Utilizing Heart Rate Variability Biofeedback in a Patient with CVA to Improve Psychophysiological Coherence

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Case Details

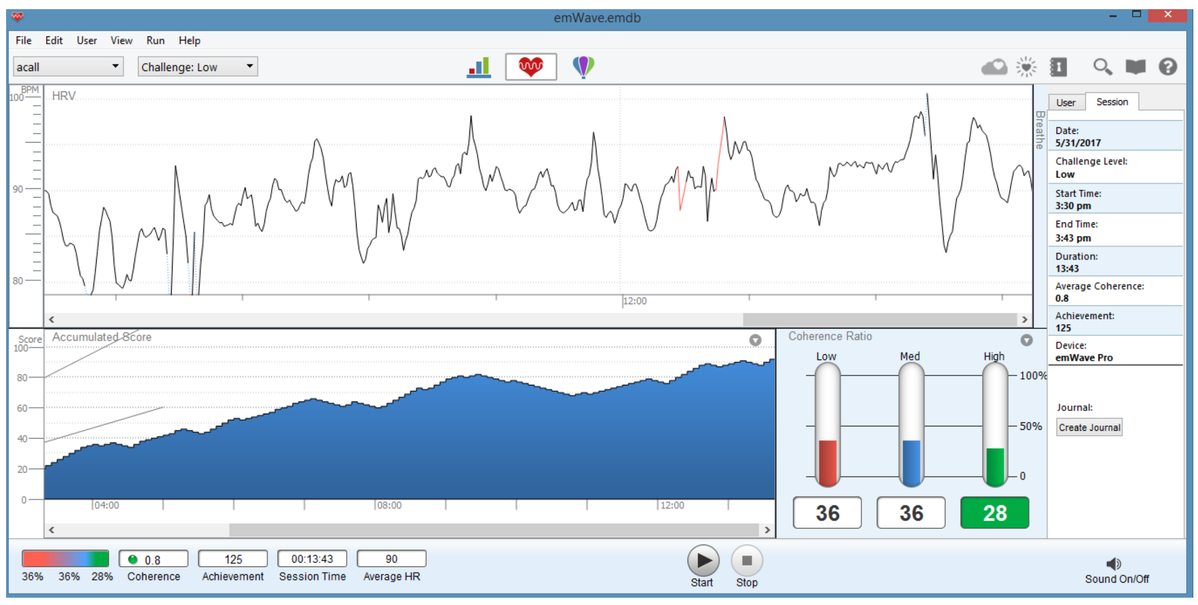
The patient is a 74 year old female who sustained L hemispheric hemorrhagic CVA. She was found on 10/14 and it was suspected that she was found down after 3-4 days. Her symptoms include: R hemiplegia, dysphagia, aphasia, R neglect, PEG tube placement due to malnutrition, HTN, pain, muscle spasms, constipation, depression, anxiety, neuropathy, GERD, nausea/vomiting, hyperlipidemia, R foot and coccyx wound. She spent approximately 2 months in a rehab hospital then 2 months in another SNF then came to AVR 4 months after her admission to the hospital. She was 6 months post CVA at the time of this intervention and was reaching a plateau with therapies because of difficulty regulating her emotions which caused increased tone and aphasia.

As the therapists involved with the case brainstormed ideas to address the barriers preventing the patient's progress, the patient's ability to self-regulate emotions and physiological states came up as a common barrier that was limiting progress and functioning. At this time, the OT learned about heart rate variability biofeedback and theorized that the patient might benefit from this intervention to facilitate self-regulation skills. She suspected that teaching the patient to control heart rate and breathing would help with emotional regulation as well as improving tone and aphasia which would allow her to make progress with her therapy goals and become more independent.

Literature Review

"Heart rate variability is a measure of the naturally occurring beat-to-beat changes in heart rate." (McCraty et al 2004). When an individual's respirations and heart rate are at an optimal frequency, this is referred to as coherence. Coherence is "the maintenance of a physiologically efficient and highly regenerative inner state, characterized by reduced nervous system chaos and increased synchronization and harmony in system wide dynamics" and "is conducive to healing and rehabilitation, emotional stability, and optimal performance" (McCraty et al 2004). Research studies which have been conducted suggest that "…individuals with brain injury and impaired self-regulation often display HRV patterns with reduced HRV" and speculate that interventions which address HRV "could directly enhance the ability to self-regulate." (Kim et al 2015). A study of individuals with severe brain injury found that there was an association observed between HRV coherence and improved emotional control, attention, life satisfaction, self-esteem, and self-awareness and concluded that "HRV biofeedback has promise as an effective, cost efficient method for improving self-regulation in individuals with severe brain injury" (Kim et al 2015). An addition study of individuals with chronic brain injury found that there was an association between HRV training and the regulation of emotion and cognition and that "individuals with severe, chronic brain injury can modify HRV through biofeedback" (Kim et al 2013).

The occupational therapy practice framework explains that engagement in occupation requires addressing both subjective (emotional and psychological) and objective (physically observable) aspects of performance. It is within the scope of practice for occupational therapists to address performance skills including emotional regulation, which is defined as "actions or behaviors a client uses to identify, manage, and express feelings while engaging in activities or interacting with others" (AOTA, 2008). Another performance skill that is within the scope of OT is cardiovascular and respiratory system functioning such as heart rate and rhythm and depth of respiration.



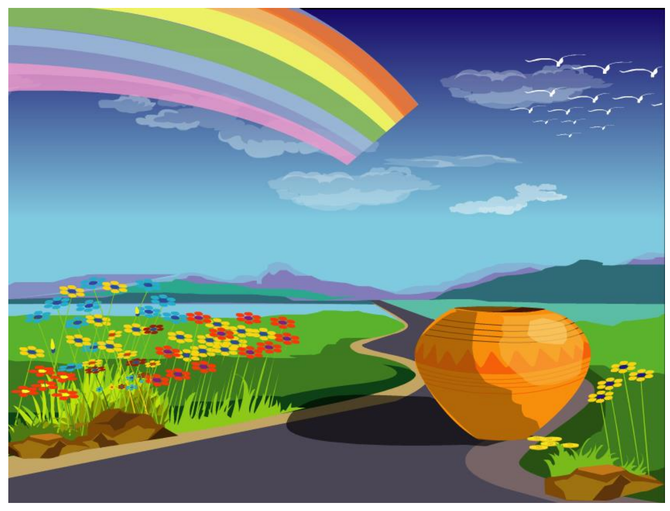
Screenshot of emWave Pro™ program. Top left is a graph of HRV. Bottom left is a graph of accumulated score. Bottom right is a visual and numerical representation of coherence achieved.

Intervention

The OT facilitated 7 treatments utilizing heart rate variability biofeedback training during a period of 3 weeks. Interventions were completed using a computer based system that tracked heart rate using a pulse oximeter and created a visual representation of heart rate variability on the computer screen. The visual representation was in the form of a line graph and a bar graph but the system also allowed for the feedback to be given in the form of a variety of games. This patient preferred to receive feedback through the games.

This intervention was used as a preparatory activity for ADL tasks such as toileting. At the beginning on this intervention period, intervention focused on discussion of toileting because toileting was a task that caused significant fear for the patient, resulting in increased tone, difficulty communicating, and difficulty problem solving to complete the task. As the patient improved her ability to modify her heart rate variability, intervention progressed to toileting in the therapy gym then in the patient room and with her CNAs.

As the patient became better at regulating her physiological states while using the program, therapist began encouraging her to apply the strategies during ADL tasks. For example, if patient become upset or frustrated during toileting, the patient was encouraged to close her eyes and picture the biofeedback games.



Example of game available in emWave Pro™ program. As patient coherence improves, the rainbow extends to the pot of gold and gold coins can be earned.

Results

During the three week period after initiating the intervention, the patient showed improvement in in the following areas of OT functioning:

	Prior to starting Intervention	After 2 weeks of Intervention
Lower Body Dressing	Max A	Min A
Upper Body Dressing	Min A	Stand By Assist
Toileting	Max A	Mod A
Overall ADLs:	Max A	Mod A
Tone (Modified Ashworth Scale)	Wrist/finger flexors: 1	Wrist/finger flexors: 0

References

American Occupational Therapy Association. (2008). Occupational therapy practice framework: Domain and process (2nd ed.). *American Journal of Occupational Therapy, 62,* 625-683.

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