

Capturing Healing Shifts: Heart Rate Variability Analysis in the Acupuncture Clinic

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Background

This presentation is part of an ongoing project to develop a practical heart rate variability (HRV) analysis protocol for use in the acupuncture clinic. Identifying and achieving optimal and reproducible clinical outcomes is the core of this effort.

Implications of HRV and Acupuncture

1. HRV gives a snapshot of patients' stress levels. Reducing patients' stress boosts health by improving pain levels, mood, longevity and immune function. Having the data to show this change would be helpful to the field of acupuncture on many levels.

2. Systems biology¹, explains how small inputs can lead to physiological cascades producing outsized effects. HRV is uniquely positioned to capture nuanced global physiological changes on a second by second basis by registering subtle shifts in autonomic balance. The immediate HRV response to needling may give additional information about the patients' response and/or responsiveness to acupuncture.

Previous HRV/Acupuncture Studies

The focus of this ongoing project is correlating HRV with clinical outcomes. HRV and acupuncture have been studied in academic settings mostly in healthy volunteers but sometimes on subjects with clinical conditions. Previous clinical studies have suggested that HRV improves after needling in patients most likely to respond to treatment²³. Furthermore, there is some evidence that HRV improves over weeks to months with continued acupuncture treatment^{4,5,6}.

Electrical Auricular Vagus nerve stimulation or Estim and HRV

Indwelling vagal electrostimulation devices are currently being explored by several groups⁷ to improve immune function, epilepsy, depression and other conditions. Since autonomic balance and monitoring have been the focus of this ongoing HRV project, using electrical auricular stimulation (estim) in the clinic is a logical offshoot. Estim could enhance vagal activity⁸ by stimulating the auricular branch of the vagus nerve without the side effects of indwelling stimulators.

Objectives

1. To illustrate the utility of the modified clinical HRV protocol which adds baseline and needling data, and divides the data into finer 3minute windows. The data of clinical responders and non-responders will be analyzed.

2. To show how the protocol might be used to evaluate treatment strategies using electrical auricular vagal stimulation (estim) as an example.

Materials and Methods

Patients selected for presentation had profound and decisive clinical improvement, and one with worsening of clinical condition. Patients' conditions are listed. Patients monitored for 5 minute baseline then during needling and 20 min supine needles in. A Nonin pulse oximeter was used for heart rate capture, and Vivosense software for HRV analysis. Needling protocols were based on TCM principles and varied from patient to patient. Auricular stim was a modified TENS unit and ear electrode clip applied to the cymba concha region. Right and left ear stim was used as well as 2Hz or 30 Hz frequency during baseline or needling segment.

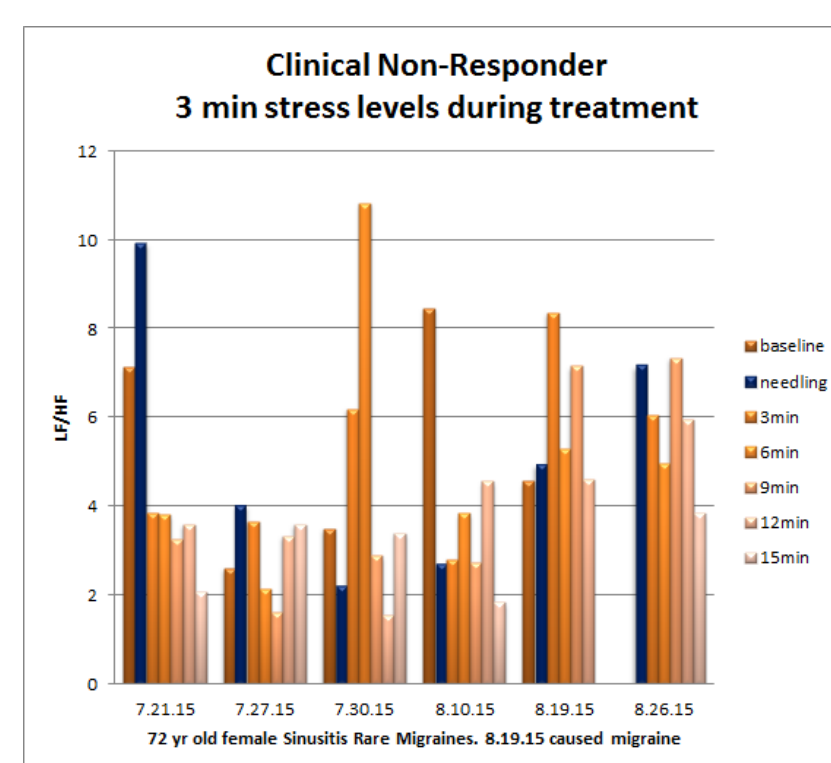
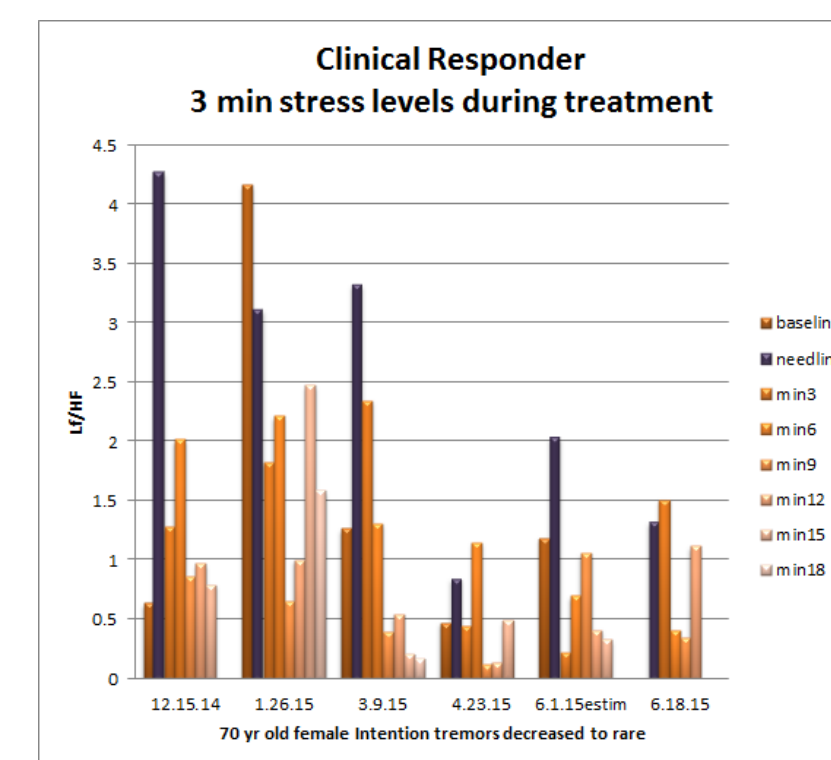
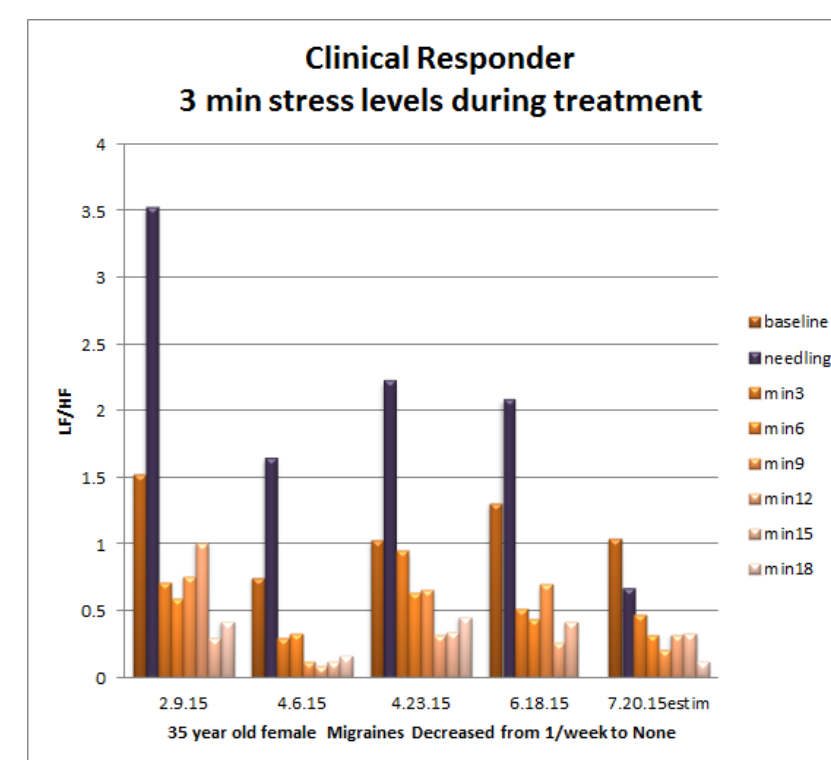
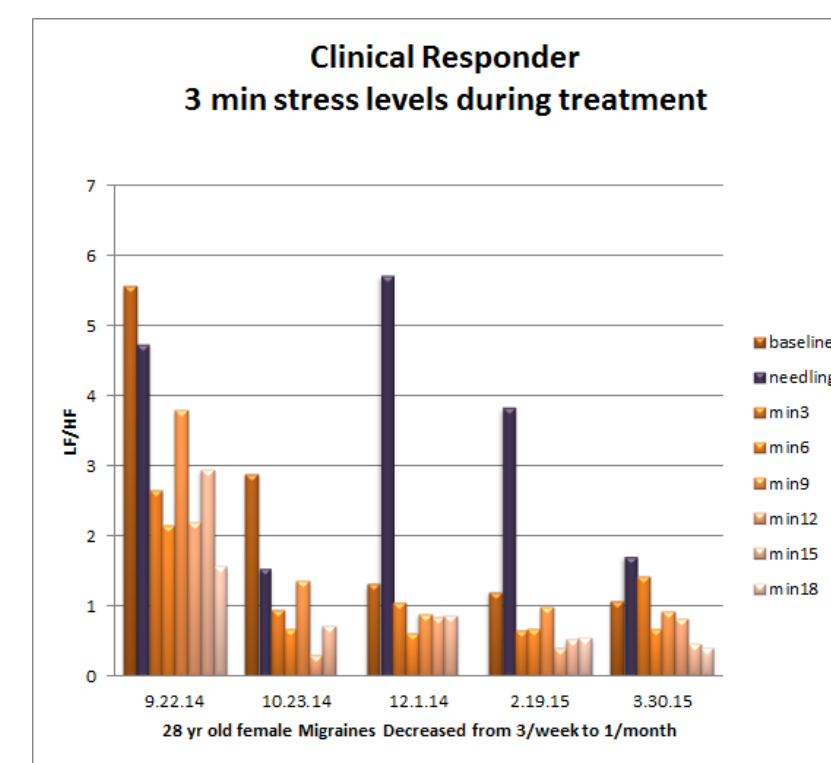
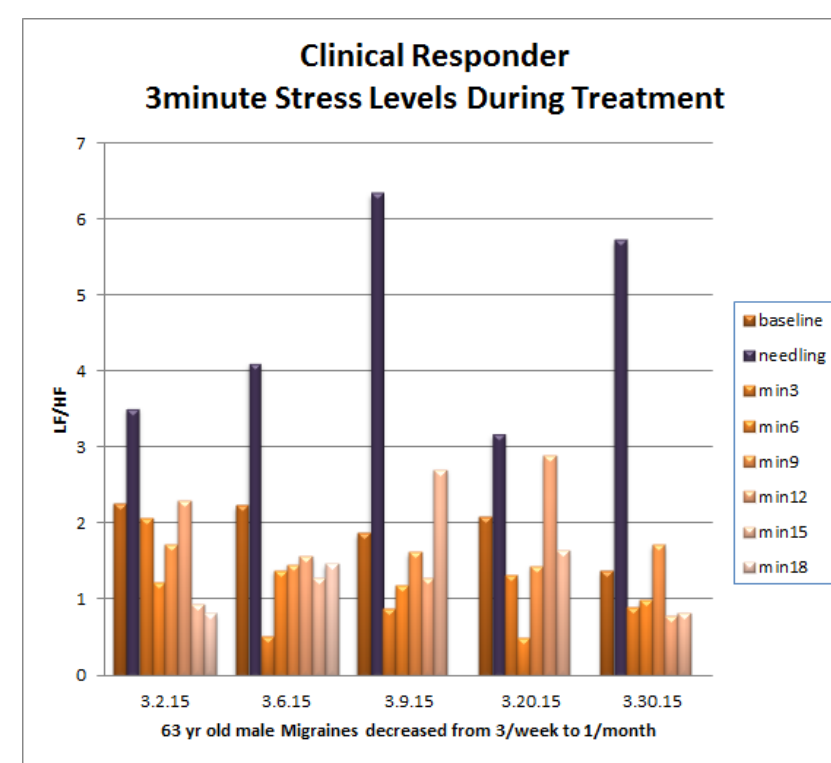


Ancient Medicine Made Modern

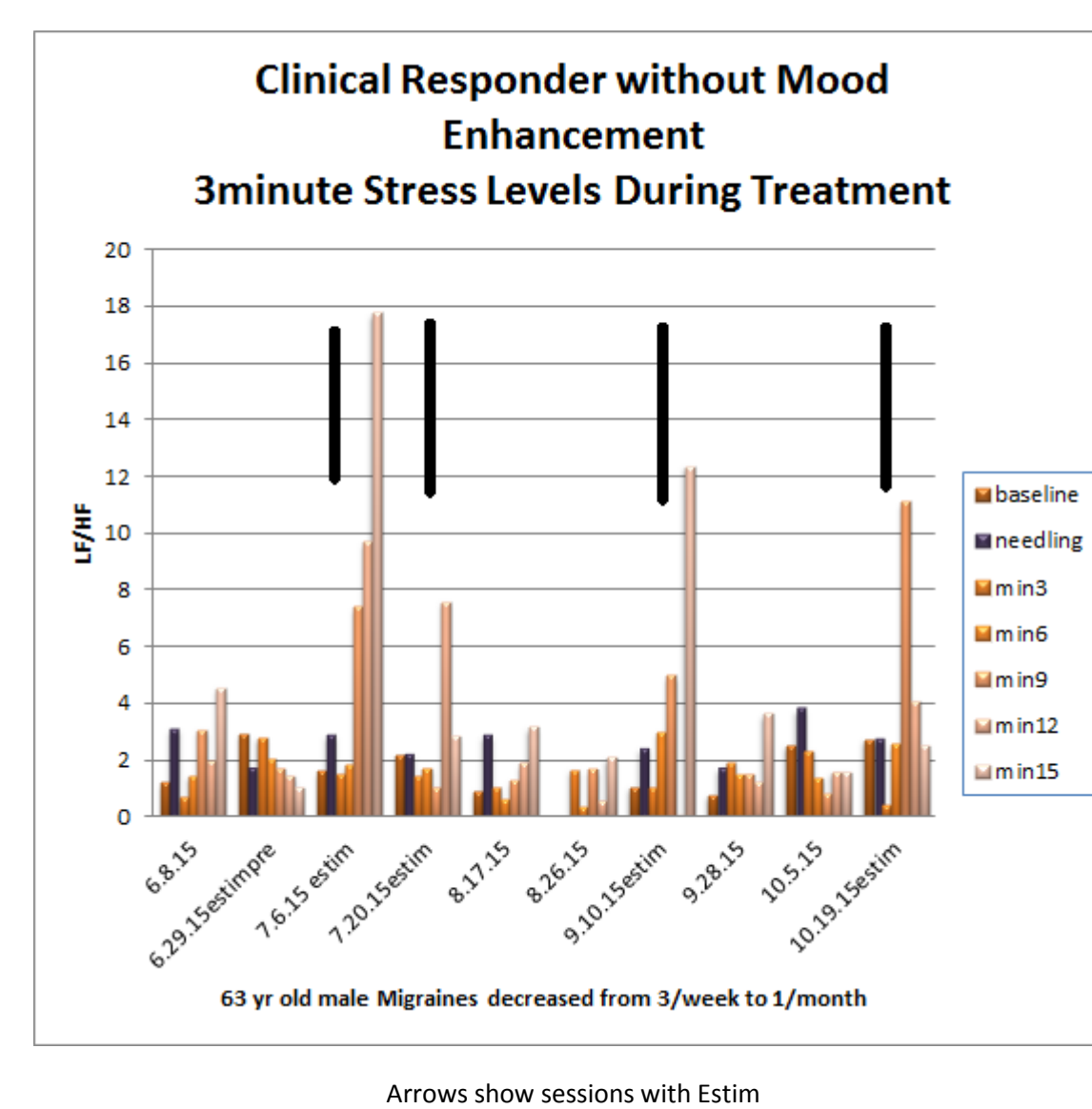
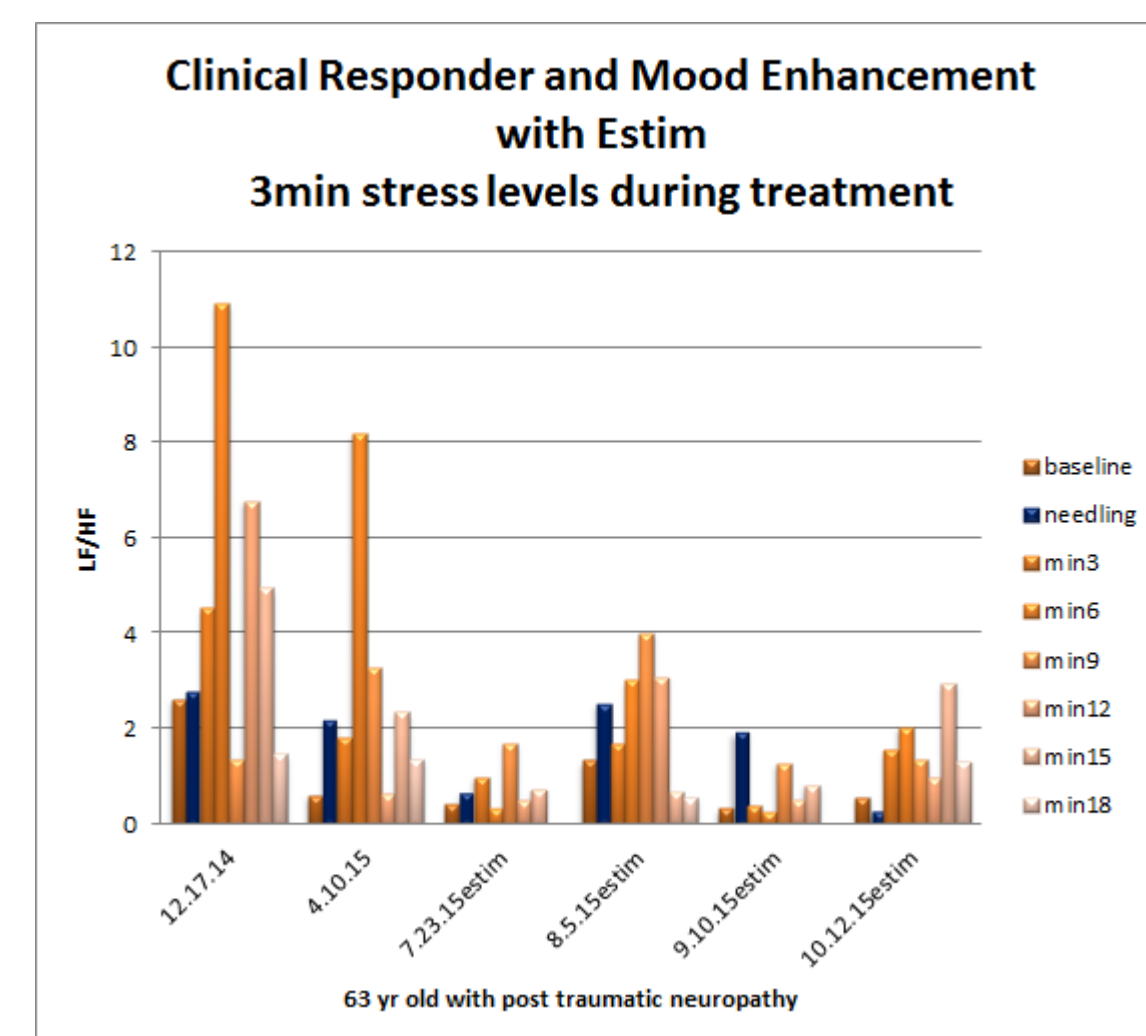
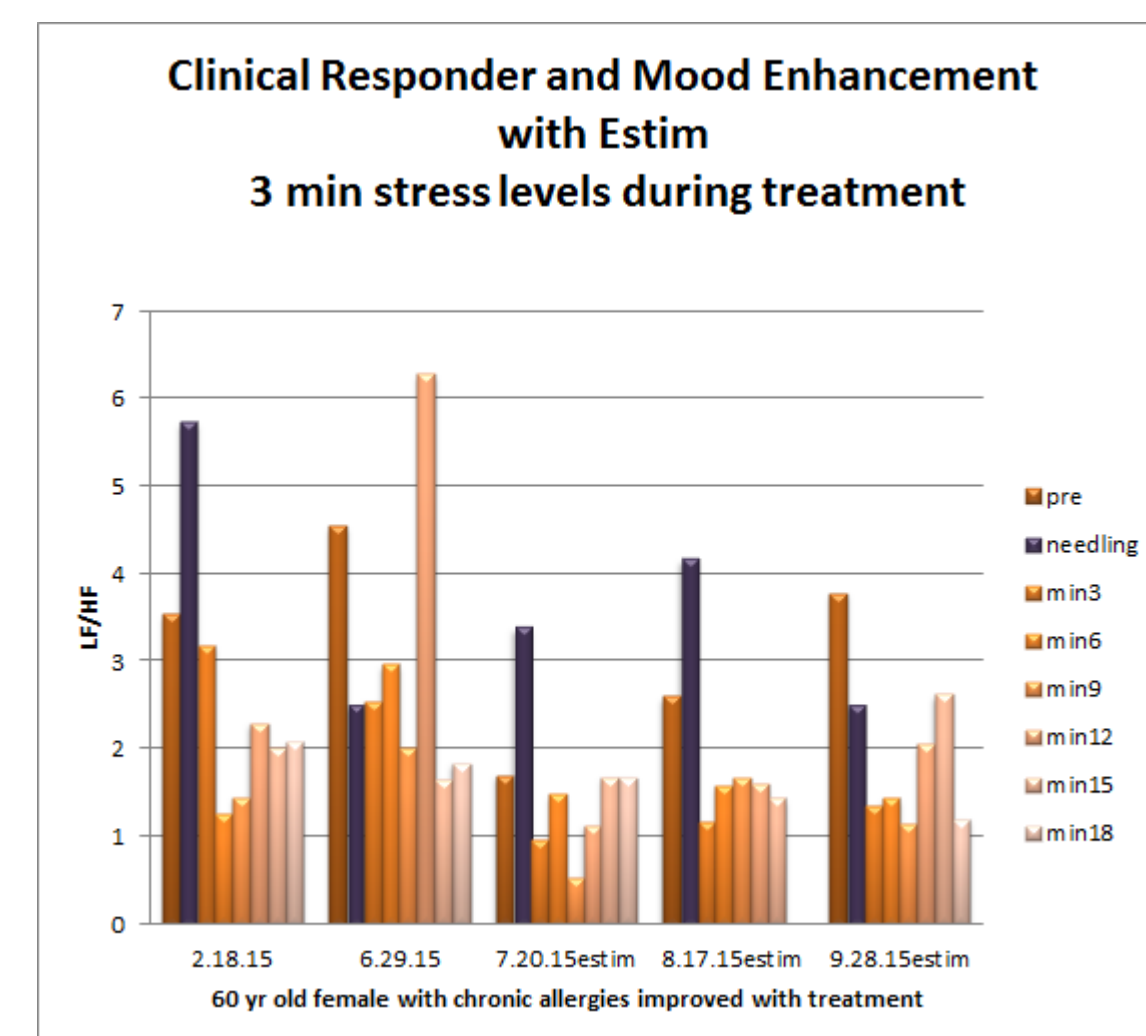
HRV Analysis During Acupuncture Treatment

Clinical Responders and Non-Responder

Dark Columns = needling segments



HRV and auricular vagal nerve stimulation “Estim”



Results

Clinical responders generally show an uptick in their stress levels(LF/HF) with needling and then a sharp drop after needling, in some instances as much as 10 fold. They also show a decrease in their stress levels during treatment session below baseline, and an overall decrease in their stress levels over weeks to months. Non-responders do not show these patterns. Estim sometimes evokes a marked sense of relaxation and euphoria (2 patients shown) with a corresponding decrease in their stress levels and HRV. This was hardly the rule, however. Patients show wide variation in HRV response to estim. No adverse clinical effects from estim were noted in spite of an increase in stress levels with treatment.

Discussion:

Clinical HRV analysis is confounded by “noise”. Mental state, coffee, sleeplessness, exercise, time of day can all impact readings. Evaluating aspects such as optimal segment length (3 min segments), and which parameters to evaluate (LF/HF, HFnorm, Sampen?) are just a part of protocol development. Choosing equipment is key, i.e. artifact has been minimized working with the Vivosense company. There are serious drawbacks to observational studies like this one. Confirmation bias, lack of controls, blinding, treatment uniformity etc... This inquiry aims to look at individuals and individual treatment to identify patterns in clinical and HRV response. The goal is to generate hypotheses and but also identify effective and reproducible treatment strategies. To detect patterns, the data of patients who are definitive clinical responders is scrutinized in depth. Analyzing HRV data during needling may prove to be important since it captures the physiological response to a subtle perturbation of the system. fMRI studies confirm that the autonomic brain centers react within seconds to needling. “Hardness”, or ability to weather unexpected inputs may lead to better health.^{10,11} The profound decrease in stress (LF/HF) level immediately after needling may be a sign that the healing cascade that is the essence of acupuncture, has been triggered. HRV may be illustrating what complexity science explains; a small input can have sizable effects. Estim was explored because of the potential for in home treatment to augment and reinforce acupuncture sessions. The hypothesis was that estim would show a decrease in stress levels through vagal stimulation, but this was not found. Though some patients seemed to have a reduction in LF/HF, the majority did not (data not shown). A study in healthy volunteers showed a decrease in LF/HF with auricular stimulation¹² as did a case study in a patient with cervical dystonia.¹³ Another study¹⁴ showed no HRV change. Even in implanted vagal stim, there is variation in HRV results with LF/HF increasing in epileptic patients.¹⁵ This highlights the variation in response between individuals/clinical conditions, and suggests caution in prescribing “one size fits all” treatments, such as estim. Variation in patient response presents a challenge and an opportunity which Traditional Chinese Medicine (TCM) has sought to categorize and explain for millennia. To add a biomarker for further clarity is the goal of this project.

Conclusions

The clinical HRV monitoring protocol explored in this project revealed pronounced swings in the autonomic response to needling and immediately after in some patients. This profile may be a sign of resiliency, or ability to adapt, inferring a positive clinical outcome, but it could also mean heightened arousal to threat. In exploring estim in conjunction with acupuncture treatment, some patients showed improved HRV and relaxation response clinically, but many did not. This highlights the variation in interpatient physiological response which is a hallmark of the teachings of TCM, and fertile ground for further study and interpretation.

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for a compendium of Acupuncture and HRV

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