and Method

Thirty-seven students in 1998 were enrolled in the two-unit test anxiety course of 14 classes. The lecture topics included new biology of emotional intelligence, stress physiology, and dynamic desensitization. Group exercises included interoceptive drills to elicit different body perceptions of anxiety arousal, biofeedback assisted tools of stress resilience to bounce back from acute blank out ("emotional hijacking") of test anxiety, and guided self-disclosure. The biofeedback included individual capnometry during baseline, recalled and actual test anxiety induction, and relaxation recovery. Pre and post measurements included Spielberger's Test Anxiety Inventory, and Beck's Helplessness Scale.

The logistics of organizing the UC Berkeley test anxiety course is as follows: The course was announced on the campus, and was sponsored by Christina Maslach, Ph.D, Professor of Psychology. The course is coordinated, and conducted by the students and a teaching doctor, and demonstrated by a professional biofeedback therapist from the community. The general information sheet on the problem of test anxiety, and the road map of the 14 classes were attached.

Results and Discussion

The most impressive result was the reduction in the capnometry readings during recalled test anxiety, which bounced back by refocusing on mindful diaphragmatic breathing of prolonged expiration. The "Trojan horse" induction process at the first class showed that the baseline mean capnometry of 39.4 (SD=2.9) dropped to 31.8 (SD=7.6) during test anxiety recall, and bounced back to 37.0 (SD=3.2) after the intervention. One way ANOVA showed significant difference between conditions ($F(2,72)=28.97$, $p<.001$), Scheffe test analysis between baseline and stressor ($F(2,72)=27.8$), stressor and relaxation ($F(,72)=12.83$ were significant. Simultaneous biofeedback of skin resistance, breath waves, and hand temperature were projected on a screen for group learning. The biofeedback helped to build the belief that test anxiety is not an external event, but a "learned alarm" of interoceptive sensitivity that can be unlearned. Systematic and dynamic desensitization were demonstrated in class, and scripted for homework. Details of the course protocol, pre-post measurements, and student feedback will be displayed as a poster.

Conclusions

The essential core of the program is utilizing biofeedback modalities to shift the perception of the test anxiety student to an internal locus of control. Interoceptive drills were conducted to provoke the internal body sensations of anxiety while biofeedback demonstrated the physiological changes. Dynamic relaxation was easy to teach with capnometry and skin resistance feedback. On-line confirmation of capnometry changes during recalled test anxiety worked as a "Trojan horse" induction (technique of Wickramsekara) to convince the students that test anxiety is just a perception of your own body arousal, rather than a real threat outside of you. The model of "emotional hijacking" explained by the neuroscientist, Joseph Ladoux, was useful in teaching students how to come out of "blank out" during test anxiety, by using centering, and diaphragmatic breathing. Biofeedback speeds up "unlearning" of test anxiety.

Future Research

Research has similarly been conducted on the 1999 school year UC Berkeley Class, and will continue as planned for future classes. New measurements were taken and the results are still being analyzed. Past research includes the effects of a 5-Visit biofeedback protocol in reducing test anxiety.

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Key words: test anxiety, emotional intelligence, stress resilience

25th Annual BSC Convention—Biofeedback Through the Ages — November 12-14, 1999 — Valencia, California

AUDIOTAPE ORDER FORM

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012	"Sleep Training" & Other Applications of 3D Sound Enhancement Therapy Systems — *Chris Alsten, PhD*	1	10.00
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014	Breathing for Health with Biofeedback — *Erik Peper, PhD & Katherine Hughes Gibney*	1	10.00
015	Home Training: The Crucial Link — *Ira Rosenberg, MA*	1	10.00
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017	Alpha-Theta Neurofeedback for Treatment of Anxiety Disorders & Optimal Functioning — *Stephen I Sideroff, PhD & William Scott, MA*	1	10.00
	Healthy Computing with Muscle Feedback — *Erik Peper, PhD, Katherine Hughes Gibney & Rick Harvey, MA*	1	10.00
019	Using Biofeedback in Marital Conflict — *Ray Varlinsky, MA*	1	10.00
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039	Keynote Address: Applied Psychophysiology in the New Millennium — *William Coby, PhD*	1	10.00
040	PANEL 4: Treatment Strategies & Biofeedback, Part 1 — *Stephen Sideroff, PhD & Janet Giler, PhD*	1	10.00
041	PANEL 5: Treatment Strategies & Biofeedback, Part !1 — *Naras Bhat, MD, Dick Gevirtz, PhD, John D. Perry, PhD*	1	10.00
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