

Global qEEG Changes Associated With Non-frequency & Non-site Specific Neurofeedback Training

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Overview

- ❖ Describe case study demographics
- ❖ Provide global NF training concepts
- ❖ Present case study NF training sample and trend data
- ❖ Dr. Hurd will then discuss qEEG data from 2003-5

Case Study Demographics I

- ❖ 63 yo right-handed female
- ❖ Dx chronic Lyme disease late 2002
- ❖ Self-referred because
 - 1) past 1.5 years of site/frequency-specific NF training protocols and hyperbaric sessions had not alleviated her SXs, including sleep problems
 - 2) SPECT scan and MRI data consistent with compromised vasculature and white matter lesions, potentially being an impediment to specific brain driving protocols

Case Study Demographics II

- ❖ Self-referred to me in part because of sleep disorders expertise and use of a comprehensive, adaptive targeting NF system
- ❖ This “global” NF training took place over 6 months and included 30+ sessions
- ❖ A qEEG performed in 2000 was within normal limits (data not shown)
- ❖ Subsequent qEEGs were performed in 2003, 2004 and following global NF training 2005

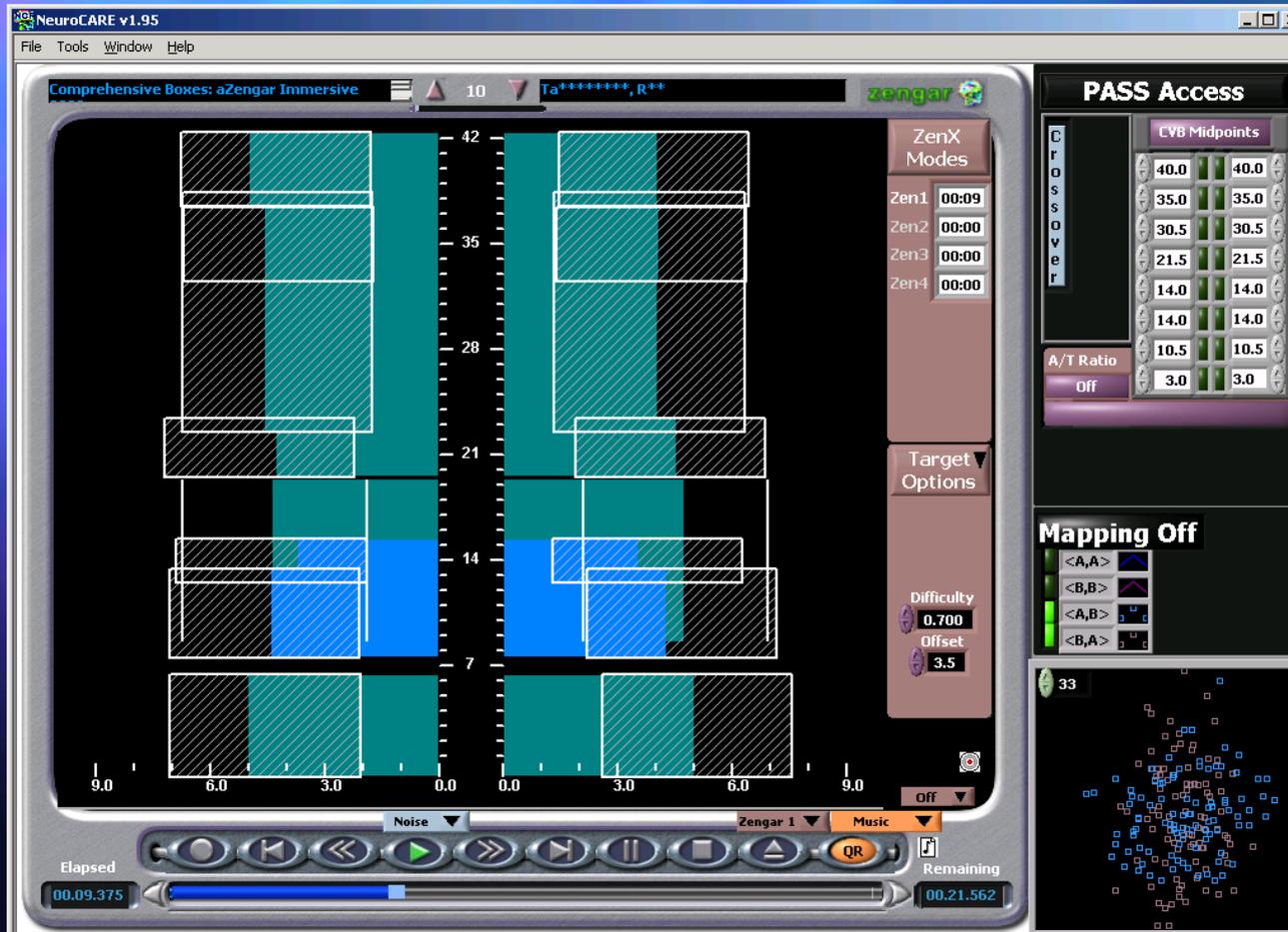
Comprehensive And Adaptive NF Training Approach To Capture Changing EEG

16 target pair neighborhoods (boxes)
overall, 8 each hemisphere

Increases or decreases in any box triggers
interruption of the music

Sliding average of the median of the last
data points collected measures changing
rates of change (adaptive targeting)

NeuroCARE[®] Neurofeedback Training System



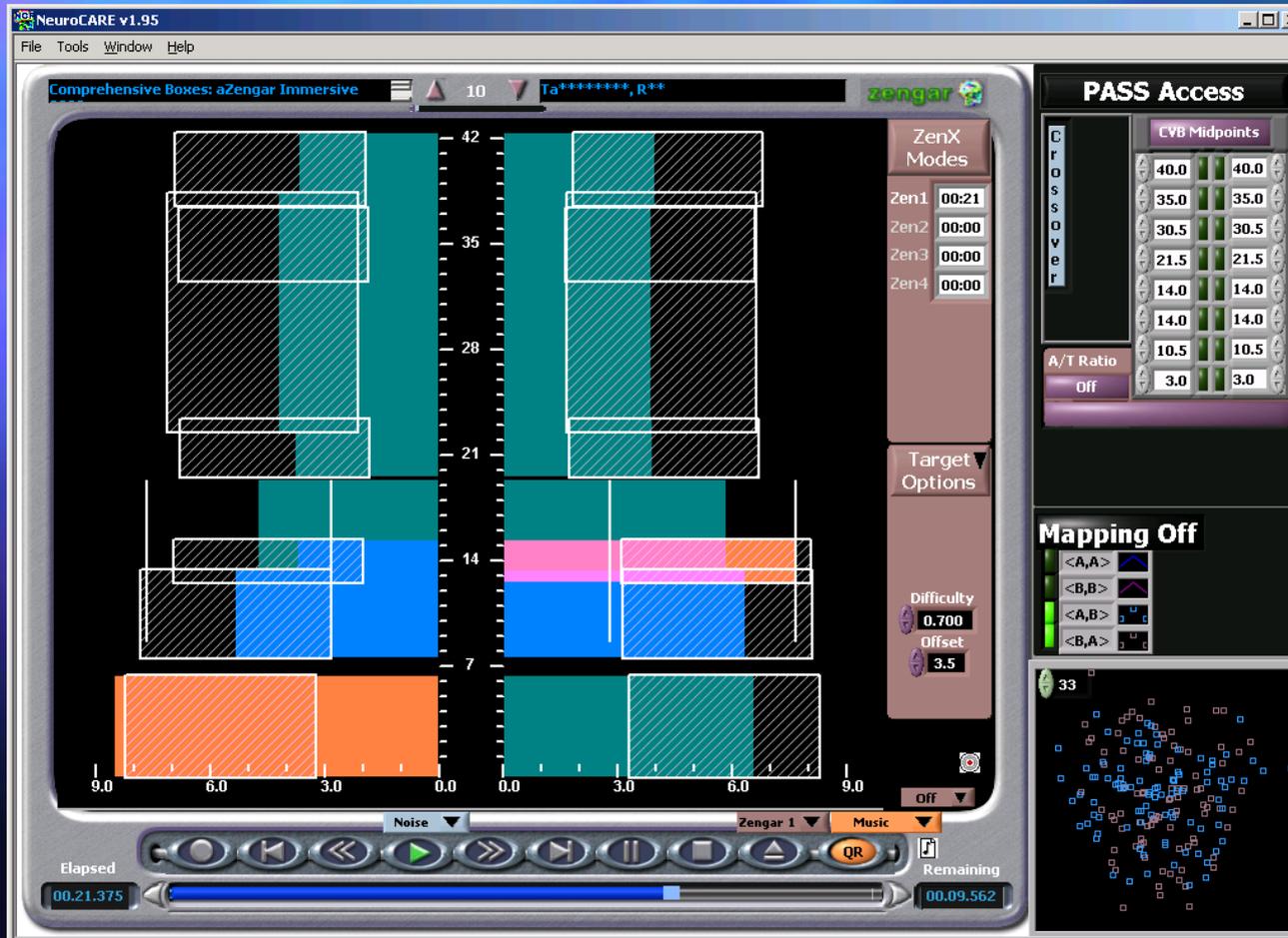
16 target pair neighborhoods (boxes)

8-C3, 8-C4

All target boxes simultaneously active

CNS “decides” where to add or subtract energy

NeuroCARE[®] Neurofeedback Training System

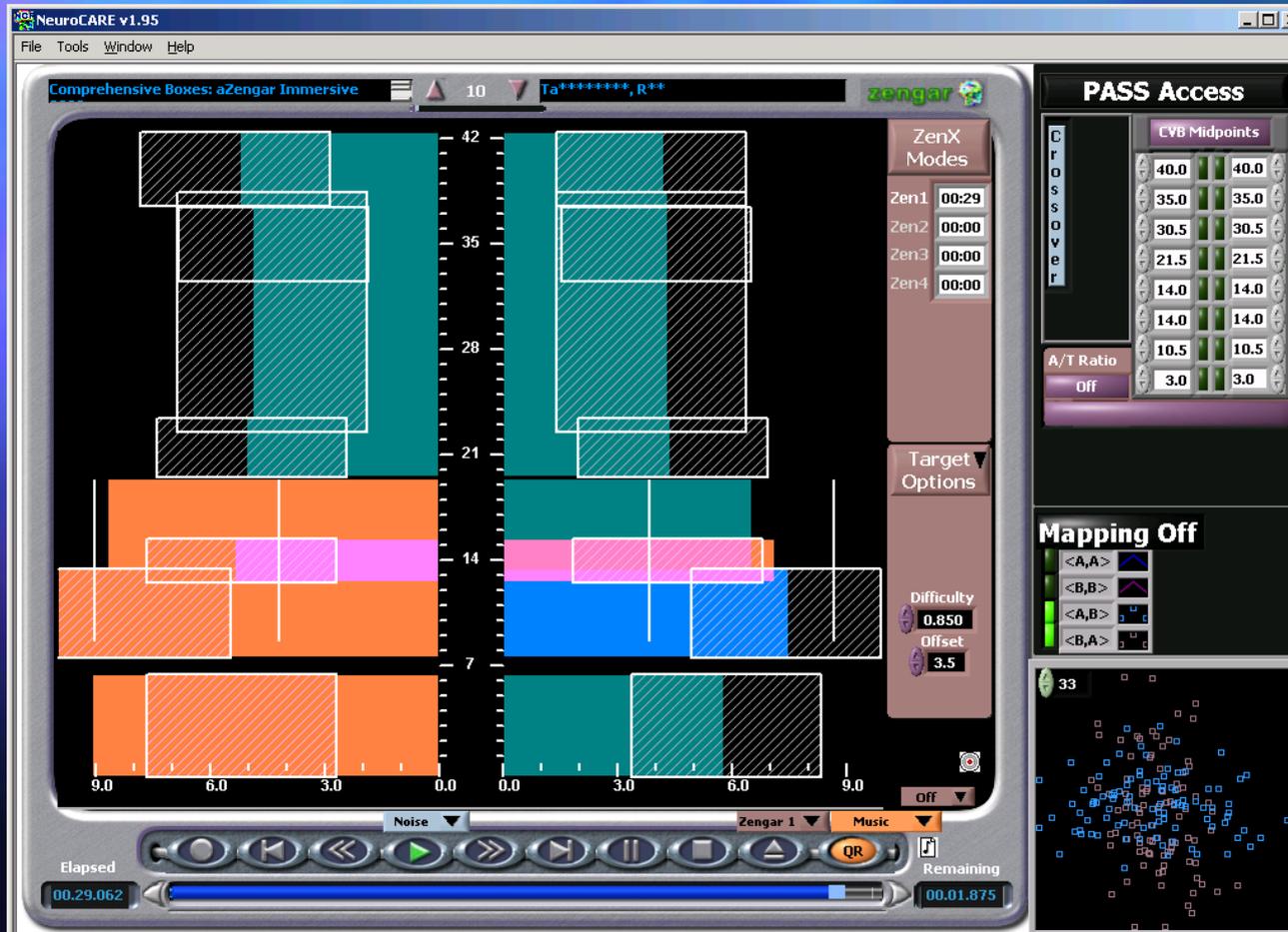


2 target boxes triggering here indicated in orange

0-6 Hz intensity exceeds box in C3

SMR intensity diminished in C4

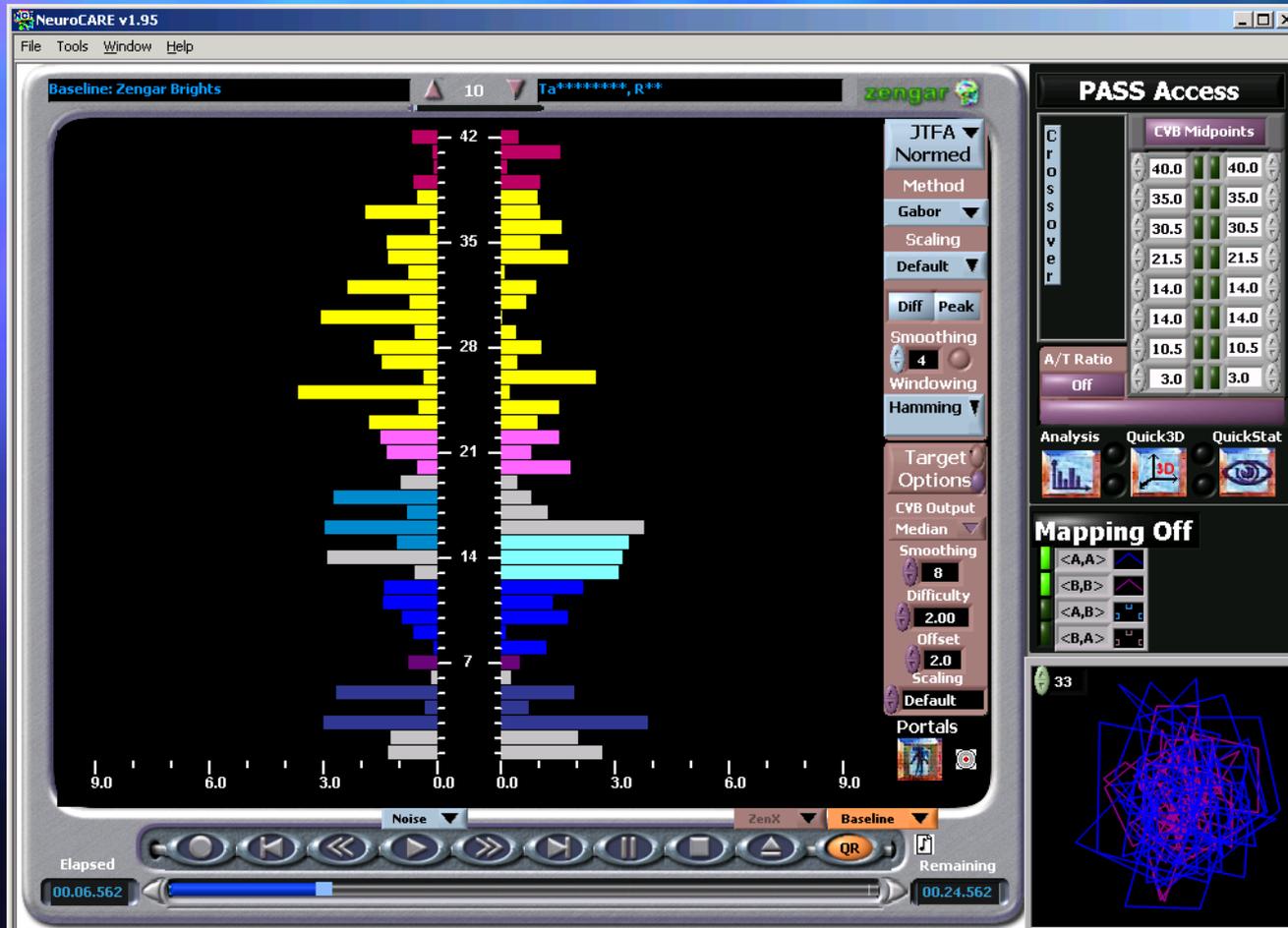
NeuroCARE[®] Neurofeedback Training System



5 target boxes triggering here (4 C3, 1 C4)

CNS “decides” where to add or subtract energy

Baseline Pre-Post Training Session



30 second
baseline data
collected pre
and post each
training session

15s EO/15s EC

Auto Correlation Measure

Time-lag the individual moments of the collected data stream

Allows visualization of how similar those moments of the time-frequency analysis are to themselves

Cross Correlation Of Autocorrelation (CCAC) Measure

Correlate the two “time series” derived from the
auto correlations

Visualize the similarity between each trajectory
of those analyses

Maximally resilient and flexible systems will
approach a gentle, logarithmic, flat correlation
line across the spectral analysis

Baseline Pre-Post Training Session CCACs

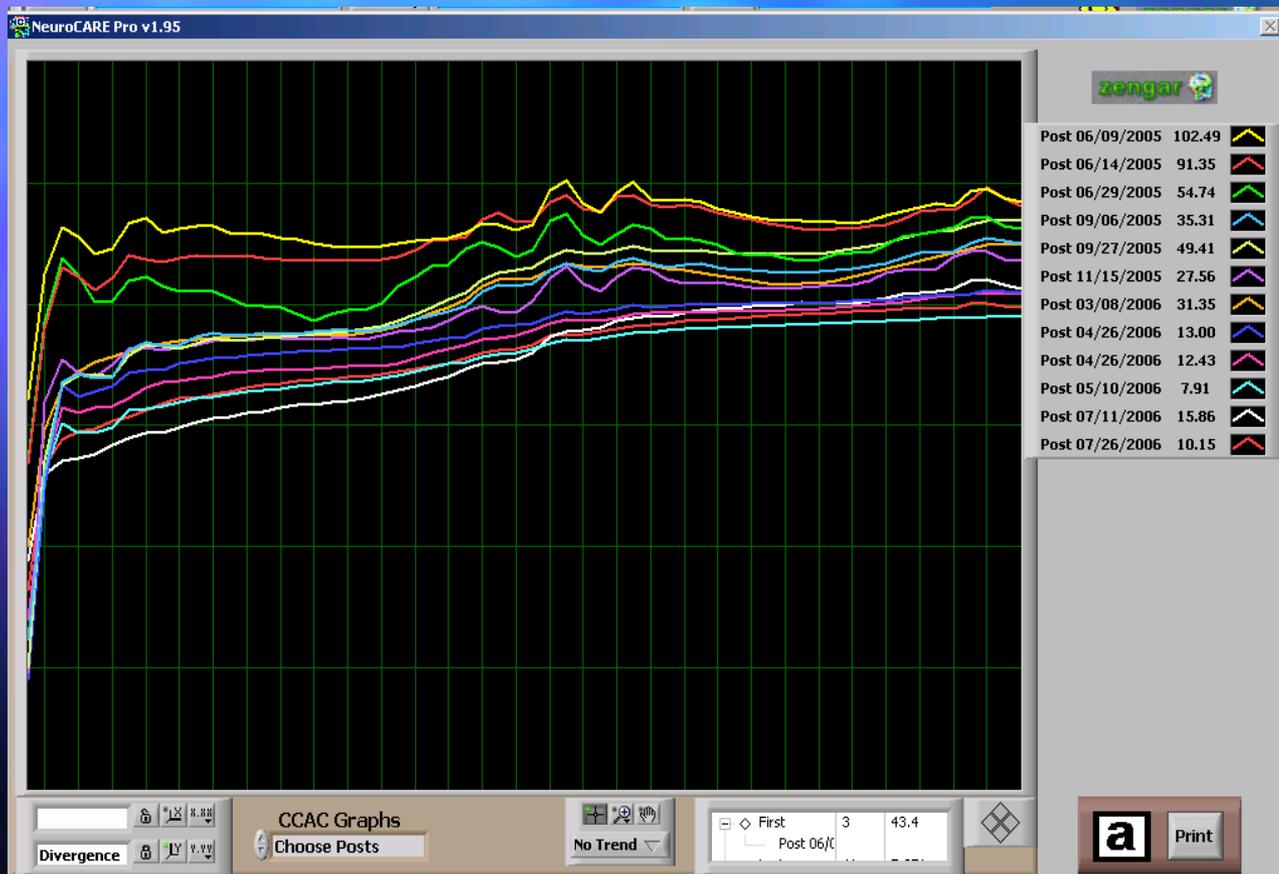


Pre (yellow-dash)
and Post (red-solid)
Training Session
Baselines

Autocorrelation of
C3 crosscorrelated
to autocorrelation of
C4

Dramatic decrease
in emergent
variability seen pre
to post baseline

Baseline Post Training Session CCACs



Decrease in emergent variability seen over time

Some “wobble” seen = worsening before further improvement

Baseline Post Session CCACs Trendline (12 sessions)



Decreased
divergence (CCAC) =
increased stability

Reflects enhanced
efficiency

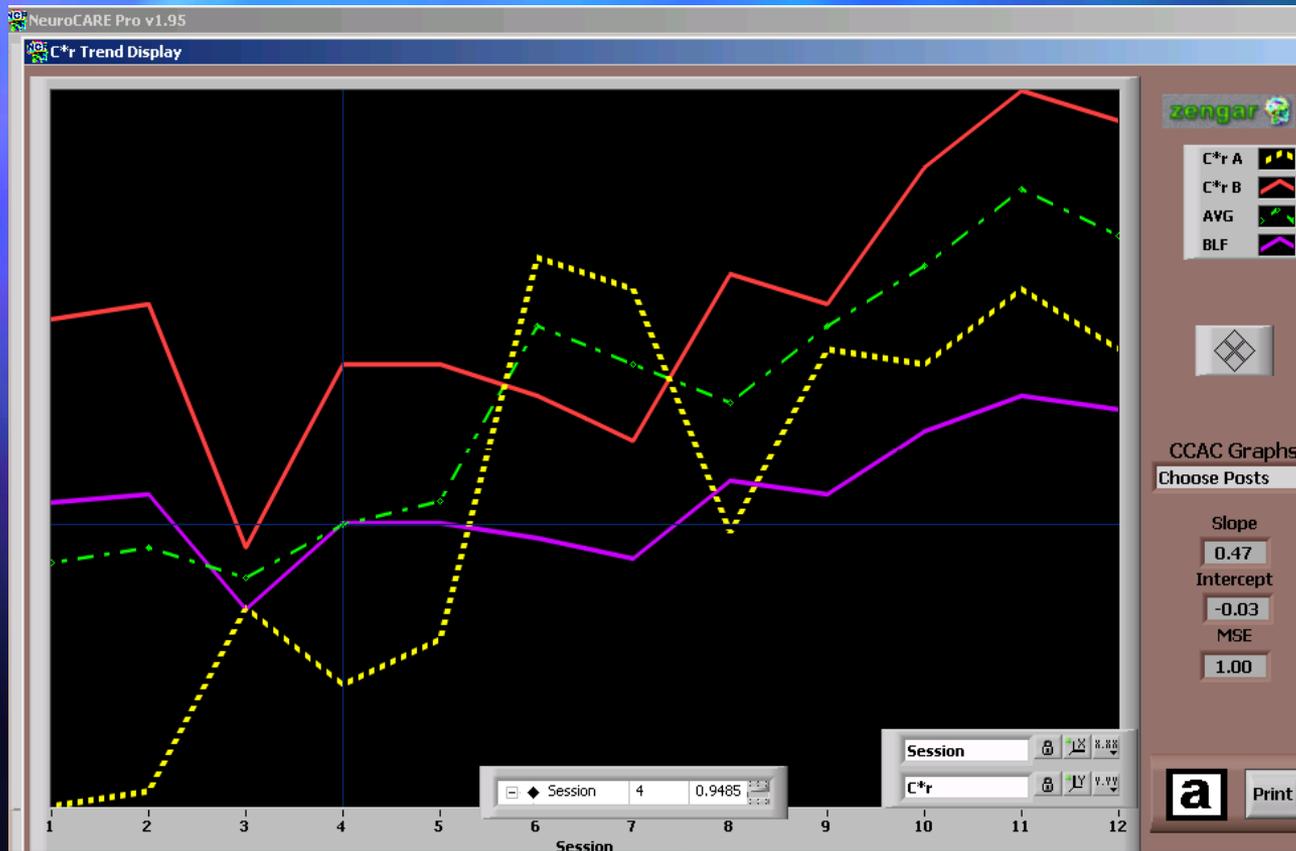
Correlation Dimension: C^*r

Measuring the diameter of the system and its trajectory

Increasing C^*r over time indicates increased richness and complexity – can handle more information

Seizure is low dimensional, low complexity

Baseline Post Session C*r Trendline (12 sessions)

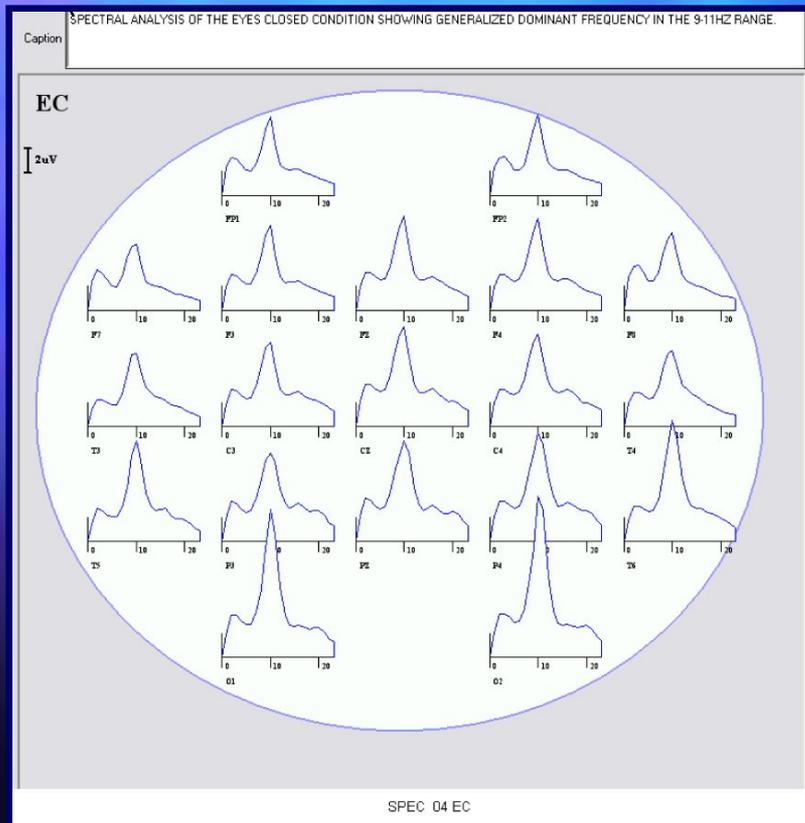


Increased C*r =
increased complexity

Reflects increased
information
processing capacity

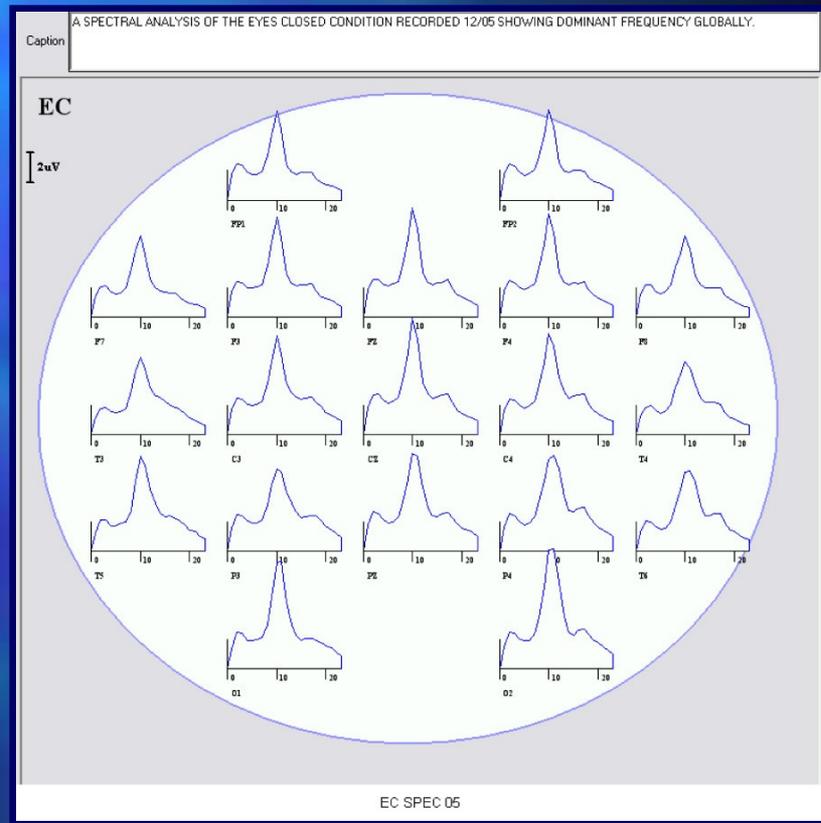
Spectral Analysis of the Eyes Closed Condition

Generalized Dominant Frequency in the 9 - 11 Hz Range



2004

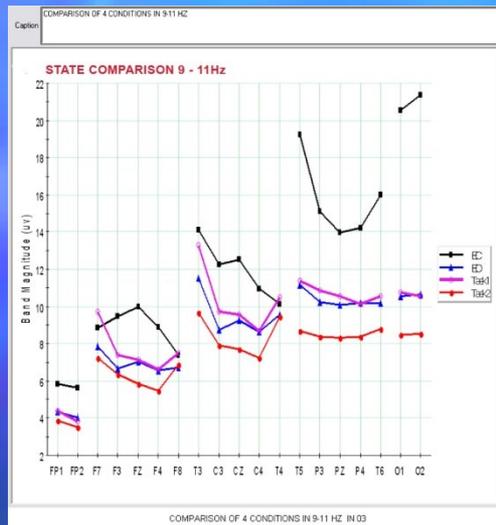
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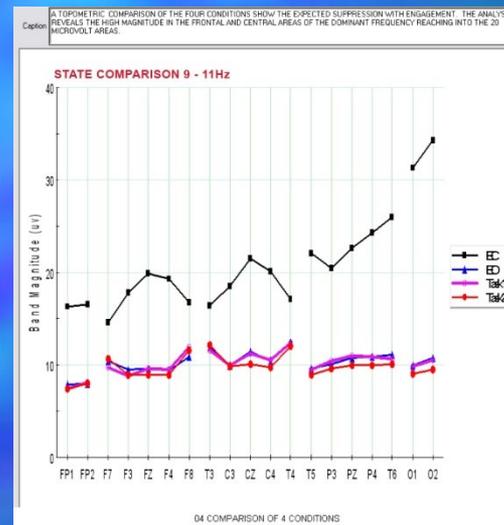
2005

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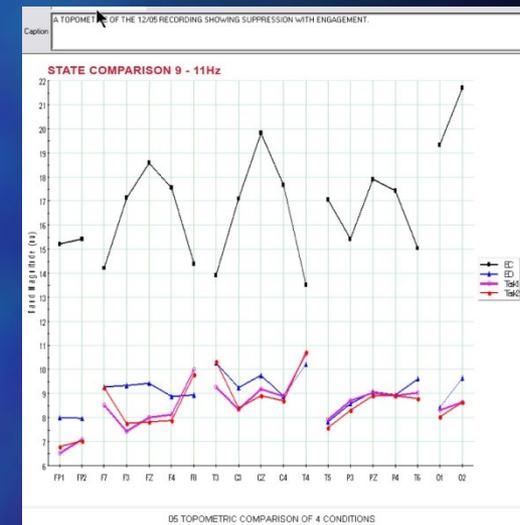
Topometric Comparison Four Conditions in 9 - 11 Hz Range



2003



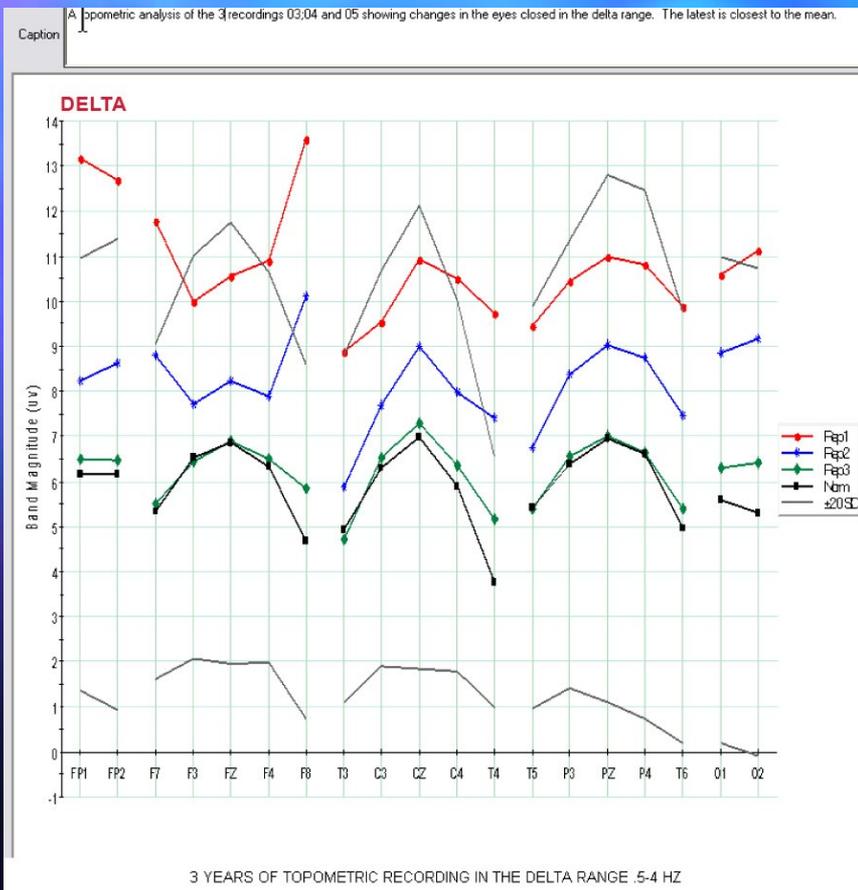
2004



2005

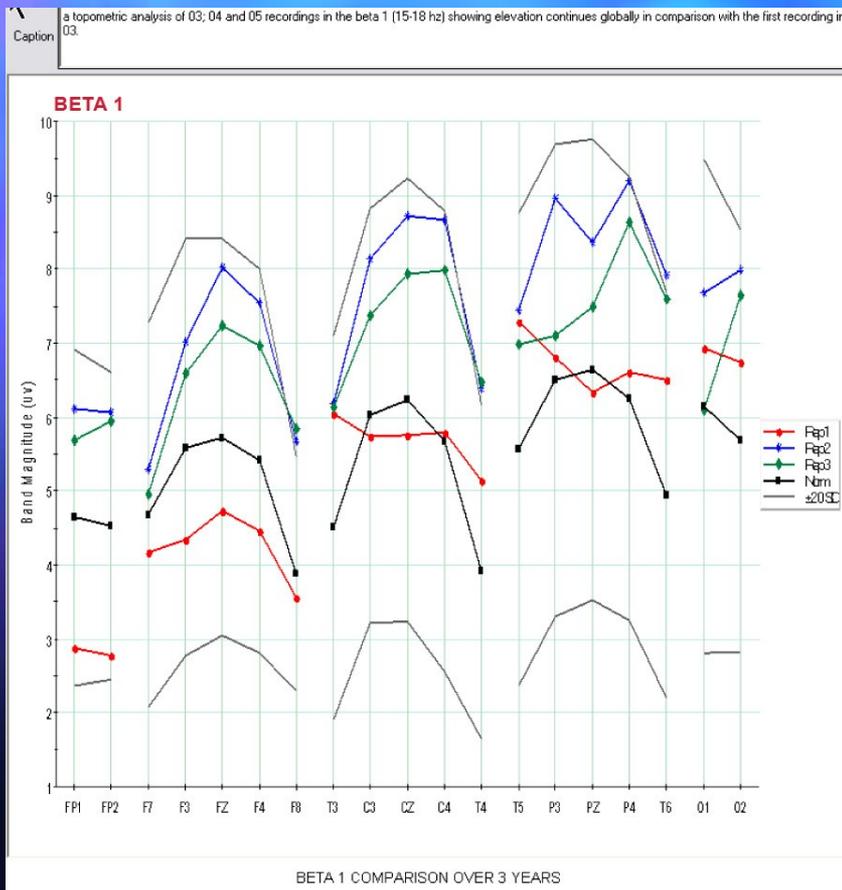
Comparison of the four conditions shows the expected suppression with engagement. The analysis reveals the high magnitude in the frontal and central areas of the dominant frequency reaching into the 20 uv range.

Topometric Comparison Delta Range Over 3 Years



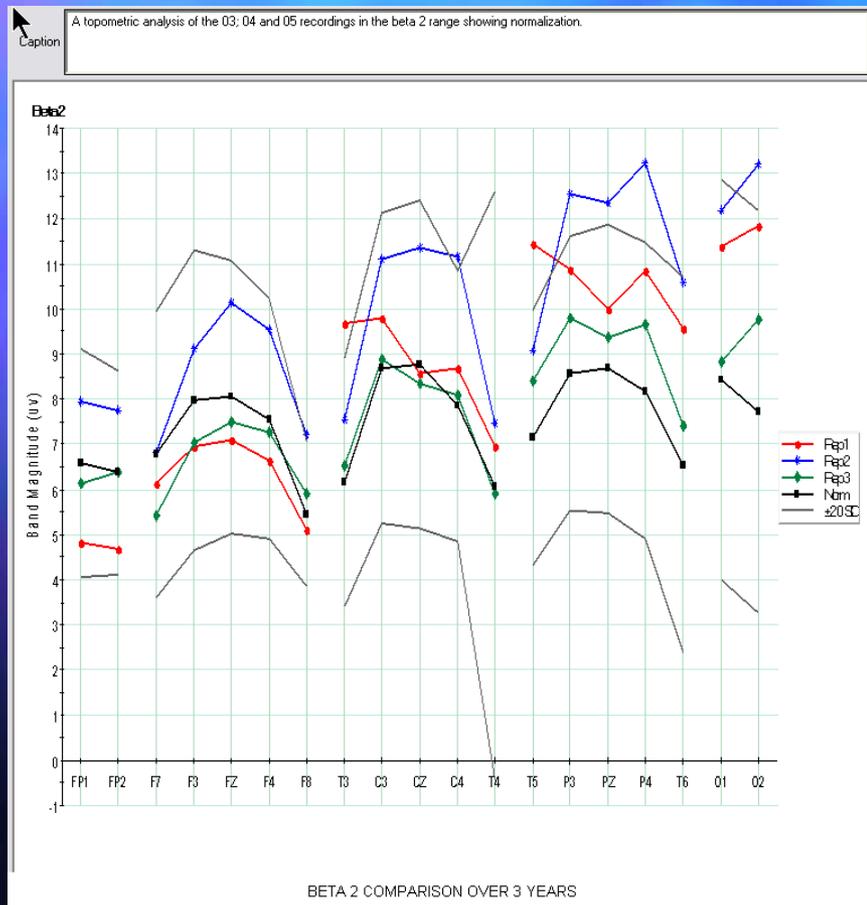
A Topometric analysis of the three recordings in 2003, 2004 and 2005 showing changes eyes closed in the delta range. The latest is closest to the norm.

Topometric Comparison Beta 1 (15-18 Hz) Range Over 3 Years



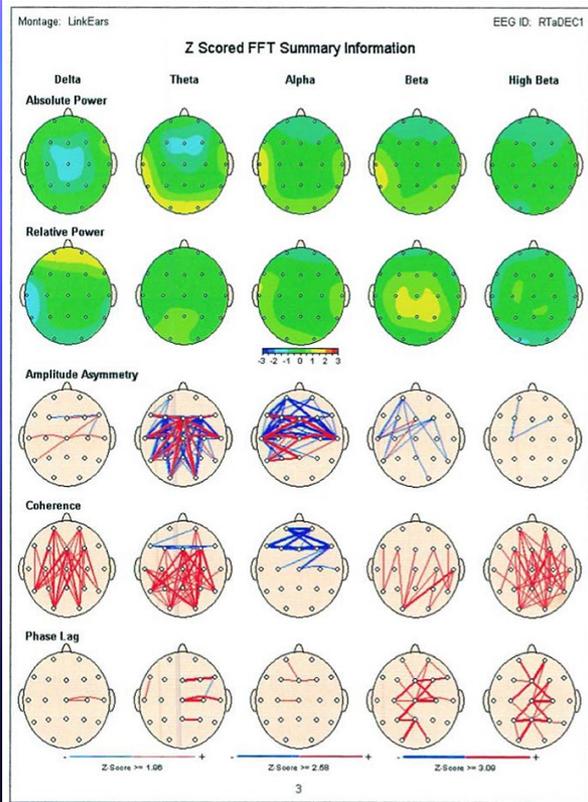
A Topometric analysis of 2003, 2004 and 2005 recordings in 15-18 Hz band showing elevation continues globally in comparison with the recording in 2003.

Topometric Comparison Beta 2 (18-23) Range Over 3 Years



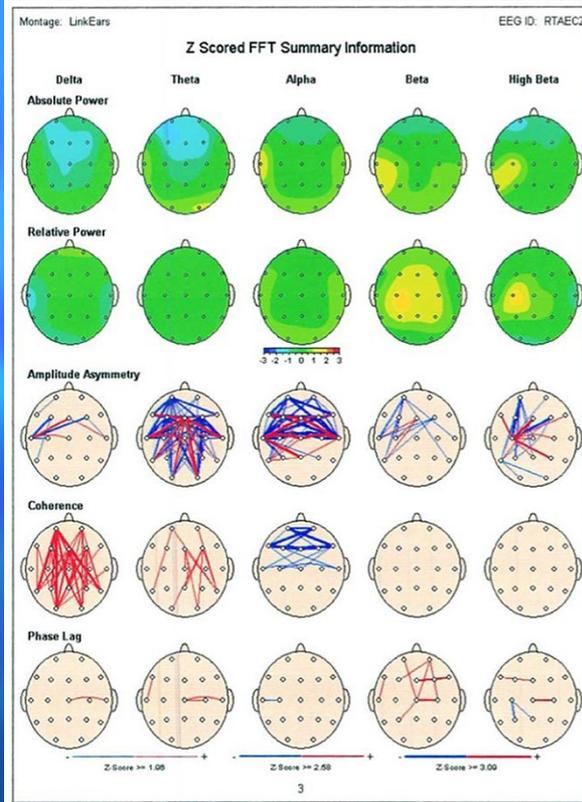
A Topometric analysis of 2003, 2004 and 2005 recordings in the beta 2 range showing normalization

Z Scored FFT Summary Information Eyes Closed



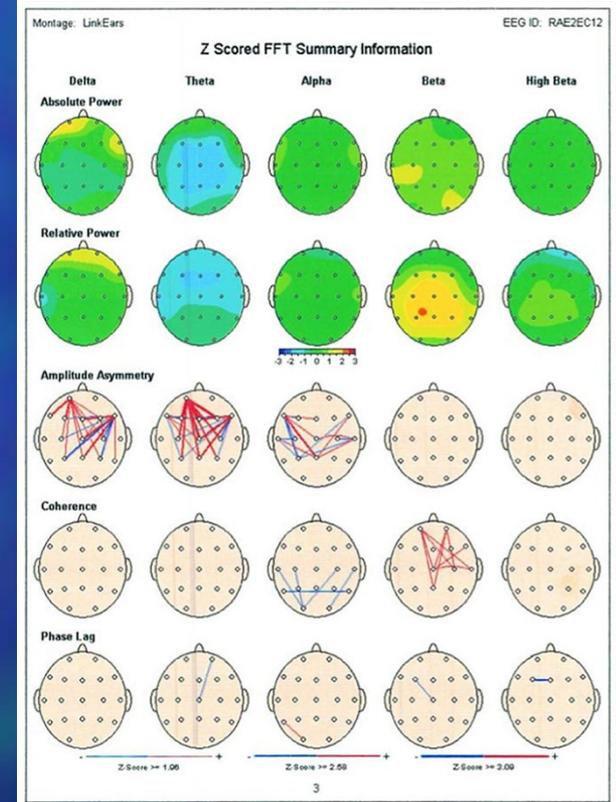
2003

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2004

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2005

Summary

- ❖ Minimal response to site/frequency specific brain driving protocols and hyperbaric TXs, and evidence of structural damage prompts different approach
- ❖ Comprehensive and adaptive global NF training protocol successfully resolves SXs
- ❖ Renormalization of qEEG maps confirms and supports functional improvement

Summary

Yale Lyme specialist attending neurologist confirms SX resolution and suggests that she “...not attend Lyme support group meetings because you will make everyone feel worse.”