THE EFFECTS OF HEART RATE VARIABILITY TRAINING ON SENSORIMOTOR RHYTHM: A PILOT STUDY

Andrea Reid[1], Stephanie IMihon[2], Lynda Thompson[1], Michael Thompson[1]

[1]ADD Centre, Mississauga, Ontario, Canada

[2]ADD Centre Sport Focus, Mississauga, Ontario, Canada

Heart rate variability (HRV) training and EEG Biofeedback are techniques used to improve neurological disorders in both clinical and optimal performance populations. HRV training uses combined respiration and heart rate biofeedback to achieve synchrony between the changes in breathing and heart rate. This specific signature of synchronization of breathing and heart rate changes appears to correlate with a relaxed state and cognitive clarity. HRV may provide a promising index for both physical and emotional stress. Improvements in mental processing (Thayer, Hansen, Saus-Rose, & Johnson, 2009) and emotional stability (Applehans&Lueken, 2006) have been demonstrated as a result of HRV training. A similar mental state is the target of EEG biofeedback training when parameters are set to increase sensorimotor rhythm (SMR). SMR is usually trained using the frequency band 12-15 Hz. These frequencies are called SMR only when they are produced across the sensorimotor strip (C3, Cz, C4). In other locations, 12-15 Hz is simply called beta. SMR production has been closely linked to a state of calm, relaxed focus (Sterman, 1996). This article proposes that HRV training may be associated with increased levels of SMR. Preliminary data have been collected for 40 clients. Twenty clients were athletes training to improve performance, and 20 clients were from a clinical population aiming to increase SMR as a part of their program. A 3-min sample of EEG baseline data was compared to a 3-min sample of EEG data collected during HRV training. Mean microvolt values were collected for SMR during both the baseline recording and during the HRV training. 7"-test results show that there was a statistically significant increase in SMR during HRV training as compared to baseline ($p<.001$). This suggests that increased HRV leads to increases in production of SMR

Recentní práce autorů Reid et al. (2012)

Jana Kopřivová

Recentní práce autorů Reid et al. (2012) přináší aktuální a klinicky relevantní zjištění o souvislosti elektrické aktivity mozku (EEG) a synchronizace pulzu a dechu. Autoři na souboru 40 osob zjistili, že při tréninku synchronizace dechu a pulzu vzůstá v EEG amplituda senzorimotorického rytmu (SMR).

Jakkoli je toto zjištěné prospěšné a slibné pro klinickou práci, je třeba poukázat na to, že podobné studie, které zaznamenaly synchronizaci EEG, dechu, pulzu, ba dokonce i okulomotoriky a psychické reaktivity byly publikovány již před lety (Faber et al., 1970; Girton et al., 1973; Bauer a Nirnberger, 1981). Tematicky nejblíže studii Reida et al. (2012) je česká práce prof. Fabera a kolegů z roku 1970. Faber et al. (1970) sledovali synchronizaci EEG, frekvence dechu a EKG a zjistili, že amplitudy EEG byly během inspiria signifikantně vyšší než během exspiria. Podobně Girton et al. (1973) popsali občasnou synchronizaci dechu a velmi pomalých vln EEG.

Současná práce Reida et al. (2012) oživuje staré téma a přináší naději, že vztahu mezi EEG, pulzem a dýcháním bude věnováno více pozornosti a že bude možno ho i klinicky využít. Jak sami autoři píší v závěru své práce, kombinace neurofeedbacku a kardio-respiračního biofeedbacku (HRV) by mohla být efektivnější. V některých případech by snad jednoduchý a dostupnější HRV biofeedback mohl být alternativou k neurofeedbacku zaměřenému na posilování SMR aktivity.

PhDr. Jana Kopřivová, Ph.D.
PCP Praha
koprivova@pcp.lf3.cuni.cz

A recent study of Reid et al. (2012)

A recent study of Reid et al. (2012) presents current and clinically relevant findings on the relationship between the electrical activity of the brain (EEG) and the synchronization of pulse and breathing. The authors examined a group of 40 people and found that during the training of synchronization of pulse and breathing the amplitude of sensorimotor rhythm (SMR) increases in the EEG.

As much as this finding is useful and promising for clinical work, it is necessary to point out that similar studies that dealt with synchronization of EEG, breathing, pulse, and even oculomotor function and psychological reactivity were published years ago (Faber et al., 1970; Girton et al., 1973; Bauer and Nirnberger, 1981). Thematically, the closest study to Reid et al. (2012) is a Czech work of professor Faber and his colleagues from 1970. Faber et al. (1970) observed EEG synchronization, respiratory rate and EKG and found out that the amplitudes of EEG were significantly higher during inspiration than during expiration. Similarly, Girton et al. (1973) reported occasional synchronization of breathing with very slow EEG waves.

Current study of Reid et al. (2012) revives an old topic and brings hope that the relationship between EEG, pulse and breathing will be given more attention and that there will be more opportunities for clinical use. As the authors write in the conclusion of their work, the combination of neurofeedback and cardio-respiratory biofeedback (HRV) should be more efficient. In some cases, perhaps a simple and affordable HRV could be an alternative to neurofeedback aimed at strengthening SMR activity.