

## **Abstracts of Scientific Papers Presented at the 10th Anniversary Meeting of the Biofeedback Foundation of Europe**

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*Erik Peper, PhD, President of BFE*

*Monika Fuhs, Program Chair of BFE*

The 10th anniversary Meeting of the Biofeedback Foundation of Europe (BFE) was held February 14–18, 2006, in Vienna, Austria. The meeting was sponsored by the Österreichische Gesellschaft für Biofeedback und Psychophysiologie and co-sponsored by The Association for Applied Psychophysiology and Biofeedback, University Clinic Vienna, Biofeedback Association of Serbia, Biofeedback Society of Florida, Deutsche Gesellschaft für Biofeedback e.V., Israeli Association for Applied Psychophysiology and Biofeedback, International Stress Management Association—Dutch branch, International Society for the Advancement of Respiratory Psychophysiology, Practice for Research and Education, Medical University of Vienna and University of Vienna. The meeting had the highest number of participants and demonstrated the ongoing and dynamic growth and interest in biofeedback and self-regulation from researchers and clinicians.

The BFE was established as a non-profit foundation in The Netherlands to promote the development of clinical, educational and research applied psychophysiology and biofeedback in Europe with Dr. Erik Peper as President. Mag. Monika Fuhs was the program chair and Dr Barry Sterman organized the EEG scientific program. The annual meetings consist of intensive 1 and 2 day workshops that teach in-depth knowledge and skills and a scientific program. The workshop faculty and keynote speakers for the scientific program are invited international experts, and all presentations for the scientific program are refereed by the program committee. The excellent workshops and scientific presentations were enhanced through the collaboration and sharing of knowledge by researchers, clinicians and educators from different disciplines and countries.

The 10th meeting featured a variety of program themes, as reflected in the numerous workshops, keynote addresses, and symposium and poster presentations. These themes included: psychophysiology of respiration, incontinence and pelvic floor disorders, chronic pain and muscle rehabilitation, stress and pain management with children and adolescents, how neurofeedback changes the brain, peak performance, complementary methods and skills to enhance success, RSA feedback, biofeedback at the workplace, and psychosomatic disorders.

Next year's meeting program committee will be under the co-chairmanship of Mag. Monika Fuhs and Dr. Erik Peper. For information see the website: [www.bfe.org](http://www.bfe.org) or email to [info@bfe.org](mailto:info@bfe.org). The journal is pleased to publish the abstracts from the scientific portion of the meeting.

**ABSTRACTS SCIENTIFIC PROGRAM 10TH BFE MEETING VIENNA  
FEBRUARY 15, 2006**

**INVITED LECTURE**

**Surface electromyography assisted pelvic floor muscle assessment and rehabilitation  
for urogenital and sexual pain dysfunctions**

*Howard Glazer,<sup>1</sup> Cornell University Medical College/New York Presbyterian Hospital*

This presentation reviews the work of Howard Glazer Ph.D. in the diagnosis and treatment of lower urogenital tract pain disorders and sexual dysfunction employing intravaginal surface electromyography. Basic pelvic muscle anatomy and physiology are presented along with the hardware/signal processing and software/Glazer protocol employed in intravaginal surface electromyography. Dr. Glazer's peer reviewed medical journal publications in the development of pelvic floor sEMG for diagnosis and data base development and pelvic floor muscle sEMG rehab for treatment are presented.

**KEY WORDS:** urogenital tract pain disorders; sexual dysfunctions; intravaginal surface electromyography biofeedback.

**EEG Neurofeedback of ADHD subtypes: Protocols derived from neuro-imaging  
and clinical studies that maximize success**

*Lynda Kirk,<sup>2</sup> Austin Biofeedback Centre*

Current research demonstrates clinical efficacy for EEG neurofeedback in the treatment of Attention Deficit Hyperactive Disorder (ADHD). Epidemiological studies conducted by the American Academy of Pediatrics show that "ADHD is the most common neuro-behavioral disorder of childhood" with an estimated prevalence of 6 to 9% of children in the USA. In addition, recent studies estimate that up to 70% of children with ADHD continue to exhibit symptoms in their adult years that significantly interfere with academic, vocational, and social functioning. With concerns about the safety, side-effects, and ineffectiveness of ADHD medications, non-drug alternatives are becoming more viable in the treatment of ADHD and are increasingly being sought out. This lecture will cover how to identify which ADHD subtype(s) you are seeing and the appropriate EEG neurofeedback protocols that have been shown to be effective. It will specifically review ADHD and its historical treatments; common co-morbidities that present with ADHD; the characteristics of clients for whom EEG neurofeedback is indicated; important neuro-imaging and QEEG findings in individuals with ADHD; the three "tried and true" protocols for ADHD subtypes which are supported by published, controlled group

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studies; and the six main protocols developed from neuro-imaging data—both QEEG and SPECT.

**KEY WORDS:** ADHD; ADHD subtypes; neurofeedback protocols; QEEG; neuro imaging.

## FEBRUARY 16, 2006

### Improving attention in adults and children: Differing eeg profiles and implications for training

Lynda Thompson,<sup>3</sup> ADD Centres Ltd.

*Problem:* Intervention with adults who present with weaknesses differences differs from intervention with children due to different EEG patterns.

*Subjects:* Subjects were 165 adults age 18 to 65 and 100 children age 6 to 17 seen consecutively in one office at the ADD Centre.

*Method:* EEG data collected during initial training session interview was reviewed. The hypothesis based on clinical observations was that some adults with ADD symptoms exhibit a 'Busy-Brain' that correlates with high amplitude bursts of hi-beta activity, a corresponding dip in SMR, and a ratio of 26–34/13–15 Hz greater than 1.5. A second hypothesis was that this pattern would be rare in children except those with high anxiety and/or Asperger's syndrome. Ratios were calculated for: 4–8/16–20, 6–10/16–20, (4–8/13–21)<sup>2</sup>, 21–25/13–15, 26–34/13–15 Hz. The Monastra (4–8/13–21)<sup>2</sup> cut offs for ADHD were used to categorize clients as ADHD. In addition, a microvolt ratio >2.2 was used as an ADHD indicator for either 4–8/16–20 or 6–10/16–20 ratios. All the children had ADHD symptoms.

*Results:* Adults can distinguish how mental states correspond to different EEG patterns: Distraction/inattention due to internal ruminative activity correlates with bursts of 23–34 Hz. High 19–22 Hz activity was associated with emotional intensity (may be anxiety). This may be combined with slowing centrally and frontally with a 13–15 Hz 'dip.' 22% of the clinically ADHD adult group showed a high 26–34/13–15 Hz ratio as the only abnormality. Only 7% of the child ADHD group showed this. These children had high anxiety (included Asperger's). Mentally hyperactive, intense, high achievers (non-ADHD) showed bursts of high amplitude frontal and central 15–18 or 23–34 Hz activity.

*Discussion:* When bursts of hi-beta (between 19 and 34 Hz) activity is present it is important to identify what mental state this correlates to for each client. If it is a negative 'busy-brain' state (anxiety, tension, ruminations) the training program should be designed to decrease the hi-beta and increase high alpha (11–12 Hz), SMR (13–15 Hz) and do biofeedback to increase RSA and peripheral skin temperature while decreasing muscle tension as appropriate to the individual.

**KEY WORDS:** attention deficit disorders in children and adults; mental states; EEG patterns.

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## SYMPOSIUM 'HEADACHE'

(Chair: Frank Andrasik, Co-chair: Wolf-Dieter Gerber)

**Pharmacological vs behavioral treatment for children and adolescents with tension-type headache: Preliminary data at two year follow-up***Frank Andrasik,<sup>4</sup> Licia Grazzi,\* Susanna Usai,\* Gennaro Bussone\*, University of West Florida, \*National Neurological Institute "C. Besta"*

Recurrent headaches are common in children and adolescents. Most current investigations have employed limited modalities (either medication or behavioral) and few have included treatment comparisons. In this study relaxation training (provided in a limited contact format) (Group A) and amitryptiline (Group B) were compared for juvenile Tension-Type Headache. The clinical improvement was significant for both groups at 1- and 2-year follow-up (days of headache/month: group A: 14.7 vs 2.6 vs 2.6; group B: 18 vs 1.8 vs 1.2). In group B, 14 of the 37 patients refused medication for side effects and/or non-compliance, 12 achieved the 2-year follow-up, 11 have to complete the last follow-up. In group A, of the 33 initial patients, 13 achieved 2-year follow-up, 8 dropped out, and 12 patients have to complete the last follow-up. All patients came regularly for the sessions, practiced routinely, and appeared to be compliant and accepting of treatment, although we did not assess this formally. Although the clinical results were similar in both groups, relaxation therapy seemed to be more accepted than medication. The limited contact modality seems to be as useful as other behavioral approaches that need more clinical meetings, without unpleasant side effects.

Because the sample sizes are small, these conclusions are tentative. Data collection will continue on a larger sample of patients.

**KEY WORDS:** juvenile headache; behavioral therapies; pharmacological therapy.

**Behavioral plus pharmacological treatment vs pharmacological treatment for chronic headache with medication overuse and disability assessment:  
Results at two year follow-up**

*Licia Grazzi,<sup>5</sup> Frank Andrasik,\* Susanna Usai, Domenico D'Amico, Gennaro Bussone, National Neurological Institute C. Besta, \*University of West Florida*

The purpose of this study was to determine the clinical course of a sample of chronic headache patients with medication overuse, a particularly difficult headache to treat, 24 months following two different treatment interventions and to assess whether functional impairment, assessed by the MIDAS questionnaire, improved upon treatment. 103 chronic headache patients with medication overuse were studied: after inpatient medication withdrawal group A was treated by a behavioral approach (limited-contact group relaxation training) plus pharmacological treatment for headache prophylaxis, while group B was treated only by pharmacological treatment. Follow-ups were fixed 12 and 24 months after treatment. Forty-two patients achieved the 24-month follow-up (19 in group A and 23

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in group B): days of headache/month decreased (group A: 30 vs 16.8 vs 11.2; group B: 29.1 vs 11.2 vs 10.6), also medication-intake/month (group A 56.8 vs 14.5 vs 11.2; group B 51.5 vs 11.1 vs 9.9) and the functional impact of headache (MIDAS total score: group A 85.7 vs 29.4 vs 6.6; group B 73.6 vs 31.7 vs 3.1). Chronic headache with medication overuse led to considerable disability prior to treatment. Significant improvement in headache parameters and in disability measures occurred after the two treatment modalities, without significant differences through the available follow-up period. Longer follow-up is needed to confirm the efficacy of behavioral technique to reinforce the withdrawal effect and the prophylactic therapy over more extended periods of time.

**KEY WORDS:** chronic headache; medication overuse; MIDAS.

**Inpatient vs day hospital withdrawal treatment for chronic headache with medication overuse and disability assessment: Preliminary results at one year follow-up**

*Licia Grazzi,<sup>6</sup> Frank Andrasik\*, Susanna Usai, Domenico D'Amico, Gennaro Bussone, National Neurological Institute C. Besta, \*University of West Florida*

Patients with chronic headache and medication overuse are particularly difficult to treat, and several different approaches have been tried with varied results. Medication withdrawal, performed either on an outpatient or an inpatient basis, is commonly used before beginning appropriate pharmacological prophylaxis treatment. The purpose of this study was to determine (1) the clinical course of 2 samples of chronic headache patients with medication overuse 12 months following two different treatment interventions (inpatient or outpatient withdrawal) and (2) whether functional impairment, assessed by the MIDAS questionnaire, improved upon treatment. 44 patients were treated: group A was treated by inpatient withdrawal, while group B by outpatient withdrawal (day hospital program). The patients in both groups at the 12-month follow up (23 in group A and 16 in group B) significantly improved: days of headache per month decreased (group A: 29.1 vs 11.2; group B: 28.6 vs 10.6), medication/month (group A 51.5 vs 11.1; group B 44.6 vs 10.6), and a measure of functional impact from the MIDAS questionnaire (MIDAS total score: group A 73.6 vs 31.7; group B 62.4 vs 11.3). From these results the outpatient withdrawal by periodic clinical meeting seems to be as helpful for this category of patients as is inpatient withdrawal.

**KEY WORDS:** chronic headaches; medication overuse; MIDAS.

**Biofeedback and pain management in a therapeutical intervention: Pediatric headache**

*Ingrid Pirker-Binder,<sup>7</sup> Institut für Biofeedback & Stresstherapie & Coaching*

Biofeedback plays an important role in therapy. For children suffering from headaches it is one of the most efficient tools: In the presentation the role and application of multimodal

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biofeedback will be discussed. The presenter gives an overview how Biofeedback equipment in therapy can be used for diagnosis and treatment. Children need a special training program according to their age and learning style.

**KEY WORDS:** pediatric headache; biofeedback; pain management.

### **One for everything: Amplified respiratory feedback**

*Ursula-Katharina Haller,<sup>8</sup> University Clinic of Neuropsychiatry in Childhood and Adolescence*

Discussed are the biofeedback procedures in the special outpatients department of the University Clinic of Neuropsychiatry for Children and Adolescents with Prof. Dr. C. Wöber-Bingöl. The aim of the interventions are not only to reduce pain but to inhibit the development of migraine and headache itself by improved self awareness and self regulation skills. Therefore biofeedback is not only a very effective treatment technique but also a good skill for ongoing prevention in headache and migraine. The crucial point in this biofeedback technique is to guide the respiration. Slow and effortless diaphragmatic breathing is a way to create a state of deep relaxation. This deep relaxation stimulates a balance in the brain which is a useful basis for increasing self-regulation in children and thereby reduces pain. However as observing only one physiological parameter sometimes does not indicate a proper image of a person's psychophysiological state other parameters should at the same time be supervised too (heart rate, pulse, skin conductance, peripheral temperature, EMG). Only in the combination of all these parameters we receive the inner answers of a persons physiological state that can then be interpreted. To achieve a state of health supporting state, it is necessary to plan individual strategies for each patient by means of teaching self control through breathing.

**KEY WORDS:** pediatric headache; respiration techniques; pain reduction.

### **PAPER SESSION 'BIOFEEDBACK IN SPORTS AND AT WORK' (Chair: Gabriel Sella)**

#### **Complaints at the worksite: Resources balanced work & living**

*Ingrid Pirker-Binder,<sup>9</sup> Institut für Biofeedback & Stresstherapie & Coaching*

Based on our extensive study to examine computer related disorders and stress we present a holistic program designed to reduce stress and enhance health in Austrian companies. A short overview of the outcome of the study (based on Erik Pepers questionnaire) and the program will be presented. Long lasting benefits need a complete change in economic and

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organizational thinking. Biofeedback is used as a tool for diagnosis as well as for training (of social skills and stress reduction). We will discuss meaningful approaches in training modules to change organizational thinking and enhance health.

**KEY WORDS:** stress; computer related disorders; biofeedback.

### **Success under pressure: Strategies to reduce musculoskeletal injuries in the hospital setting**

*Candy Frobish,<sup>10</sup> Dallas VA Medical Center & Erik Peper, San Francisco State University*

Health care employees are at high risk for musculoskeletal injuries and biofeedback at job sites within the hospital can be a valuable tool for symptom reduction. This study investigated the use of biofeedback for a variety of hospital jobs that are done in the Operating room, Intensive Care Unit, Pharmacy and the Emergency Room. Each of these jobs required a high level of responsibility, precision and time urgency. The biofeedback applications were individually adapted because the employees have to put the care of patient ahead of their own needs—at times it is literally a matter of “life and death.” In many cases there were no easy ergonomic solutions and the only modification remained was for employees to be aware of and strengthen their mind-body connection and learn self-regulation strategies. Described, through a series of case examples, is an integrated strategy that combines job analysis, sEMG biofeedback and work style assessment, ergonomics, somatic and psychological awareness to optimize performance and health with in a hospital setting.

**KEY WORDS:** RSI; sEMG; hospital setting; ergonomics; somatic awareness.

### **Biofeedback combined treatment (biofeedback, psychotherapeutic treatment and coaching)**

*Brigitte Hueber,<sup>11</sup> private practice in Vienna*

*Initial Situation:* Stress at work and in private life has increased. The consequence is less quality of life together with psychosomatic ailments. Recent research (Tress *et al.*, 1999) states that up to 80% of all illnesses reveal that the psyche is involved. Employees who have symptoms first consult their General Practitioner and it often takes a very long time until they are ready to seek psychological or psychotherapeutic help. Especially as everything connected with the “psyche” is still viewed as dubious and there is a great fear of stigmatisation from colleagues and/or family.

*Goal setting and focus groups:* People who lose their balance through stress symptoms and fall ill should be caught in time by the therapy of INSOP and directed towards a pleasant quality in their lives. People who are in employment and already perceive that as a result of stress they have symptoms such as sleeplessness, racing heart beat, muscle tension, migraine, panic attacks or essential hypertension etc. can with the help of biofeedback and therapeutic talks and coaching overcome their problems.

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*Method:* A course of therapy consists of 12 to 15 single sessions with the same therapist. The aim is to build a trusting relationship between patient and therapist as quickly as possible. This encourages cooperation and the respective therapist knows exactly what the patient already has achieved and can therefore specifically aim at further helping him/her.

*Conclusion:* The combined treatment (biofeedback, psychotherapeutic treatment and coaching) of individuals in individual sessions with the same therapist shows a significant improvement at the end of the treatment. Out-patient treatment allows patients to keep their jobs. This type of out-patient treatment with clinical psychologists offers the opportunity to reduce costs for employers, employees and national insurance institutions by intervening in time.

**KEY WORDS:** stress management; biofeedback; psychotherapy; coaching; worksite; intervention program.

### **PAPER SESSION ‘NEUROFEEDBACK’ (Chair: Lynda Thompson)**

#### **Self-regulation of brain DC potentials by meditation**

*Michael Trimmel & Christina Pieringer,<sup>12</sup> Medical University of Vienna*

Meditation is a traditional technique to get in a specific state of mind by a behavioral procedure. States of “concentration,” of “mindfulness” and an eyes-closed relaxation control condition were investigated in 16 persons trained in meditation according a balanced within design. Brain DC potentials were recorded from 8 skin punctured locations against linked mastoids during the 22 minutes lasting conditions. Mood was assessed after each condition by the MDBF. Repeated ANOVA indicated a negative changing DC potential of  $-400 \mu\text{V}$  during mindfulness meditation, a variation around the baseline-level during the control condition, and a slightly but insignificant positive DC potential during the concentrative meditation. As mindfulness is described that all sensory, perceptual, emotional and other mental processes are available to awareness in the here-and-now, a negative brain DC potential seems to be a physiological correlate of such higher cognitive processes.

**KEY WORDS:** self-regulation; meditation; concentration; mindfulness; brain DC potentials.

#### **Golf performance enhancement by means of real-life neurofeedback training based on personalized event-locked EEG profiles**

*Michiel Kleinnijenhuis,<sup>13</sup> Martijn Arns & John Rijpma, Radboud University Nijmegen*

*Summary:* The presentation will introduce a new method for improving golf performance. Some sports psychology/brain physiology backgrounds will be discussed as well as the assessment method and the promising results from the initial experiment.

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**Abstract:** This study reports on a very promising, new method for golf performance enhancement employing real-life neurofeedback during golf putting.

Participants ( $n = 12$ ) received an assessment and three real-life neurofeedback training sessions. In the assessment, a personal event-locked EEG profile was determined for successful vs. unsuccessful puts. Target frequency bands and amplitudes marking optimal mindset were derived from the profile by two raters. The training sessions consisted of four series of 80 puts in an ABAB design. The feedback in the second and fourth series was administered in the form of a continuous NoGo tone, whereas in the first and third series no feedback was provided. This tone was terminated only when the participants EEG met the assessment-defined criteria. In these series, participants were instructed to perform the put only after the NoGo tone had ceased.

From the personalized event-locked EEG profiles individual training profiles were established. The inter-rater reliability was 90%. Individual training results show that 92% of participants improved their putting performance in the feedback condition as compared to the no-feedback condition. The overall percentage of successful puts was significantly larger in the second and fourth series of training compared to the first series ( $p = 0.0005$  and  $p = 0.0095$ , respectively; two-sided paired  $t$ -tests).

This study demonstrates that the ‘zone’ or the optimal mental state for golf putting shows clear recognizable individual patterns. Furthermore, most subjects improved their performance with feedback on their personal EEG profile with 10%, on average. The learning effects suggest that this real-life approach to neurofeedback improves learning. In a follow-up study we will study the long term learning effects and the effects on these golf players handicaps.

**KEY WORDS:** golf; peak performance; real-life neurofeedback.

### **QEEG guided neurofeedback treatment at personality disorders: 12 case studies**

*Tanju Surmeli & Suna Ozisik,<sup>14</sup> IOL MHC for research & education*

**Introduction:** According to DSM-IV, personality disorder is only when personality traits are inflexible and maladaptive and cause either significant functional impairment or subjective distress that they constitute a class of personality disorder. These patients are far more likely to refuse psychiatric help and deny their problems than are patients with anxiety, depression, or obsessive compulsive disorder. Classical treatment of choice has been psychotherapy or/and pharmacotherapy for personality disorders. The approach is to determine if subjects with personality disorders will benefit from neurofeedback treatment.

**Methods:** 12 subjects ranging from 19 to 48 y.o. (8 male, 4 female). Evaluation measures includes Qeeg analysis with NXLINK data bank, MMPI, TOVA tests and SA-45 questionnaires at baseline, every 20 or 40 sessions and at the end. Lexicor Qeeg signals sampled at 128 Hz. 30 minutes Neurofeedback sessions completed between 20–120 sessions depending on the case. Electrodes were sited according to Qeeg analysis.

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*Results:* 11 out of 12 patients who received neurofeedback training showed significant improvement based on qeeg reports, MMPI reports (abnormal reports became normal), TOVA reports and SA-45 questionnaires. One showed no progress during or after training.

**KEY WORDS:** QEEG; MMPI; personality disorder.

### **The analysis of strength and coherence of infant electric brain activity in function of speech and language processing examination**

*Zoran Radicevic,<sup>15</sup> Mirjana Sovilj, Ljiljana Jelicic & Marina Vujovic, Institute for Experimental Phonetics and Speech Pathology*

The paper presents the strength and coherence EEG activity analysis at the 1.5 months old infant, in conditions of different forms of speech and language stimulation. EEG responses are analyzed in following acoustic modalities: (1) specific (mother speech, unknown female speech, native language speech of mother and unknown female, unknown female speech of foreign language); (2) unspecific (murmur, ripple of water, noise). Known and unknown texts present the contents of speech material. The responses of strength and coherence of EEG activity are analyzed from the strength and coherence maps. The paper discusses the findings of strength and coherence brain rhythms in relation to different types of acoustic stimulus and the possibility of tracking of some speech and language processing elements through the specific in relation to unspecific stimulation modalities.

Results indicate two processing types: specific modality in theta rhythm and unspecific modality in delta rhythm. By analyzing of strength and coherence modal specific responses show that infant at this age differentiate mother voice then unknown female person voice (1), some characteristics of speech and language substrate in the frame of its native language (2) and some characteristics of native language substrate in relation to foreign language (3).

**KEY WORDS:** prenatal stimulation; speech and language processing; specific modality; EEG coherence.

## **INVITED LECTURE**

### **A resilience model for enhancement of biofeedback**

*Stephen Sideroff,<sup>16</sup> School of Medicine, UCLA*

Biofeedback is a tool that needs a context for best results. Frequently that context is stress management, where the goal is arousal reduction, and autonomic control. But most approaches leave out psychological factors including motivational conflicts that can interfere with treatment. This talk will present a model of Resilience that addresses important psychological factors that influence biofeedback results. It will introduce the

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psychobiological construct of primitive gestalts to address the ongoing influence of early childhood experience on stress perception and reaction. The model identifies nine components of resilience within three subcategories: organismic balance and mastery, relationship and process. These nine components are: psychophysiological balance and mastery, cognitive balance and mastery, emotional balance and mastery; relationship with self, relationship with others, and relationship with something greater; presence, flexibility and power (the ability to get things done).

**KEY WORDS:** stress management; resilience; symptom reduction.

## EEG-SYMPOSIUM

### **‘Why SMR training is effective: The physiological and functional basis of findings with SMR and Slow Potential Feedback Training’ (Chair: Barry Sterman)**

#### **An integration of fMRI, neurophysiological, synaptic, and functional effects of SMR and Slow Potential Feedback Training**

*M. Barry Sterman,<sup>17</sup> School of Medicine, UCLA*

Recent fMRI studies in human subjects indicate that the SMR as well as positive slow potential (PSP) EEG patterns are clearly associated with altered metabolic activity in the striatum of the basal ganglia nuclear complex. Other recent studies suggest that motor programming is related to sensorimotor EEG spindle activity. These findings support the notion that the state changes underlying the SMR are associated with functional changes in motor regulation and excitability. The striatum, which is the anterior component of the basal ganglia, has been characterized anatomically as a system of fiber connections which form a loop primarily from sensorimotor cortex back to motor cortex via thalamic relays. When input to the striatum from the sensorimotor cortex is *reduced*, as would be expected during SMR and vertex PSP activity, inhibition is imposed upon thalamic relays to motor cortex. This inhibition would alter involuntary motor regulation, reducing muscle tone and the intention to move. Consistent with an activation of striatal inhibitory mechanisms, earlier animal studies have documented a reduction in background motor tone, reflex excitability, and activity in extrapyramidal motor pathways during SMR bursts. It is also evident that both animals and humans suppress the intention to move. This convergence of findings suggests that facilitation and/or regulation of these EEG patterns is achieved through altered motor regulation.

In the case of the SMR, this reorganization of motor and thalamic status is accompanied by volleys of strong oscillatory discharge to cortex with each trained response. Many studies have shown that strong, repetitive afferent input to cortical and other forebrain neurons can promote increased synaptic strength in relevant circuits.

With proper timing and excitatory convergence these changes result in a synaptic state called “long-term potentiation” (LTP), which increases synaptic sensitivity and the probability of future activation in affected neuronal circuits. Thus, the functional changes in motor regulation mediating the discrete and recurrent onset of SMR activity in the

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EEG may be *specifically strengthened* during feedback training through a progressive potentiation process, resulting in a lasting decrease in sensorimotor excitability.

**KEY WORDS:** SMR; EEG patterns; sensorimotor activity.

### **Brain-computer-interfaces (BCI) for communication and paralysis**

Niels Birbaumer,<sup>18</sup> Ranganatha Sitaram, Leo Cohen, Cornelia Weber & Andrea Kübler, Eberhard-Karls-University of Tübingen

We present an overview of BCI research with Locked-in patients suffering from ALS and retraining of paralyzed hand in chronic stroke using SMR-feedback. Our recent results of P300, SCP and SMR based BCIs with ALS patients will be discussed. In addition, a new fMRI-BCI for the activation of under-activated emotional brain areas in criminal psychopaths is demonstrated. Finally, our first results with a new Near Infrared Spectroscopy BCI using imagined motor action will be presented.

**KEY WORDS:** SMR; ALS; psychopaths.

### **Impact of neurofeedback training on the fronto-striato-thalamo-frontal circuits mediating selective attention and inhibitory control in AD/HD children**

Mario Beauregard,<sup>19</sup> University of Montreal

There is growing evidence that inhibitory control and other cognitive executive functions, such as selective attention, are underpinned by fronto-striato-thalamo-frontal circuits. In line with this, a number of structural magnetic resonance imaging (MRI) studies have found significant volumetric reduction of prefrontal areas and caudate nucleus in children and adolescents with Attention Deficit Hyperactivity Disorder (AD/HD). In addition, single photon emission computed tomography (SPECT) and positron emission tomography (PET) studies carried out in AD/HD individuals have shown decreased metabolism in the striatum and prefrontal areas during resting state and cognitive tasks. Clinical studies carried out during the last thirty years suggest that neurofeedback may be efficacious in treating children with AD/HD. Thus, the present functional magnetic resonance imaging (fMRI) studies sought to investigate the impact of neurofeedback training (NFT) on the fronto-striato-thalamo-frontal circuits mediating selective attention and inhibitory control in AD/HD children.

The study sample was composed of 20 un-medicated AD/HD children randomly assigned either to an Experimental or a Control group. Training was provided for a period of 13 weeks, with three training sessions per-week. It involved two phases (20 sessions in each phase). In the first phase, subjects in the experimental group were trained to enhance the amplitude of 12–15 Hz SMR activity and decrease the amplitude of theta activity (4–7 Hz); in the second phase, subjects were rewarded instead for increasing 15–18 Hz SMR

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activity. For both phases, the electrode was placed at CZ and a monopolar montage was used. Both groups were scanned with a 1.5 Tesla system one week before the beginning of training and one week after the end of this training, while they performed a “Counting Stroop” task and a Go/NoGo task.

Findings demonstrated that: (1) this training markedly improved the functioning of the fronto-striato-thalamo-frontal circuits mediating selective attention and inhibitory control in AD/HD children; (2) key components of these circuits are crucially involved in these cognitive executive functions. The loci of activation detected in the substantia nigra, during both the Counting Stroop task and the Go/NoGo task, strongly suggest that training exerted a notable effect on dopamine. Other studies indicate that this biogenic amine is implicated in AD/HD, and suggest that dopamine is involved in motor control and attention processes. We propose, therefore, that the neurofeedback protocol used here normalized the dopaminergic neuromodulatory effect on the neural activity in the fronto-striato-thalamo-frontal circuits underpinning selective attention and inhibitory control.

**KEY WORDS:** ADHD; children; neurofeedback; dopamine release.

### **Enhancement of sensorimotor rhythms with motor imagery**

*Gert Pfurtscheller,<sup>20</sup> Graz University of Technology*

It is well documented that enhancement of sensorimotor rhythms (SMRs) affects different aspects of attentional processing and reduces seizures in epileptic patients (e.g. Sterman and Shouse EEG Clin. Neurophys., 1974 and Egner and Gruzelier CLINPH 2004). One way to enhance e.g. the hand area SMRs (Rolandic mu rhythm, central beta rhythms) is to imagine foot movement. In a multichannel EEG study performed on a able-bodied subject it was found, that imagination of hand movement suppressed or desynchronized the hand area SMRs and imagination of foot movement enhanced or synchronized the hand area SMRs. It is of interest to note that event-related desynchronization (ERD) was broad-banded in the alpha band (8–13 Hz) whereas the event-related synchronization (ERS) was narrow-banded and centered at 12/13 Hz (Pfurtscheller et al. Neuroimage in revision). Motor imagery with imagined rehearsal of leg/foot movement is therefore a suitable neurofeedback therapy with the goal to enhance sensorimotor rhythms.

**KEY WORDS:** sensorimotor rhythms; motor imagery; epilepsy, SMR.

### **Specific learned control of motor neuron responses after central nervous system damage**

*Bernard S. Brucker,<sup>21</sup> University of Miami School of Medicine*

Recent findings from the neurosciences have shown that CNS cell damage occurring from trauma or disease has the capability of long term repair, such as axonal growth and remyelination. Further, both dendrite and axonal sprouting have been known to occur after

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damage, although it still remains apparent that cell death results in the absence of CNS tissue due to the inability for regeneration of new CNS cells. Individuals who suffer CNS damage have been known to regain some if not a substantial amount of function clinically although the time of recovery does appear to be limited to about one year post damage.

As such, the clinical field assumes that all the repair and alternate cell use of the CNS occurs within that time. However, it has been shown that behavioral techniques, especially those using an operant conditioning based learning paradigm applied to specific learned control of motor neuron responses can result in significantly more efficient use of remaining and repairing cell structures with a substantial improvement in functions which would not otherwise occur. This presentation will discuss the recent findings related to cell repair and demonstrate how specific operant conditioning techniques, designed to increase voluntary control of motor neuron responses, can result in significantly greater use of CNS cell tissue regardless of the time since damage and its associated clinical effect.

**KEY WORDS:** CNS damage operant conditioning; learned control; motor neuron responses.

### **PAPER SESSION ‘PSYCHE AND SOMA: EFFECTS, DISORDERS AND COMPLAINTS’ (Chair: Alexandra Martin)**

#### **Neurofeedback therapy for fatigue states: Assessment and protocols**

*Lesley Parkinson,<sup>22</sup> BrainHealth, The Diagnostic Clinic*

The main aim of this presentation is to describe a conceptual framework of fatigue disorders.

The neuro-physiological and neuro-anatomical systems underpinning fatigue disorders will be described, as will the discrimination between primary and secondary fatigue disorders. Primary fatigue disorders are those such as “adrenal stress,” “cellular burnout,” Chronic Fatigue Immune Deficiency Syndrome (CFIDS) and mood disorders such as anxiety and depression. Secondary fatigue disorders are those such as thyroid dysfunction, inflammatory disease, toxic overload, multiple chemical sensitivities and “tired all the time” or TATT. Neurofeedback protocols for fatigue disorders, neuro-vegetative states and other physical dysfunctions will be illustrated. Case studies illustrating the approaches will be outlined.

**KEY WORDS:** fatigue disorders; neurofeedback; protocols.

#### **Biofeedback treatment for gastrointestinal disorders (obstipation and IBS)— Results of a meta-analysis**

*Alexandra Martin,<sup>23</sup> Philipps-University Marburg*

Chronic constipation and Irritable Bowel Syndrome (IBS) are highly prevalent and disabling functional gastrointestinal disorders. Biofeedback (BF) has been suggested as behavioral treatment for both. Success rates vary considerably across trials. The aim of the

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present meta-analysis was to estimate the efficacy of BF for these two conditions based on the primary studies' outcome.

*Method:* A total of 18 trials of BF for constipation or IBS in adults met inclusion criteria.

Two independent reviewers rated relevant study characteristics (IRR 0.91–1.0). Effect sizes (pre/post) were computed for every treatment group and outcome variable using Hedge's unbiased estimator  $d$ . The variance-adjusted effect sizes were integrated within fixed effect models and/or random effect models.

*Results:* In constipation, the main result was a reliable and robust effect size of  $d = 0.92$  (CI = 0.44–1.39), suggesting a strong effect of BF (in  $N = 402$  subjects). The outcome with EMG-feedback seems to be better than with anorectal balloon-feedback. In IBS, temperature-BF has been mainly used within a multi-component treatment (MCT). The global effect of the MCT + BF post treatment is small, but robust  $d = 0.32$  (CI 0.17–0.47). Maintenance of outcome is unsure, but single studies suggest good results at follow-up.

*Discussion:* The results of BF for constipation are very promising. BF as monotherapy for IBS is not sufficiently investigated. Methodological and health care aspects will be discussed.

**KEY WORDS:** IBS; meta analysis; biofeedback; interventions.

### Biofeedback in the treatment of irritable bowl syndrome

Olga Shubina,<sup>24</sup> Larisa Kuznetsova & Elena Miguskina, *Research Institute for Molecular Biology and Biophysics*

The aim of this study was to evaluate the effectiveness of electromyography and alpha-stimulation BFB-training in the complex therapy inpatients (women aged 21–58,  $N = 30$ ) with irritable bowl syndrome. Psychiatric interview has revealed following comorbid states: dysthymic disorder, depressive episode ( $N = 12$ ), adjustment disorder with physical complaints ( $N = 8$ ), obsessive compulsive disorder ( $N = 2$ ), and generalized anxiety disorder ( $N = 8$ ).

EEG (bipolar electrode montage F-4, O-2) of anxiety patients characterized by high EEG voltage, hyper synchronic alpha-rhythm, depressive patients had low level of alpha-activity with predominance of low-wave activity (theta-band). Patients with combined (anxiety-depressive) state had low alpha-activity level with predominance of beta-activity. Anxiety patients were treated with EMG-training with EEG control. Depressive patients were treated with alpha-stimulation training.

Ten percent increase of alpha activity during alpha-stimulation training and 3–5 mcV decrease of EMG activity during EMG relaxation training indicated effectiveness of the training. It was shown that efficient myographic training contributed to significant reduction of EEG power.

BFB course made up at (involved on average) 8–12 sessions. After BFB course patients reported about reduction of pain syndrome, improving of emotional state, appearance of relaxation (more relaxed condition). Clinical results were confirmed by reliable data of

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psychological tests (BDI, TAS-20, STAI, visual analog scale). The level of inner fixation and alexithymia traits were shown to decrease.

**KEY WORDS:** EMG; alpha stimulation; biofeedback; IBS, depression.

### **Effects of inspiratory and expiratory breath holding on respiratory, cardiovascular variables and on mood**

*Gerhard Strauss-Blasche,<sup>25</sup> Medical University of Vienna*

Respiratory pauses are a known phenomena in various psychological circumstances such as relaxation, orientation and anxiety. We compared the effect of voluntary 2 s inspiratory and expiratory pauses in paced respiration on heart rate and heart rate variability, respiratory tidal volume, flow and amplitude as well as on mood. Contrary to expectation expiratory pauses were associated with worse mood and higher levels of arousal than inspiratory pauses. A possible explanation for these findings is that expiratory breath holding lead to a greater sensation of need for air.

**KEY WORDS:** respiratory pauses; paced breathing; heart rate variability; HRV.

### **PAPER SESSION 'STRESS MANAGEMENT AND SELF-REGULATION FOR ADULTS AND KIDS' (Chair: Daniel Hamiel)**

#### **The acquisition of control in self-regulation of Galvanic skin response and slow cortical potentials: A randomized trial**

*Rien Breteler,<sup>26</sup> Michiel Kleinnijenhuis, Desiree Spronk, Erica Heesen & Martijn Arns, Radboud University Nijmegen*

Learning curves of volitional control of GSR and SCP after feedback will be presented, and compared to changes in simultaneously measured spontaneous SCP and GSR. Effects of training on QEEG profiles and neuropsychological functioning will be discussed.

Both GSR and SCP have been associated with epilepsy. These measures may be different expressions of a single underlying neurophysiological (arousal) system. Eight men and 11 women were randomly assigned to either a GSR biofeedback condition or an SCP neurofeedback condition. GSR and SCP were measured in both conditions. Each subject participated in 24 sessions of four runs, consisting of 40 trials each, in which pseudo-randomly increases and decreases in SCP or GSR were trained.

For the GSR feedback a polynomial curve was found to fit the data best. An increase in arousal (increase in GSR) appeared to be learned slightly better than a decrease. Four out of 10 subjects showed evidence of discrete self-regulation of their GSR.

For the SCP feedback, preliminary analyses suggest a flat linear learning curve (regression coefficient  $r = 0.033$ ). Again, an increase in arousal (cortical negativity) appeared

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to be learned slightly better than a decrease. Three out of 9 subjects showed evidence of discrete self-regulation of their SCP's.

Interrelationships of GSR and SCP grand averages over sessions and changes from pre to post QEEG and neuropsychology will be discussed.

The polynomial curve for the GSR group suggests GSR was easier to learn, further supported by the individual results. Future studies should focus on these effects in epilepsy patients.

**KEY WORDS:** GSR biofeedback; SCP neurofeedback; self-regulation.

### **The role of biofeedback in pediatric epilepsy patients**

*Ursula-Katharina Haller,<sup>27</sup> University Clinic of Neuropsychiatry in Childhood and Adolescence*

*Purpose:* To investigate the anticonvulsive effect of biofeedback.

*Methods:* Two patients, aged 15 and 16 years respectively having refractory frontal lobe- and temporal lobe epilepsy, were studied.

*Results:* The first patient was a 17 year old boy, who was a postoperative case of refractory frontal lobe epilepsy, who remained seizure-free for one year thereafter and had acute seizure recurrence having about 20 seizures/day. Seizures were preceded by tachycardia and anxiety. The boy failed to respond to Lamictal 200–0–200 mg, and Kepra 600–0–600 mg and then biofeedback training was attempted. Five months into follow up he was seizure free and currently he has only nocturnal seizures. 1–3 times/night (since reduction Trileptal: 450–0–600 mg).

The second patient is a 16 year old girl, who had refractory temporal lobe epilepsy (non lesional). She was refractory to Kepra. 500–0–500 mg, and was trained in biofeedback techniques for 4 months and was seizure free in the following time.

*Conclusion:* Pediatric epilepsy with tachycardia and anxiety as aura respond excellently to biofeedback therapy. This is a very effective technique for obliterating seizures precipitation by controlling heart rate and respiratory feedback.

**KEY WORDS:** pediatric epilepsy; biofeedback; seizures; case reports.

### **Treatment of dyslexia and hyperactivity in children: Using a system approach in a private practice**

*Monika Fuhs,<sup>28</sup> Holistic Learning Institute*

Successful treatment of anxiety, hyperactivity and dyslexia in children needs to include a system's perspective; namely, the child is part of the family system. Treatment needs to include (1) biofeedback training to reduce anxiety and increase attentional focus without hyperactivity and (2) reduce the cycle of failure and fear of failure. In many cases parent

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and child react to, and are affected by, each other in a process of escalating stress produced by the fear of failure. Through the use of SCR, RSA, Temp biofeedback, EMG and respiratory feedback the contagious cycle between parent and child can be interrupted. A major component is the development of child’s autonomy and independence from the parent so that the child is less affected by the emotional projections from other people.

This autonomy training with biofeedback for the treatment of dyslexia and hyperactivity is illustrated with the case example of a nine-year old boy who was diagnosed for ADHD and Dyslexia and treated with Ritalin. After 10 sessions of training the boy was taken off medication (Concerta) and successfully reduced his aggressive behaviour and learned to concentrate for long periods of time. He also learned to be able to express emotions and allow, and even seek, body contact and nurturing from his parents. The system intervention did not only change the child’s behaviour, it equally changed the mother.

**KEY WORDS:** ADHD; system approach; biofeedback; self-control.

**Coronary artery disease patients benefit from meditation**

Anil Singhal,<sup>29</sup> Divya Singhal, Achala Singhal & Virendra Chauhan, Himalayan Institute Hospital Trust

*Summary:* CAD patients in the meditation group practiced meditation for 30 days and experienced significant reduction in the frequency, duration and severity of angina as compared to the control group. Blood pressure and HRV parameters showed a favorable response, showing that meditation is an important and effective adjunct therapy in the treatment of Coronary Artery Disease.

*Abstract: Background and Aims:* To investigate the beneficial effects of meditation in patients with stable CAD (Coronary Artery Disease).

*Material and methods:* An experimental and control group study was conducted on 30 patients with CAD focusing on meditation as an adjunct therapy. All patients with coronary heart disease had stable angina. The experimental group, comprising fifteen patients, was taught a guided meditation which they practiced for 10 minutes twice daily. The control group, comprising 15 patients, read any material of their choice for the same duration.

*Results:*

Parameters	Experimental group		Control group	
	Reduction	P-value	Reduction	P-value
(1) Duration of angina	60.5%	<0.001	9.03%	<0.05
(2) Frequency of angina	57.1%	<0.001	16.67%	<0.05
(3) Severity of angina	100%	–	26.6%	–
HRV Parameters	%Age change	P-value	%Age change	P-value
Low frequency	26.6% reduction	<0.05	7.69% increase	<0.05
High frequency	40% increase	<0.05	27.2% decrease	<0.05

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*Conclusion:* Ten minutes of meditation done twice everyday over a period of one month leads to significant reduction in the duration, frequency, and severity of angina pain in stable coronary artery disease patients and the HRV parameters show a favorable response.

Thus, meditation is an important and effective adjunct therapy in the treatment of Coronary Artery Disease.

**KEY WORDS:** heart rate variability (HRV); coronary artery diseases (CAD); meditation.

### **Treating test anxiety through the internet with cognitive behavioral techniques and biofeedback**

*Daniel Hamiel,<sup>30</sup> Cohen-Harris Center for Trauma and Disaster Intervention*

Text anxiety is a common condition. About 20 percent of high school and college students suffer from text anxiety. The most helpful therapy for this condition is cognitive behavioral therapy (CBT), sometimes in combination with medications. In many cases universities offer this therapy to students either in an individual or group setting. Nevertheless many students cannot enjoy this therapy because it is not available for such big population or because they do not come to therapy from different reasons. We therefore tried intervention through the internet. The students use at home a very simple biofeedback device while working on a CBT program through the internet. The intervention is done either by a real or virtual counselor. The first results from our study show that many students can be helped by internet intervention. In this presentation I will describe the intervention, the process that happens during this intervention and the new horizons opened by internet interventions in different psychological fields.

**KEY WORDS:** test anxiety; internet; CBT; biofeedback.

### **Relaxation without drugs: The use of biofeedback in the treatment of drug offenders**

*Jennifer Ettl,<sup>31</sup> Tamara Lederman Maman, Barbara Trinkl, Wolfgang Werdenich & Ilse Kryspin-Exner, University of Vienna*

Within the framework of the cooperation between the Lehr- und Forschungspraxis (LeFoP, Study and Research Practice, Faculty of Psychology, Vienna University) and a Vienna-Prison, a biofeedback-project was initiated in mid-January. This project examines the efficacy of biofeedback training for drug offending inmates.

The biofeedback training takes place once a week and extends, in this pilot phase, over 6 to 8 weeks, whereby inmates are escorted to the LeFoP premises by prison guards. The aim of the biofeedback training is for drug offenders to learn and recognise that they possess personal resources for relaxation without the use of drugs. Personal sessions are

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individually designed according to the needs of each participant. Training includes learning to control and influence temperature (hand warming relaxation training), skin conductance level (relaxation and activation training) and respiration (relaxation training).

In accordance with literature on this topic, expected results of the training include improvements in the area of well-being, self-efficacy and competence and control beliefs.

The following standardised instruments are part of the test battery for evaluation of the above described factors: Basler Befindlichkeits-Skala, Eigenschaftswörterliste, Fragebogen zu Kompetenz- und Kontrollüberzeugungen. Furthermore a detailed drug anamnesis is being carried out, with the aim of evaluating effectiveness of biofeedback-treatment for consumers of different substances. For this purpose, the Lehr- und Forschungspraxis team developed the "LeFoP Drug-Inventory," whereby drug experiences as well as previous therapy- and treatment experiences can be assessed.

**KEY WORDS:** biofeedback; prisoners; drugs; addiction; hand warming; respiration training.

### **OPEN DISCUSSION: 'WHAT I HAVE LEARNED FROM FAILURE: HOW TO IMPROVE CLINICAL BIOFEEDBACK' (Chair: Erik Peper)**

#### **Participants**

*Monika Fuhs, Mag.rer.nat, Dipl.Psych., Holistic Learning Institute, Vienna, Austria; Richard Gevirtz, Ph.D., Alliant University, San Diego, CA, USA; Lynda Kirk, M.A., Austin Biofeedback Center, Austin, TX, USA; Alexandra Martin, Ph.D., Dr.rer.nat., Philipps-University Marburg, Germany; Erik Peper, Ph.D.,<sup>32</sup> San Francisco State University, San Francisco, CA, USA; Stephen Sideroff, Ph.D., School of Medicine, UCLA, Los Angeles, USA; Barbara Timmer, Ph.D., Klinik Roseneck, Prien am Chiemsee, Germany*

Successful outcome of clinical and educational biofeedback is often enhanced when the procedures are individually adapted. Although one often assumes that the actual learned material was responsible for the clinical outcome, in reality, it is not always known. As therapists we may learn less from a success than a failure. Unsuccessful outcomes often give specific and sometimes unique hints how to improve. Failure is often an opportunity to learn and to change. The purpose of this open discussion among outstanding clinicians is to explore the lessons they have learned from their failures. By exploring the factors that contributed to unsuccessful outcome, successful application of clinical and educational biofeedback can be enhanced. In addition, important hints in how to get your client do the homework and helpful tricks to enhance success will be discussed.

**KEY WORDS:** case reports; clinical efficacy; biofeedback; psychotherapy.

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## INVITED LECTURE

### Trigger point pain theory and practice: Recent developments

*Richard Gevirtz,<sup>33</sup> Alliant International University; Christopher-Marc Gordon, Center für Integrative Therapie*

This lecture will consist of a brief presentation of:

- The Trigger Point (TP) Model
  - Premise: Trigger Points are sympathetically mediated muscle spindles that account for most muscular pain syndromes.
- Heart rate variability (HRV) biofeedback
  - Premise: HRV biofeedback strengthens autonomic reflexes and reduces sympathetic input to Trigger Points.
- Combining manual therapies and biofeedback
  - Premise: HRV biofeedback and CBT type interventions combined with manual therapy produces outcome that are dramatically better than either alone.

A variety of clinical case studies will be shown using short video clips, demonstrating methods of therapy on patients suffering from orthopaedic soft-tissue pain, movement restrictions, and stress symptoms.

The methods applied were breathing re-education techniques, Heart Rate Variability training (HRV), and osteopathy/physical therapy entailing the re-balancing of shortened, strained, and hyper-tensed muscular tissues using Myofascial Release techniques, together with the deactivation of Trigger Points.

The methods shown demonstrate how the combined use of three powerful techniques can have immediate and surprisingly positive effects on pain, physical movement restriction, and stress. In most cases, the results are long lasting or even permanent.

HRV biofeedback measurement parameters of patients before and after training will be discussed and demonstrated.

**KEY WORDS:** heart rate variability (HRV); pain management; stress management; myofascial release; trigger point therapy.

## POSTERS

### Psychophysiological stress profiling and subjective bodily feelings in patients with functional somatic syndrome

*Kenji Kanbara,<sup>34</sup> Mikihiro Fukunaga, Yuko Mitani, Hiromi Mutuura & Yoshihide Nakai, Kansai Medical University*

*Summary:* Psychophysiological Stress Profiling (PSP) is a method for assessment of autonomic response or muscle tension at the stress task. We investigated PSP and subjective

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bodily feeling with functional somatic syndrome (FSS) patients compared with healthy controls to clarify characteristics of psychophysiological response and subjective bodily feelings in these patients.

*Abstract: Objective:* Mind-body interactions are important in FSSs, therefore, in the assessment of the PSP in these patients, both subjective feelings and psychophysiological response should be simultaneously measured. We investigated PSP and subjective feeling rating score with FSS patients compared with healthy controls. *Subjects:* Patients with FSSs who visited our Department and healthy controls were participated. *Methods:* Surface-electromyography (SEMG), skin-temperature (TEMP), skin conductance level (SCL), non-specific skin conductance response (NSSCR), blood volume pulse (BVP) and respiration (RESP) were measured with procedures of 3 steps; baseline resting, stress, and post stress period. The degrees of subjective mental tension, muscle tension, palpitation, and warm/cold sensations experienced during each period were also estimated. *Results:* (1) Patients with FSSs have psychophysiological hypo-reactive stress responses to the task, (2) Pulse rate and respiratory rate was significantly higher in the baseline and post stress period, (3) Subjective bodily feeling scores were lower in the patient group compared to the control group. *Discussions:* These results provide a clue to help clarify the pathology and perceptual characteristics of FSSs. We discussed pathologies of the diseases to explain the results, including the concept of hypofunctional stress systems and "Alexisomia," difficulty in the awareness and expression of bodily sensations.

**KEY WORDS:** psychophysiological stress profile; functional somatic syndrome; subjective bodily feeling.

### **Coronary Artery Disease patients with dyslipidemia benefit from meditation**

Anil Singhal,<sup>35</sup> Divya Singhal, Achala Singhal & Virendra Chauhan, Himalayan Institute Hospital Trust

*Summary:* CAD patients in the meditation group practiced meditation for 30 days and experienced a significant reduction in their blood pressure levels. Lipid profile and HRV parameters showed a favorable response, showing that meditation is an important and effective adjunct therapy in the treatment of Coronary Artery Disease.

*Abstract: Background:* Coronary Artery Disease (CAD) has reached epidemic proportions in Asian countries. Lipid profile is the single best predictor of risk of CAD progression. Meditation balances the Autonomic Nervous System (ANS) by bringing about parasympathetic predominance in patients with sympathetic over activity. Blood pressure is an important measure of ANS activity in the heart. This study examines the effect of meditation on lipid profile and blood pressure levels of patients with known CAD.

*Method:* An experimental/control group study was conducted on 30 patients with CAD and dyslipidemia. The experimental group, comprising 15 patients, meditated for ten minutes twice daily for a period of one month. The control group patients read any material of their choice for the same duration.

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**Results:** The serum cholesterol levels of experimental group patients showed a 10.2% reduction ( $P < 0.001$ ); systolic blood pressure levels dropped by 8 mm Hg, and there was a 6 mm Hg decrease in the diastolic blood pressure levels. The same variables in the control group did not show any change. The respiratory rate, fingertip temperature did not show any significant change in either group.

**Conclusion:** Meditation is an important effective adjunct to regular medical therapy in the treatment of CAD.

**KEY WORDS:** heart rate variability (HRV); coronary artery disease (CAD); dyslipidemia.

### Effect of diaphragmatic breathing on biofeedback parameters in hypertensive patients

Anil Singhal,<sup>36</sup> Divya Singhal, Achala Singhal & Mayank Chugh, Himalayan Institute Hospital Trust

**Summary:** The experimental group patients with essential hypertension practiced diaphragmatic breathing for 30 days and experienced a significant immediate and sustained reduction in their blood pressure levels. Biofeedback parameters showed a favorable response, showing that diaphragmatic breathing can be an important and effective adjunct therapy in the management of essential hypertension.

**Abstract: Background:** Blood pressure level and Biofeedback parameters are important measures of autonomic nervous system activity in the heart. This study examines the effect of Diaphragmatic Breathing (DB) on BP and biofeedback parameters.

**Method:** An experimental/control group study was conducted on 38 patients with essential hypertension. The experimental group practiced DB ten minutes twice daily for one month while control group patients read aloud any material of their choice. Lifestyle changes were made by both groups of patients.

**Results:**

Parameters	Experimental group		Control group	
	Change	P-value	Change	P-value
EDG	3.77 decrease	<0.05	0.44 increase	>0.05
Systolic BP (mm Hg)	14.64 decrease	<0.0001	12.3 decrease	<0.0001
Systolic BP	14.15 decrease			
Diastolic BP	13 decrease	<0.0001	9 decrease	<0.0001
Diastolic BP Pauses (per minute)	2.1 decrease	<0.05	2.77 decrease	>0.05
Quality of life (Visual Analog score)	1.33 increase	<0.0001	0.94 increase	<0.0001
Immediate change in BP (Day 30), After:	DB		Reading aloud	
Systolic BP (mm Hg)	14.15 decrease	<0.0001	4.3 increase	>0.05
Diastolic BP	6.85 Increase	<0.0001	2.71 Increase	>0.05

Respiratory rate showed no significant change.

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*Conclusion:* Diaphragmatic Breathing leads to immediate and sustained lowering of BP in hypertensive patients.

**KEY WORDS:** biofeedback; hypertension; diaphragmatic breathing.

### **Neurofeedback can be the solution—A case study**

Karin Erngrund,<sup>37</sup> Norwegian University of Science and Technology

This poster describes a boy with the diagnoses ADHD, combined type, and Oppositional Defiant Behaviour, who was offered neurofeedback training (EEG-based biofeedback) as an attempt to reduce his serious, so far therapy resistant, problems with attention and behaviour. According to EEG he had an excess of beta activity over the frontal lobes and a lack of sensory-motor rhythm compared to the normative data. The protocol for the training was to normalize his EEG pattern. As neurofeedback went on, the patient's attention and behaviour changed dramatically to the better both in school and at home. After 31 sessions of neurofeedback a new EEG was done showing that as well spectrograms as event-related potentials (ERPs) in a GO/NOGO task were normalized.

**KEY WORDS:** ADHD; oppositional defiant behaviour; neurofeedback.

### **Positive effects of alpha neurofeedback training in the rehabilitation process of stroke patients—A prospective study**

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*Summary:* Stroke patients of a rehabilitation centre, who displayed severe memory disturbances, have been trained to increase EEG alpha power using Neurofeedback (NFB) in order to enhance memory performance. As compared to a control group the increase in memory performance was significant only for the patients in the NFB group.

*Abstract:* Neurofeedback (NFB) is used in the treatment of a variety of neurological disorders (1, 3). However, the potential benefit for rehabilitation of stroke patients has not yet been demonstrated. Patients often suffer from severe disturbances of memory and attention related processes, both strongly related to the EEG alpha band (2).

To test whether an increase in tonic alpha power, induced by NFB, is capable of increasing memory performance after stroke, patients have been either trained with NFB ( $n = 17$ ) to increase alpha power at Pz (18 sessions), or by traditional methods as computer training ( $n = 15$ ). Stroke patients of the Medical Park Loipl participated voluntarily after signing an informed consent.

Only those subjects who practiced NFB displayed a significant ( $F(1,30) = 4.293$ ,  $p = 0.047$ ) increase in memory performance (Rivermead Memory Behavioural Test).

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Furthermore a significant increase ( $F(1,14) = 6.853$ ,  $p = 0.020$ ) in alpha resting power (eyes closed) within sessions was found.

These preliminary results suggest that Neurofeedback can be a valuable tool in rehabilitation after stroke.

**KEY WORDS:** neurofeedback; stroke, alpha.

### **Contextual cues in mental practice with motor imagery: Effectiveness in post-stroke hemiparesis rehabilitation**

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In the field of sport psychology, it has long been known that mental practice with motor imagery, combined to physical practice improves the acquisition of motor skills in novice learners. The process of motor imagery refers to the internal simulation of a motor act, in the absence of gross overt motor output. Converging evidence from neuroimaging studies show similar neural networks associated with imagination and execution of a movement. Starting from these premises, clinical studies have examined the potential role of mental practice with motor imagery as a restorative technique for post-stroke hemiparesis, with encouraging results.

It has been suggested that mental practice-based interventions may benefit from external visual cues that depict the movement to be mentally rehearsed (i.e. “mirror therapy”).

The present project aims at further investigating the role of external perceptual cues supporting mental practice with motor imagery in hemiparetic stroke patients. A single-case experimental design with Pre-Post and Follow up assessments will be carried out. Neurovegetative correlates of motor imagery will be also assessed. The main hypothesis is that the use of appropriate contextual cues can stimulate the patient in creating compelling motor images, thereby improving effectiveness of mental practice on motor rehabilitation.

**KEY WORDS:** motor rehabilitation; mental practice; contextual cues.

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