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Can Heart Rate
Variability Monitoring
Of Clinical
Transcutaneous
Auricular Vagal Nerve
Stimulation Optimize
Treatment?

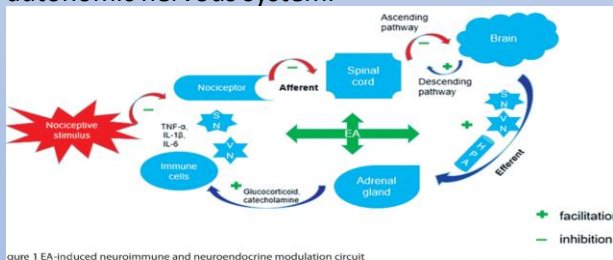
Objective of this clinical case study is to compare nonlinear Detrended Fluctuation Analysis (DFA α) parameter of Heart Rate Variability (HRV)-a noninvasive measure of autonomic balance- with standard frequency measures in conjunction with Transcutaneous Auricular Vagal Nerve Stimulation (TAVNS) to find optimal biomarkers of autonomic balance. .

Hypothesis

1. That by adding TAVNS to clinical acupuncture treatment one could further improve autonomic balance seen with acupuncture treatment.
2. Nonlinear DFA α 1 might provide more robust data than frequency or time series measurements

Background

Acupuncture Peripheral nerve stimulation in the form of acupuncture has been used for centuries. Acupuncture has been shown to improve autonomic balance --decreasing sympathetic and increasing parasympathetic activity-- partly through the Neuroendocrine-immune response (NEI). NEI is a series of feedbacks decreasing inflammatory markers via the autonomic nervous system.

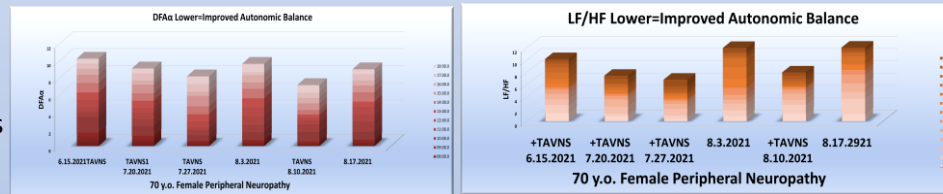


HRV is well suited for clinical study because it is noninvasive and gives results over various time scales, minutes to hours or as a trend over time. **TAVNS** connects via the auricular branch of the vagus nerve directly to the nucleus tractus solitarius to then affect autonomic activity.

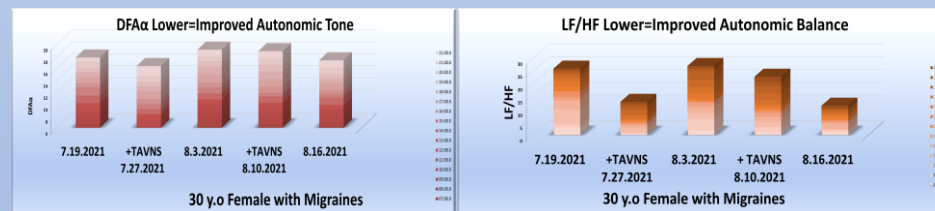
Materials and Methods

Patients' HRV was monitored in supine position for 5 minute baseline and then for entire treatment including TAVNS application, needling and 20 minutes rest with needles. TAVNS at 1hz applied using clip electrode on the cymba concha unilaterally left ear. Analysis of 1 minute segments are shown comparing DFA α and LF/HF. LF/HF represents the ratio of the frequency measures for sympathetic/parasympathetic activity. Patients shown all were successfully treated with acupuncture showing positive clinical results.

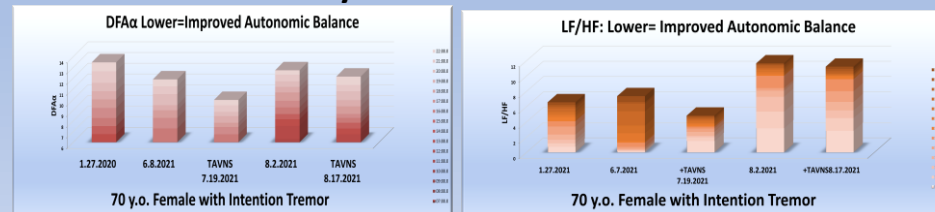
Patient 1 60 year old female with Neuropathy



Patient 2 30 year old female with Migraines



Patient 3 70 year old female with Intention Tremor



Results

- The data show modest improvements in autonomic tone with TAVNS in some but not all cases.
- DFA α correlates with LF/HF roughly. Where there are big discrepancies, the LF/HF data has artifact.

Discussion

- This study is part of a project to develop and optimize a system for patients to easily apply TAVNS in the home setting. Using HRV as a feedback, the settings and electrode can be optimized in the clinic and then applied in the home.
- Some researchers believe that nonlinear methods such as DFA α are a more robust, reliable measure of autonomic balance and have the most promise for a closed loop feedback system for TAVNS.
- Researchers also believe that TAVNS decreases sympathetic activity more than increasing vagal activity, so TAVNS at lower .5 to 2 hz inhibit sympathetic activity, so 1hz was used for this study.
- The ear clip is not an optimal electrode since it delivers over a more diffuse area. It is easier for patients to use, however, and to transition into a home application.
- A significant problem with this study is that TAVNS is added to acupuncture treatment not on its own.

Conclusion: These observational results show a modest improvement in autonomic balance in some cases with the addition of TAVNS to standard acupuncture. By using HRV as a biomarker for autonomic balance, the hope is to optimize TAVNS for clinic and home use. DFA α may be a reliable measure to use as feedback in optimizing TAVNS efficacy.



Please scan the qr code for references, more detailed explanations, legible charts and figures, my bio and more. Welcome! K. Sparrow, MD San Francisco, California USA