NEURO CONNECTIONS Newsletter

Summer 2013

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& the aapb Neurofeedback Division

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Online Supplement

The following material may be found in the *NeuroConnections* Supplement at http://isnr.org/neurofeedback-info/neuroconnections-newsletters.cfm.

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Hemoencephalography: A Practical Approach to Neurofeedback Training

Christel Kannegiesser-Leitner and Ralph Warnke

Neurofeedback is a fast-progressing treatment method. The scope of pathologies and non-pathologies being treated with neurofeedback is likewise growing steadily. One of the biggest challenges in neurofeedback, particularly when treating children (i.e. with ADD/ADHD), is that EEG-based neurofeedback is easily affected by artifacts; in addition, at a rate of one session per week, typical neurofeedback therapies for ADD/ADHD take about a year to complete.

This article describes a different approach to neurofeedback treatment. It is based on the concept of nIR-based hemoencephalography (HEG) therapy as proposed by Toomin and others. While there also is pIR-based HEG as well, this publication focuses on nIR-based HEG. The key target groups here are ADD/ADHD children, dyslexic children, and children with other forms of learning disorders. The authors are in the process of assessing the potential of a time-compressed HEG training of several sessions per day over a period of one or two weeks each (over a maximum of two to three weeks total). The aim is to provide children and youth with limited concentration and endurance a treatment they can more easily cope with and perceive as successful in a fast and convincing way.

The treatment in this case is embedded in the clinical practice of a child and youth psychiatrist. The participants of the HEG training have undergone a sequence of other measures prior to HEG treatment which is briefly described in the following for better reference and understanding:

The "psychomotor holistic therapy" (PMHT) is a form of dedicated therapy where diagnosis and development of the individual therapy plan take place in the clinical practice, while the actual training for the most part is done at home.

The "psychomotor holistic therapy" (PMHT)[1] is a form of dedicated therapy where diagnosis and development of the individual therapy plan take place in the clinical practice, while the actual training for the most part is done at home .[2] The HEG treatment described in this article is the one key exception to this routine procedure. PMHT integrates and combines several therapy methods depending on the individual client's needs. This includes PADOVAN therapy, the Warnke Method for Central Auditory Processing (CAP),[3] and others. HEG was added as a key therapy well over a year ago, with astonishing success. Patients with ADD/ADHD, with or without additional developmental disorders, particularly struggle with focusing and are easily distracted by stimulus from their respective environment. Therefore, the clients described in this article originally received an extensive training program based on PMHT and elements of the Warnke Method[4] dedicated to improve both auditory and visual brain processing skills. This is added to by Padovan's concept of neurofunctional reorganization[5], which is likewise designed to facilitate interhemispheric coordination as a key requirement for improved concentrative skills. Improvements in the cumulated training sequences typically are accompanied with advances in endurance, speed, and concentration in day-to-day routines. Still, there are patients who, despite training success, still do not meet the real-life demands towards those parameters. These are the patients additionally treated with HEG. Neurofeedback using HEG trains the subject to increase blood flow to a targeted area of the brain.[6]

While HEG and EEG-based neurofeedback settings typically propose train-

[1] "Psychomotorische Ganzheitstherapie" a German therapy model for children and youth focusing on specific neuropsychological and motor skill treatments.

[2] Kannegiesser-Leitner, Christel, ADS, LRS & Co., Sequenz Medien Produktion, Fuchstal, 2008

[3] Warnke, Fred, Das Warnke-Verfahren—Praxishandbuch, MediTECH, 2008

[4] Ibid.

[5] Padovan, BA, Neurofunctional reorganization in myo-osteo-dentofacial disorders: complementary roles of orthodontics, speech and myofunctional therapy, Int J Orofacial Myology. 1995 Nov; 21:33–40. (PMID: 9055669,)

[6] Toomin, Hershel, Hemoencephalography (HEG): The Study of Regional Cerebral Blood Flow, Biofeedback Society of California NL, Vol. 18, No. 2, Summer 2002

ing on a once-a-week basis, the settings in the ongoing case studies are different. As clients generally travel long distance to receive their treatment, a 30- to 40-session HEG therapy on a once-a-week basis seemed essentially impossible.

For those clients, a new concept of compact HEG training was developed and carried out. Instead of spreading training sessions throughout 30–40 weeks, it was consolidated into two weeks, with three different training sessions per day. While the overall evaluation of this new form of compressed HEG treatment is still an ongoing process, the following case studies show the potential of this new approach.

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Case 1: Philipp

When starting his PMHT treatment, Philipp had just started 5th grade, facing severe problems related to both ADD and dyslexia. He showed no signs of hyperactivity or excessive impulsivity. His original test scores, particularly his coordination and basic low-level skills in both visual and auditory processing tasks, were correspondingly poor. After six months of PMHT treatment it became clear that while Philipp had no problem understanding the school curriculum, his endurance was poor and his working speed was too slow, requiring his extreme effort to accomplish given school tasks. His willingness to continue working at this effort level deteriorated, while his advances in perception remained stable. Attention and spelling skills got better, but still needed further improvement. In order to accomplish this, Philipp started with concentrated HEG neurofeedback in July 2012, going through a first week of intensified HEG training sessions.

In the beginning, Philipp showed obvious problems concentrating when conducting HEG neurofeedback. His blood flow in the prefrontal cortex scarcely improved or remained stable. He was unable to control the change in blood flow and even dropped in his RED/IR ratio. This changed in a matter of days. With his endurance increasing, his level of concentration also improved, and his overall training scores got better.

In order to compare and evaluate progress more effectively, the Seconds-Points Ratio (SPR) was introduced. The SPR indicates the level of concentration over the extent of a training unit. Dividing seconds by the number of points scored produces a number that is to be compared to the optimal score of 10. With a standard setting of one point for every 10 seconds of stable/increasing HEG ratio. For example, over three minutes, a maximum score of 18 points can be reached. Hence, the value 10 is equivalent to the best-possible score a client can accomplish with a continuously stable/growing

Figure 1: *Philipp, first training session (3 minutes, 2 points)*

Figure 2: *Philipp, 30th training session (17 minutes, 100 points)*

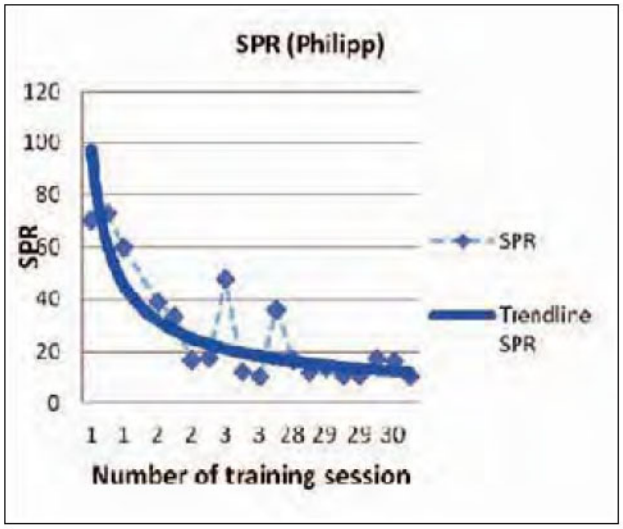

Figure 3: *Philipp's SPR sessions 1–30*

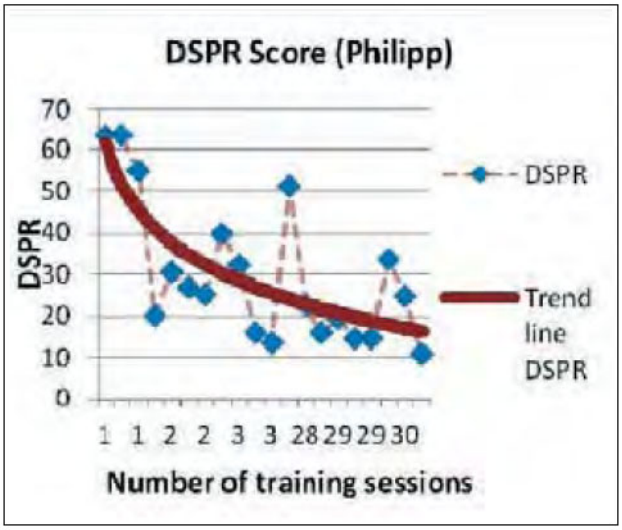

Figure 4: *Duration Second Point Ratio (DSPR) trend sessions 1–30*

HEG ratio. The higher the SPR value, the poorer the overall level of concentration. The SPR offers no insight on the level of endurance shown by the client. With a low SPR value, the growing overall session duration indicates a growing level of endurance in the client, as obviously it is more challenging to maintain a low SPR over an extended period of time.

Even on the second day of training, Philipp's SPR started to drop in value significantly, once even reaching the optimal score of 10. However, at this time, Philipp was able to focus for merely a very few minutes. With ongoing training, the session duration extended with an increasingly stable low SPR score. In the process, Philipp became able to switch between focus and defocus in a controlled and defined manner. In the beginning, he needed to conduct specific concentration tasks (i.e. mental arithmetic) in order to refocus after a phase of relaxation. He learned in an impressive way to toggle between focus and defocus upon command. From this point on, the remaining training days were aimed towards further improvement of Philipp's endurance level and the ability to switch from relaxation mode to concentration and back.

As a side effect of the HEG condensed training, it was possible to show to Philipp that he tended to get nervous when facing sudden tasks despite that fact that intellectually he could successfully complete such exercises. Since Philipp had been suffering from a severe case of exam nerves, he practiced maintaining his level of concentration when being challenged by surprise tasks and to better cope with sudden fear levels. Over the next months, Philipp shall try his best to transfer his new focusing and coping skills into everyday life. Since both his motor skills and low-level functions (auditory and visual processing skills) have been trained successfully and exceed his target scores, the corresponding training has been reduced to a weekly maintenance exercise.

In the overall analysis, Philipp's endurance, as well as his level of confidence, has strongly improved, adding to an overall positive personal development. He voluntarily works for school (i.e. actively learning vocabulary or practicing for exams, which before was unheard of) as he has become far more ambitious, thanks to his training success. In October 2012, his second week of condensed intensive HEG training took place. After a brief struggle in his first session, Philipp could soon continue with his level of success in training as before in July. When challenging him with reading tasks, it became obvious in both his skill level and the HEG performance, how much his level of concentration during reading tasks had improved. For reference, the same setting was repeated with Philipp now playing his accordion, a task he had always mastered without struggling with concentration. With an increasingly high point score, he continued to extend the duration of his training sessions. Several times, he reached the maximum scores of 10.2, 10.3, and 10.6, with a total training time per session of 15–17 minutes and an impressively stable HEG ratio.

The Duration Second Point Ratio (DSPR) combines the SPR with the change in session duration. The session duration was scaled between 2 and 20 minutes; the longer the session the lower the score.

The SPR provides an objective measure of Philipp's progress; at first only in rather brief training sessions, then with a growing duration (of more than 17

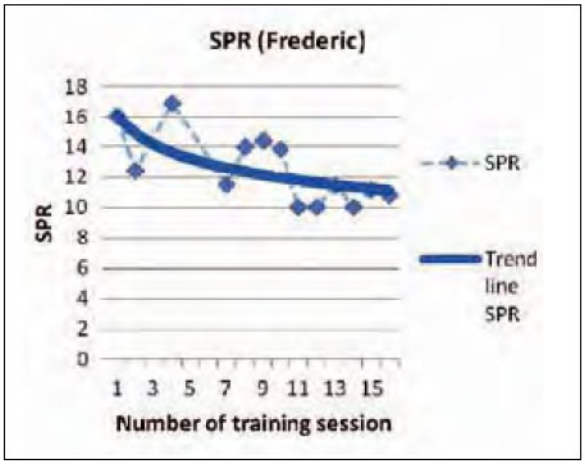

Figure 5: *Frederic SPR sessions 1–16*

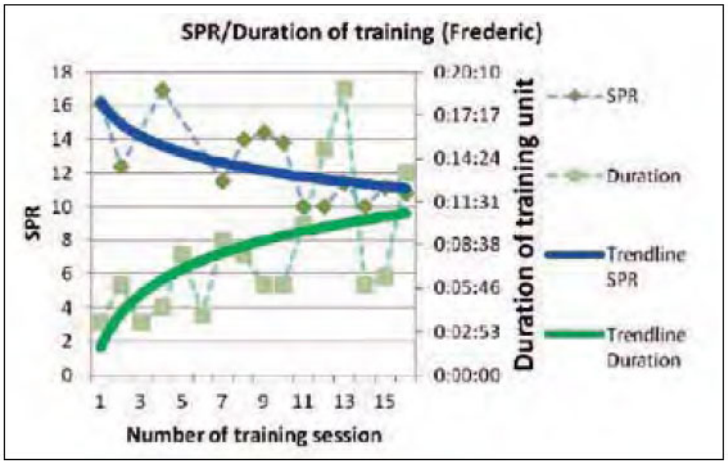

Figure 6: *Frederic SPR/Duration trend development: sessions 1–16*

minutes) showing his increasing level of endurance. Die low-level pre/post analysis of Philipp's low-level functions was not possible since he had already undergone a specific training of those skills using the Brain-Boy® training system, which otherwise had been a solid additional reference for improvement in fundamental brain processing skills.8 Subjective measures are Philipp's growing level of self confidence, his ambition, his willingness to make an effort, and in the following interval, his noticeably improving school grades, both in preferred and non-preferred subjects. Philipp's third and final HEG training week is scheduled for May 2013.

Case 2: Frederic

Frederic (13 years old) has been struggling with a combination of ADD and a severe case of dyslexia. Arithmetic is no problem for him, yet math word-tasks turn out to be severe challenges, as are reading and writing in general. Frederic improved in both areas thanks to his original PMHT training (see above). His growing academic achievements made him more ambitious, so with his spelling skills getting better, his lack of concentration due to ADD remained a severe problem for further academic progress.

Frederic's initial HEG training session lasted merely 2 minutes and 20 seconds; in session 16, Frederic managed to keep his attention and the corresponding HEG ratio up for a full 14 minutes without disruption. His SPR strongly improved likewise, as he reached the optimal score of 10 repeatedly, twice scoring the top score of 100 points. His endurance grew significantly as he was able to maintain his focus for longer periods of time.

There was an additional advancement to be seen in Frederic throughout

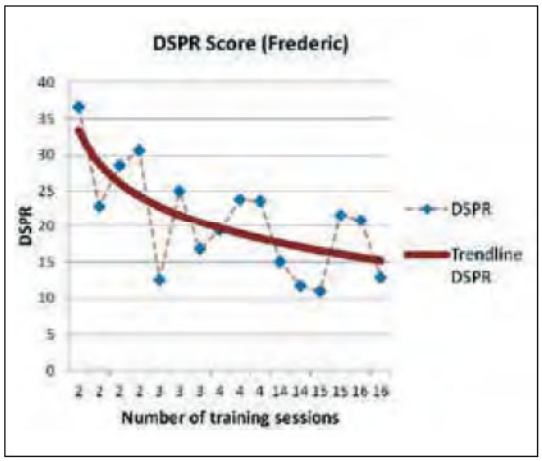

Figure 7: *Duration Second Point Ratio (DSPR) trend sessions 1–16*

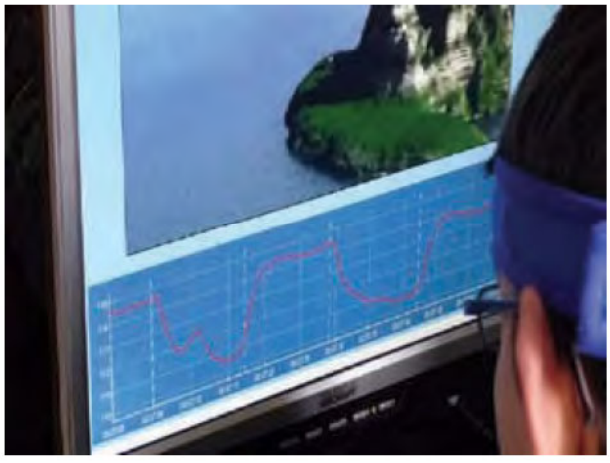

Figure 8: *Philipp turning attention on and off at will*

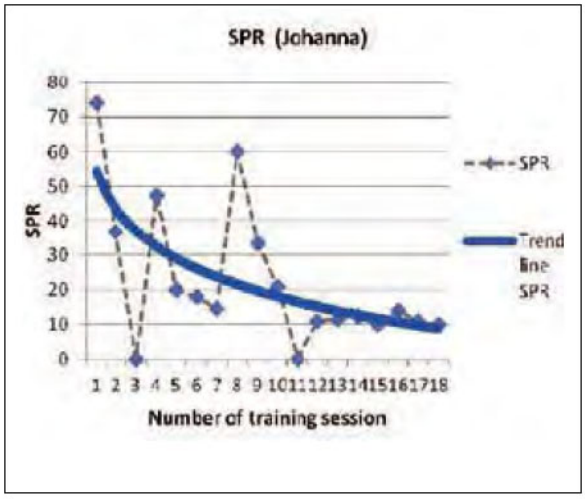

Figure 9: *Johanna SPR, sessions 1–18*

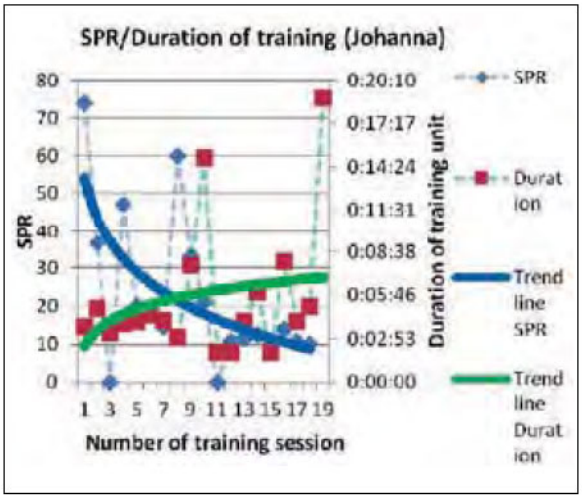

Figure 10: *Johanna SPR/Duration trend development: sessions 1–30*

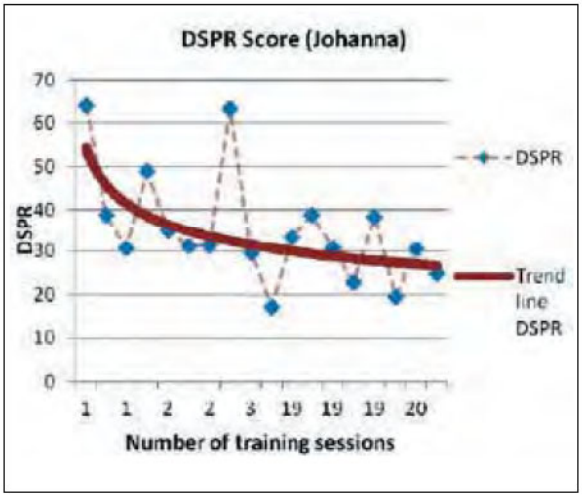

Figure 11: *Duration Second Point Ratio (DSPR) trend sessions 1–18*

this first week of training. While it took him some time in the first couple of days to establish the required level of focus, on day five he managed to do so swiftly, even early in the morning. According to his parents, Frederic was all but a morning person, so the poor early morning results in the first days were not surprising. It still remains to be seen to what extent Frederic can transfer the training effects to his daily routines. Particularly noteworthy and impressive, was his ability to toggle between focus and defocus after training unit 12 on command (Figure 8).

This new ability will certainly be beneficial to Frederic to concentrate in school. Frederic reported in the first weeks after his initial HEG training that he found it much easier to focus during exams in school. His grade point average (GPA) improved and so did his low-level functions. Reviewing Frederic's SPR shows a similarly successful development in the course of training (Figure 7). The ability to maintain his level of focus grew in time. Figure 8 shows how Frederic's SPR closes in on 10 while his session durations kept increasing. His overall objective DSPR score steadily improved, as can be seen in Figure 9.

Case 3: Johanna

The third case is Johanna. Born in 2000, she was diagnosed with ADD, CAPD, a disorder of speech development, and dyslexia, with an average IQ to work with. A Medikinet medication treatment was aborted as it caused Johanna to fall into depressive moods.

Johanna started her PMHT in 2011. Her initial therapy protocol included sensory-motor skill training as well as low-level training to improve her central auditory processing skills. When starting the training, some of her low-level skills had already been close to the expected training target scores. Johanna improved her reading skills and her spelling. Likewise, her self-confidence and her attention got better. Thanks to this improvement, prior to her first HEG training it was decided to move her from the special needs school to a regular high school, repeating the grade level.

To help Johanna in coping with the increased demands in school, particularly in regard to focus and perseverance, she underwent an HEG training in summer/autumn 2012 with several trainings per week and two to three intensive training days per week during vacation.

During summer vacation Johanna struggled severely with HEG; her daily routine in the summer lacked orderliness at large. She completed a total of 18 training units, usually with three trainings per morning on two to three days per week. Even at the 3% auto-threshold level, she could not establish a decent level of attention. There was limited progress in her training, still failing to focus at the expected 1% auto-threshold level. After summer vacation her daily routine returned to being structured and regulated. Upon her next visit she appeared much more balanced, despite the fact that she had changed schools. She no longer seemed overburdened and was able to integrate in her new class. Johanna had a good start in her new school. Her ability to focus was noticeable.

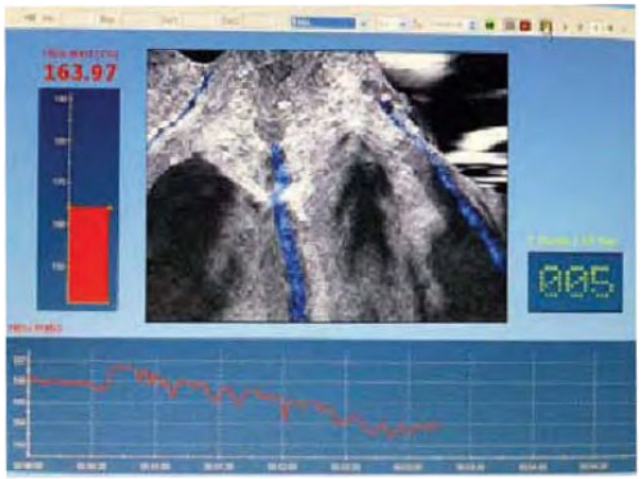

Figure 12: *Johanna session 1*

Figure 13: *Johanna session 18*

Despite the fact that Johanna had paused her low-level training with the Brain-Boy®, a test of those functions on September 27, 2012, after summer vacation, showed strong improvements with most scores within or near the target values. There was little room for additional HEG training. In the next sessions Johanna swiftly reached an SPR of around 10. This apparently is a positive aftereffect, as Johanna likewise has managed to apply the trained patterns of focus/defocus. Nevertheless, it is suggested for her to continue with another round of condensed intense HEG training in order to help her stabilize and maintain her skills in the long run and to succeed in school. Johanna's overall SPR development shows the improvement she underwent (Figure 10). Starting at a score of 55, she managed to bring down the SPR to close to 10. Her session duration also grew from three to up to eight minutes, showing a solid increase. The overall combined progress score is expressed by her DSPR score (Figure 12).

Summary

In all three cases a condensed intensive HEG training with up to 15 sessions per week, of 20–30 minutes each, appears to be a promising alternative to the long-term once-a-week training. All three cases benefitted from the condensed training, both measurable in their SPR and growing session lengths. All three youth and their parents reported significant positive effects in everyday life, particularly noticeable in respect to concentration, ambition, self-confidence, and academic achievements. Typically, an improvement of 1 to 1.5 GPA points was reported.

It has yet to be seen what the long-term effects of the training will be. Further analysis with a greater number of participants is planned to validate the promising effects in these first case studies. So far, condensed intensive HEG training has shown to be a solid training option to help with ADD/ADHD and related issues.

About the Authors

Christel Kannegiesser-Leitner, PhD, is an experienced child psychiatrist from Southern Germany. She has written several books on ADD/ADHD, learning disorders and associated subjects. The Psycho-Motor Holistic Therapy (PMHG) was developed by her, helping many hundreds of children with learning problems to severe physical and/or mental disorders in Central Europe. Kannegiesser-Leitner has been invited speaker on dozens of presentations and has created a network of medical doctors and trainers in Germany working with PMHG. Contact: kannegiesser-leitner@web.de, website: www.foerdervereinpsyga.de.

Ralph Warnke is the president of MediTECH, an innovative German medical device manufacturer. Warnke has been teaching biofeedback and neurofeedback courses for well over a decade. He has led and participated in national and international research projects targeting improved learning, concentration, and brain processing skills (the European-funded research project F.L.I.C. [Foreign language Learning with the Instinct of a Child]). His latest research was dedicated to the treatment of functional analphates, showing significant plastic neuronal changes in the brain regarding language tasks shown in fMRI. Contact: ralph.warnke@meditech.de, website: http://meditech.de/index.php?id=10&L=2.

References

Kannegiesser-Leitner, Christel, (2002). *Das ADS-Schnellprogramm für zu Hause.* Ravensburger. Freiburg.

Kannegiesser-Leitner, Christel, (2008). *ADS, LRS & Co.* Sequenz Medien Produktion. Fuchstal

Padovan, B.A., Neurofunctional reorganization in myo-osteo-dentofacial disorders: complementary roles of orthodontics, speech and myofunctional therapy, *Int J Orofacial Myology*. 1995 Nov; 21:33–40. (PMID: 9055669,)

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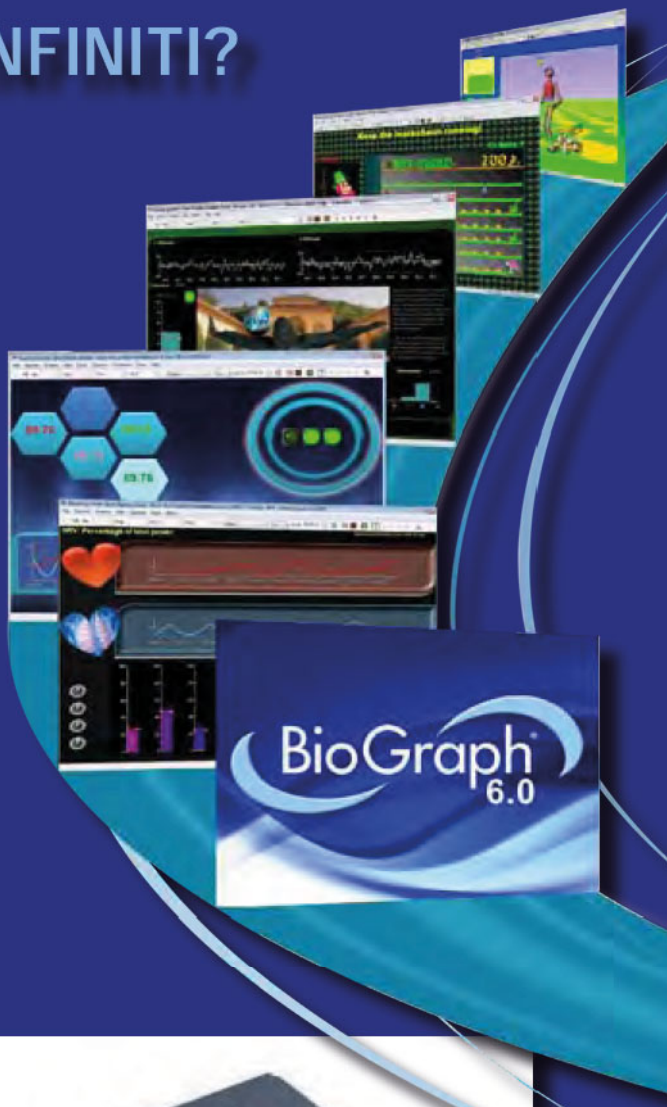

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