Resonant Frequency Heart Rate Biofeeback in Chronic Headache

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Background

Biofeedback has been proven to be a valuable treatment for headache disorders. It produce relaxation, thus reducing autonomic arousal. In past studies, the variables measured were EMG, temperature and Blood Volume Pulse (BVP). We explored another measure: the resonant frequency of heart rate (the phase relationship between heart and respiratory rate).

Objectives

To determined if Resonant Frequency Heart Rate Biofeedback was an effective way to treat headache patients, we measured the relaxation effect of this technique as well as assessing autonomic nervous system changes and changes in pain specific belief.

Materials & Methods

We recruited 25 patients for a five session program spanning three months. Patients were seen at 0, 1, 2, 6 and 12 weeks. No treatment regimens were changed during that time. During the first and last sessions, **MIDAS** and the **Survey of Pain Attitudes** (SOPA) questionnaires were completed. Abdominal respiration was taught with abdominal and thoracic bands during the first session and patients were asked to slow their breathing rhythm to six respirations per minute until they reached their **Resonant Frequency Heart Rate** (measured by one derivation EKG). Skin conductance was registered throughout the session as evidence of sympathetic arousal. The biofeedback device used was Thought Technology "ProComp Infinity System". Patients were asked to practice this form of respiration at home for 20 minutes daily. The 2nd session began by observing if they reached their Resonant Frequency without seeing the screen, followed by a practice with the screen. The 3rd, 4th and 5th sessions were structured the same. **Heart Rate Variability** was analyzed and artifacts corrected with the "CardioPro Infiniti" software from the same company.

Results

Twelve patients completed the 5 session program.

MIDAS questionnaire:

1) Mean MIDAS score for these 12 patients at first session was: 17.7 (SD 17.3) and 8.3 (SD 6.6) at the last session.

2) Mean headache days reported in the first session for the three months prior to the start of the experiment (MIDAS question A) was 52.9 (SD 30.6) days and 39 (SD 32.5) days at the completion of the experiment.

3) Mean intensity of headache in the first session for the three months prior to the start of the experiment (MIDAS question B) was 6/10 (SD 1.9) and 4.7/10 (SD 1.9) at the completion of the experiment.

4) Seven patients had a 50% reduction in headache days or intensity and five patients had no change.

SOPA questionnaire trend:

1) For the seven patients who had beneficial changes, we compared pre- and post-treatment sub-scale values. Control subscale was more elevated at the end of the treatment (1.49 vs 1.97); Disability, Solicitude and Medical Cure subscales were diminished with mean values respectively of 2.08 vs 1.70, 0.88 vs 0.60, 2.05 vs 1,86.

2) Completers compared with non-completers at first evaluation scored less on the **Control** , **Solicitude**, **Medical Cure** and **Emotion** subscales with mean value respectively of 1.73 vs 2.28, 0.86 vs 2.42, 2.09 vs 2.35, 2.03 vs 2.4.

Subscales definitions:

Control: belief in one's personal control over pain; **Disability:** belief in oneself as unable to function because of pain; **Sollicitude:** belief in the appropriateness of solicitous responses from one's family when in pain; **Medical cure:** belief that a medical cure exists for one's pain problem; **Emotion:** belief in a relationship between emotions and pain.

Heart Rate Variability (HRV) data:

For the 12 patients who completed five sessions, three-minutes segment of the recording were used for calculation when patients breathed deeply at resonnant frequency.

Time domain data:

The max-min mean difference (assesment of vagal cardiac innervation): **9.45** at first session and **15.06** at last session.

Standard Deviation of the NN interval (SDNN) (estimation of overall HRV): **49.72** at first session and **62.77** at last session.

Root Mean Square Successive Difference (RMSSD) (index of cardiac vagal control): **32.82** at first session and **36.26** at last session.

Frequency domain data:

Variations among patients prevent any interpretation of the data.

Conclusions

The results of the MIDAS questionnaires suggest that HRV biofeedback should be considered as a preventive treatment for headache patients. It seems to be more suitable for motivated patients since 50% of patients abandoned the program before completion. The data from the SOPA questionnaires suggest that completers reinforce their internalization of locus of control. Non-completers, as opposed to completers, seem to have higher expectations on Control and Medical Cure, which might explain why they gave up at beginning of treatment. Time domain analysis of HRV shows an augmentation of variability, indicative of the activity of the parasympathetic branch of the autonomic nervous system. This form of treatment is probably mediated by an interplay of psychological and physiological variables in which the autonomic nervous system is an important component.

References

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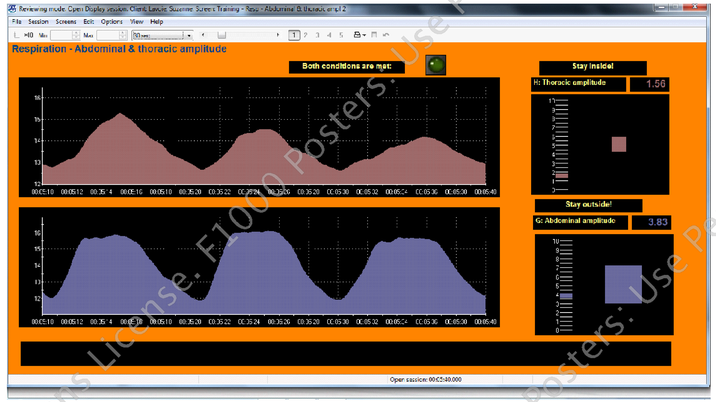
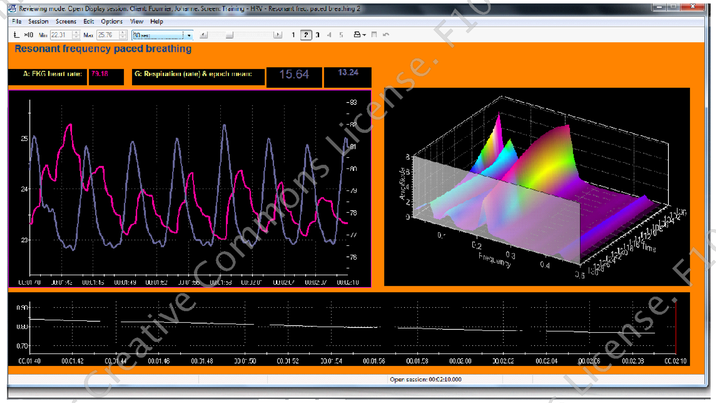
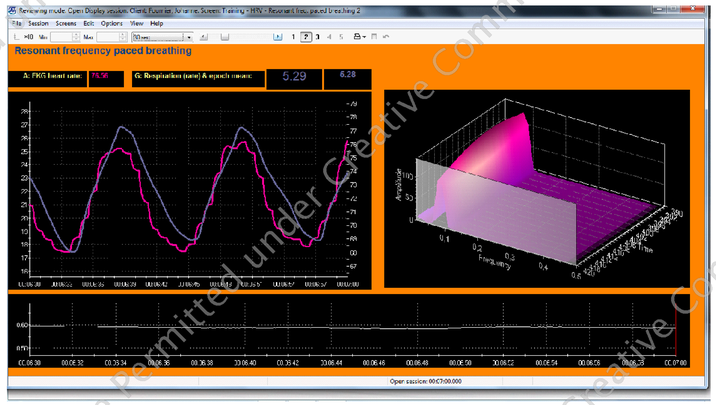
Screen sample







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