

Effectiveness of Neurofeedback Training in Chronic Insomnia

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Introduction

- **Current Therapies for Insomnia**
 - **Chronic Insomnia affects approximately 11.76%, or 32 million of the adults in the US**
 - **Treatment in the real world clinic insomnia population is limited by:**
 - **Access to skilled clinicians who provide Cognitive Behavior Therapy**
 - **Successful CBT requires sustained patient motivation**
 - **Limited long-term efficacy of pharmacologic agents, and risks of adverse effects.**
 - **Need for more therapies that provide long term efficacy in patients with chronic insomnia.**

Background

- **Neurofeedback For Insomnia**
 - **Chronic Psychophysiologic Insomnia is likely related to underlying hyperarousability.**
 - **Neurofeedback (a.k.a. EEG biofeedback) provides physiologic training independent of patient cognition or motivation.**
 - **Early studies in neurofeedback showed highly significant benefit for patients with insomnia, but so far this modality has not been used in standard clinical practice.**

- **Neurofeedback with NeuroCARE[®]**
 - **Neurocare system calculates variability in EEG, in real time, across the spectrum of frequencies from 1 – 60 Hz.**
 - **A threshold is maneuvered to provide auditory feedback (brief interruptions in music being played) when EEG variability increases.**
 - **The efficiency and resiliency of each individual's brain wave patterns are cultivated over successive neurofeedback sessions**

Method

■ **Retrospective Analysis of Insomnia Real World Treatment**

- Retrospective analysis of sleep logs in 18 consecutive patients diagnosed with Chronic Psychophysiologic Insomnia
 - Difficulty initiating and/or maintaining sleep on at least 4/7 nights for at least 6 consecutive months
- Standard Insomnia treatment strategies were provided: sleep restriction, stimulus control, sleep hygiene, and pharmacological treatment as would normally occur.
- Neurofeedback sessions were provided twice weekly, 30 min. per session.

Method

- **Neurofeedback training sessions**
 - **Patients in a recliner chair watch a LCD monitor displaying random visual graphics.**
 - **EEG data collected from C3 and C4 referenced unilaterally to earlobes with separate grounds.**
 - **Patients listen to music through headphones.**
 - **Periods with high EEG variability triggers interruptions in the music (negative feedback).**
 - **Sessions: biweekly for an average of 2 months.**

Result

Mean age: 50 ± 17 yrs, range – 24-91 yrs

Sex: M- 8; F-10

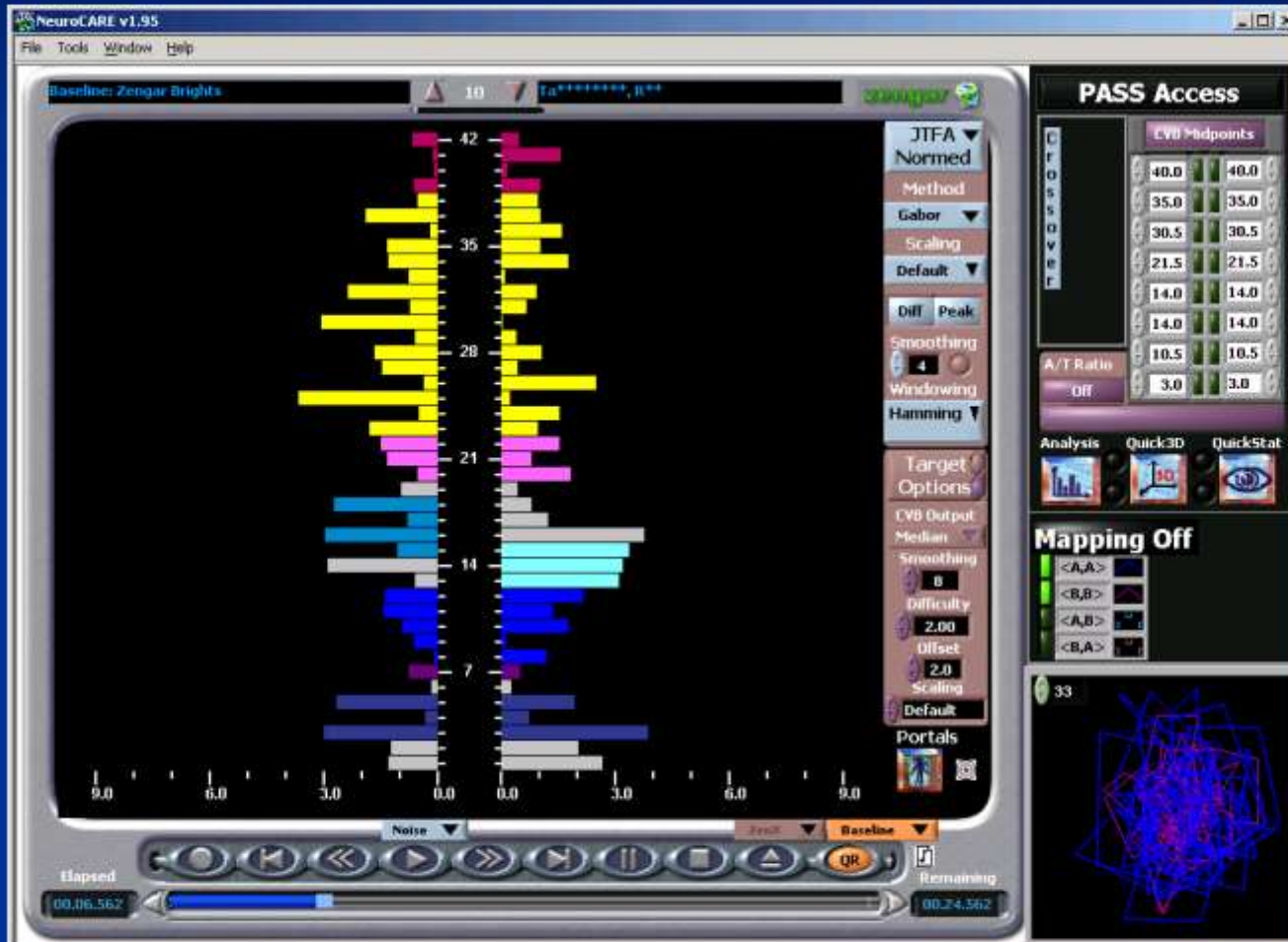
Mean # NFB sessions: 15

Sleeping Aids Used:

Ambien (A), Elavil (E), Lunesta (L), Clonazepam (C),
Estazolam (S), Benadryl (B), Tylenol PM (T), Restoril (R),
OTC-over the counter sleeping aid

Sub #	Age	sex	Insomnia duration (years)	Prev. Med	Curr. Med	Co-morbidity	# of NFB	Sleep Restrictio	Sleep Hygiene	Response n	Relaxatio	Stimulus control
1	91	M	5.5	A, E	L, R	Depression	23	Y	Y	Y		
2	79	F	>10	A	L	PLM, OSA, hypothy.	19	Y	Y			Y
3	59	M	10	A, L	L	OSA	15	Y	Y	Y		
4	62	F	6	A, B	C, L, S	Anxiety, Depression	19	Y	Y	Y		
5	24	F	1	OTC	-	Anxiety	7		Y			
6	39	M	1	-	-	-	11	Y	Y	Y		
7	53	F	8	L, A, B, T	-	Hypothyroid.	4	Y	Y	Y		
8	51	M	1	L	L(pm)	-	6	Y	Y			Y
9	39	F	1	M	A, Alp	Anxiety	15		Y			Y
10	54	M	30	K, A, Zo	K, Zo	Anxiety, Panic attacks	27		Y	Y		
11	34	F	2	L, A, Zo	Alp, Te	Anxiety,	15		Y			
12	52	M	1	Wellbut	A	OSA, Bruxism	13		Y	Y		
13	59	F	29	L, A, E	C	Anxiety, Depression	4		Y	Y		
14	43	F	3+	A, Zolof	Zolof	Anxiety	10		Y	Y		
15	46	F	2	L	A	Anxiety	5		Y	Y		
16	20	M	8	Xyrem	Lexa, Zy pre.	Anxiety, Depression, OCD, Lyme, Tension	4		Y			
17	55	M	>10	-	Neuron	Mild OSA, RLS, PLM	30		Y			
18	47	M	14	Zolof	L	OSA	14		Y			

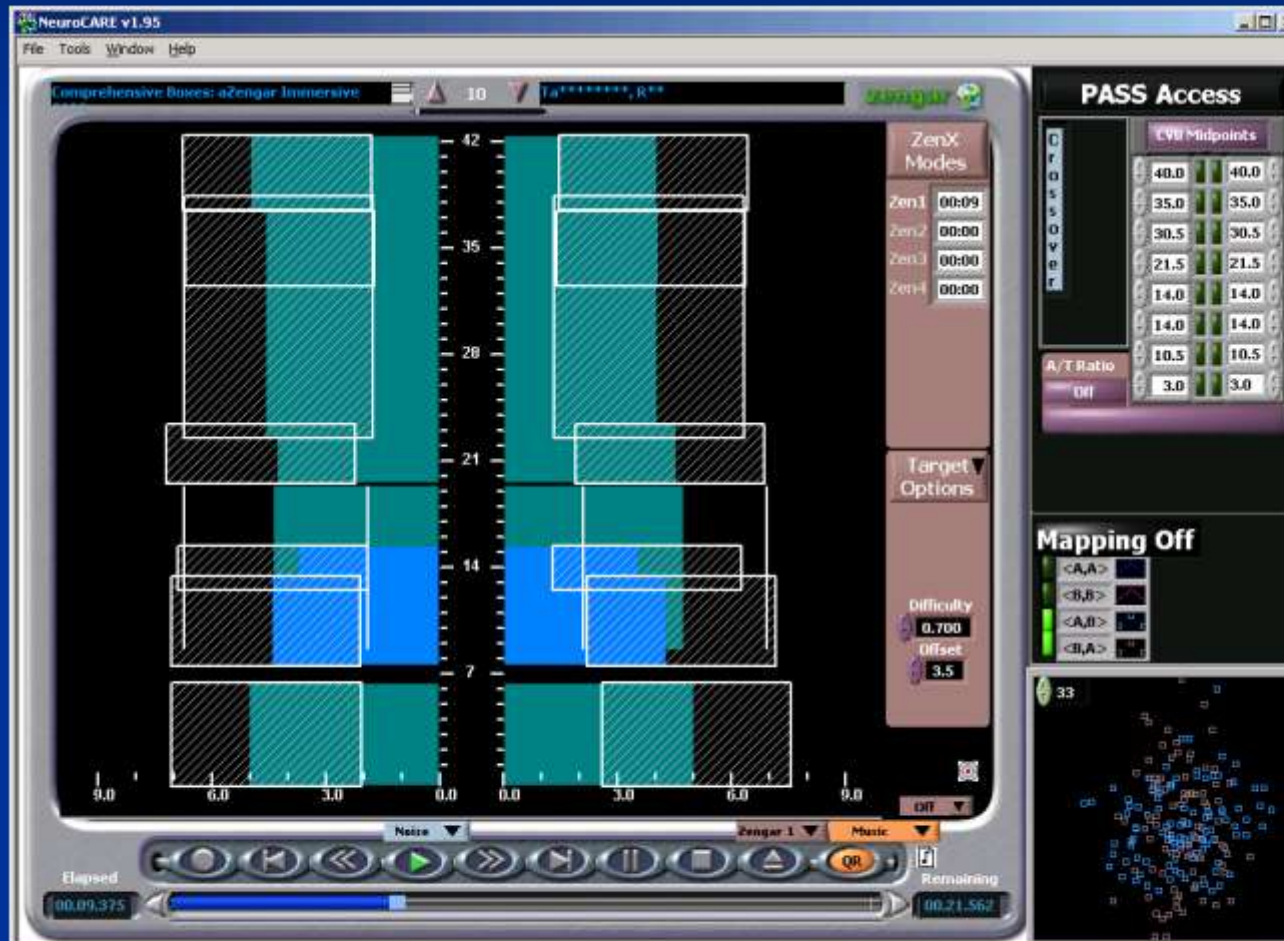
Baseline Pre-Post Training Session



30 second
baseline data
collected pre
and post each
training session

15s EO/15s EC

NeuroCARE[®] Neurofeedback Training System



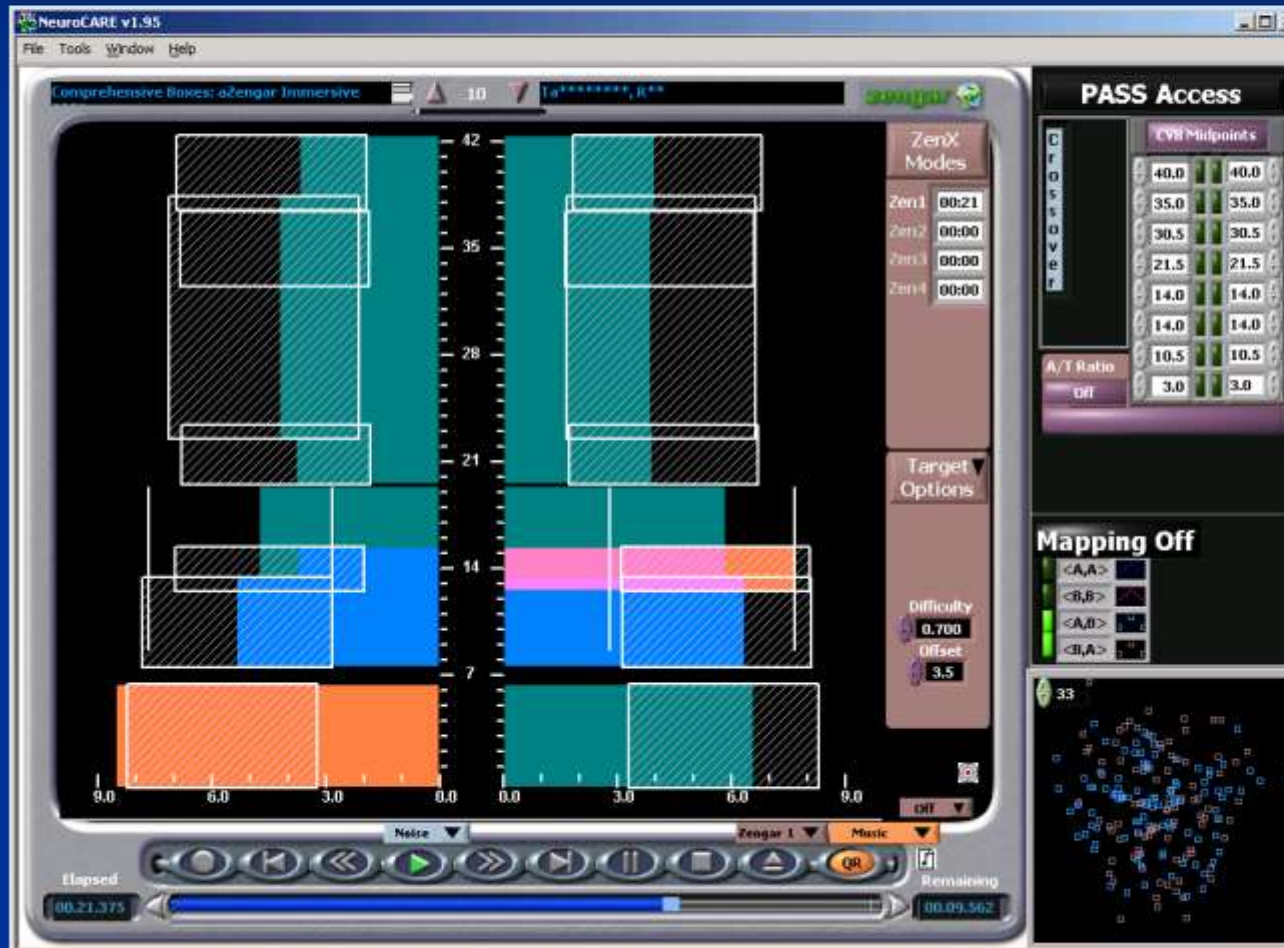
16 target pair neighborhoods (boxes)

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

Table 2.

Sleep Log Data (mean \pm SD)

Sleep Parameters	Pre-NF	Post-NF	% Change	p value
Total sleep time (hrs)	5.7 \pm 1.3	6.6 \pm 0.8	+15.8.9%	<0.005
Sleep efficiency (%)	75 \pm 11	90 \pm 6	+ 20.0%	<0.001
Wake after sleep onset (hrs)	1.1 \pm 0.8	0.4 \pm 0.3	- 63.6%	<0.001
Sleep onset latency (mins)	47.2 \pm 33.5	20.8 \pm 25.1	- 55.9%	<0.005

Wake after Sleep Onset

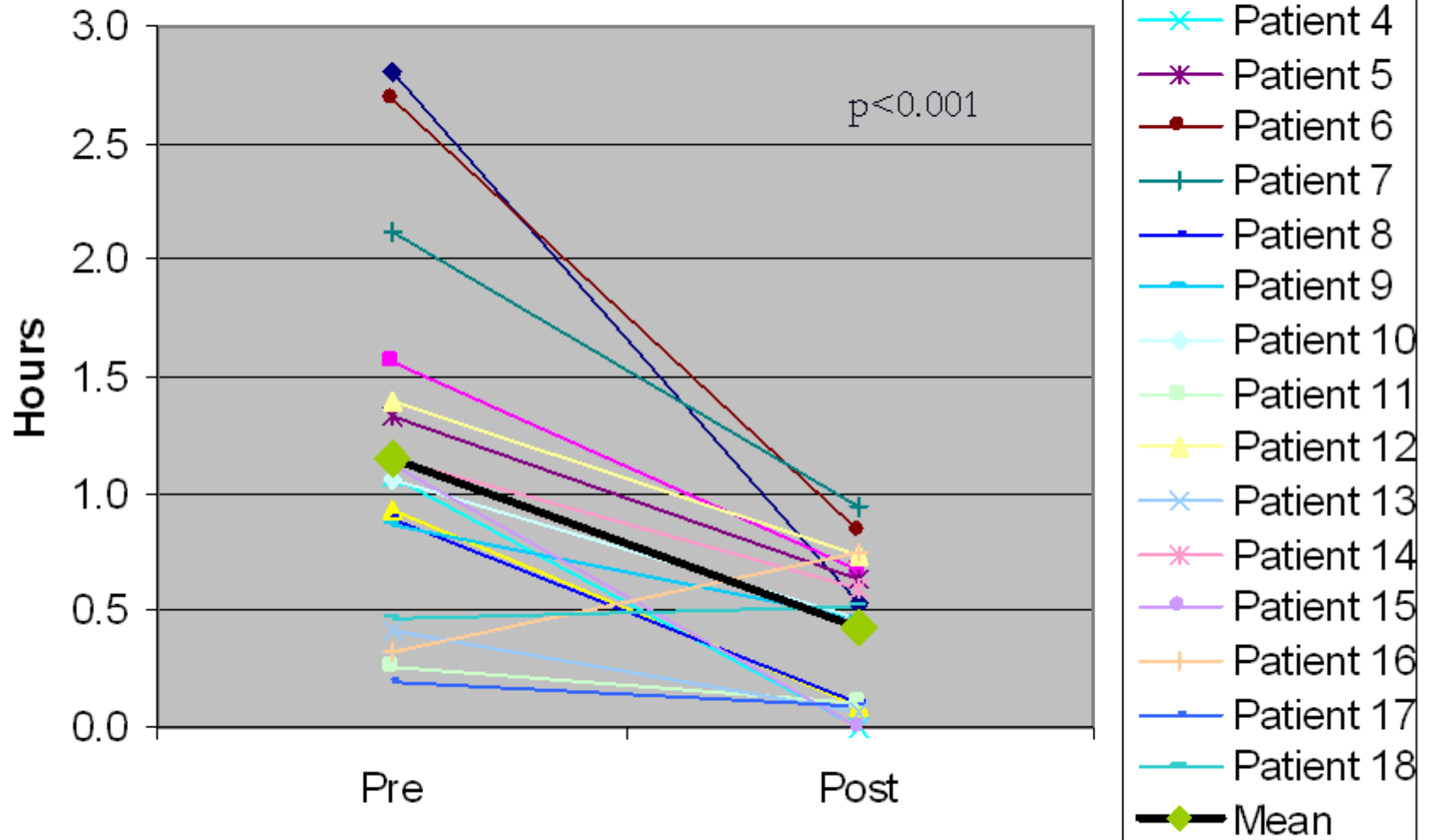


Fig 1. Decrease in Mean WASO (1.1hr to 0.4hr)

Sleep Onset Latency

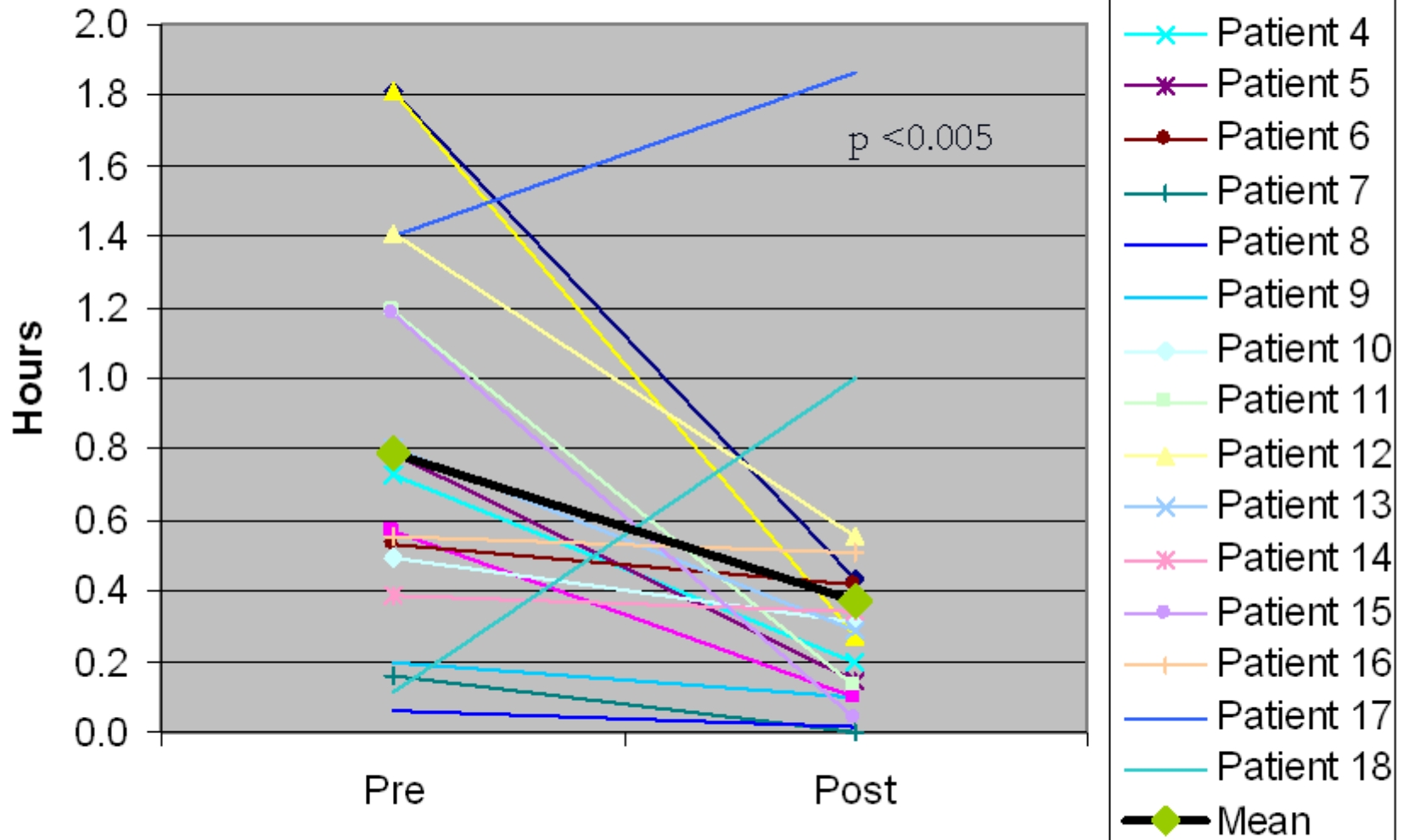


Fig 2. Decrease in Mean SOL (0.8hr to 0.4hr)

Total Sleep Time

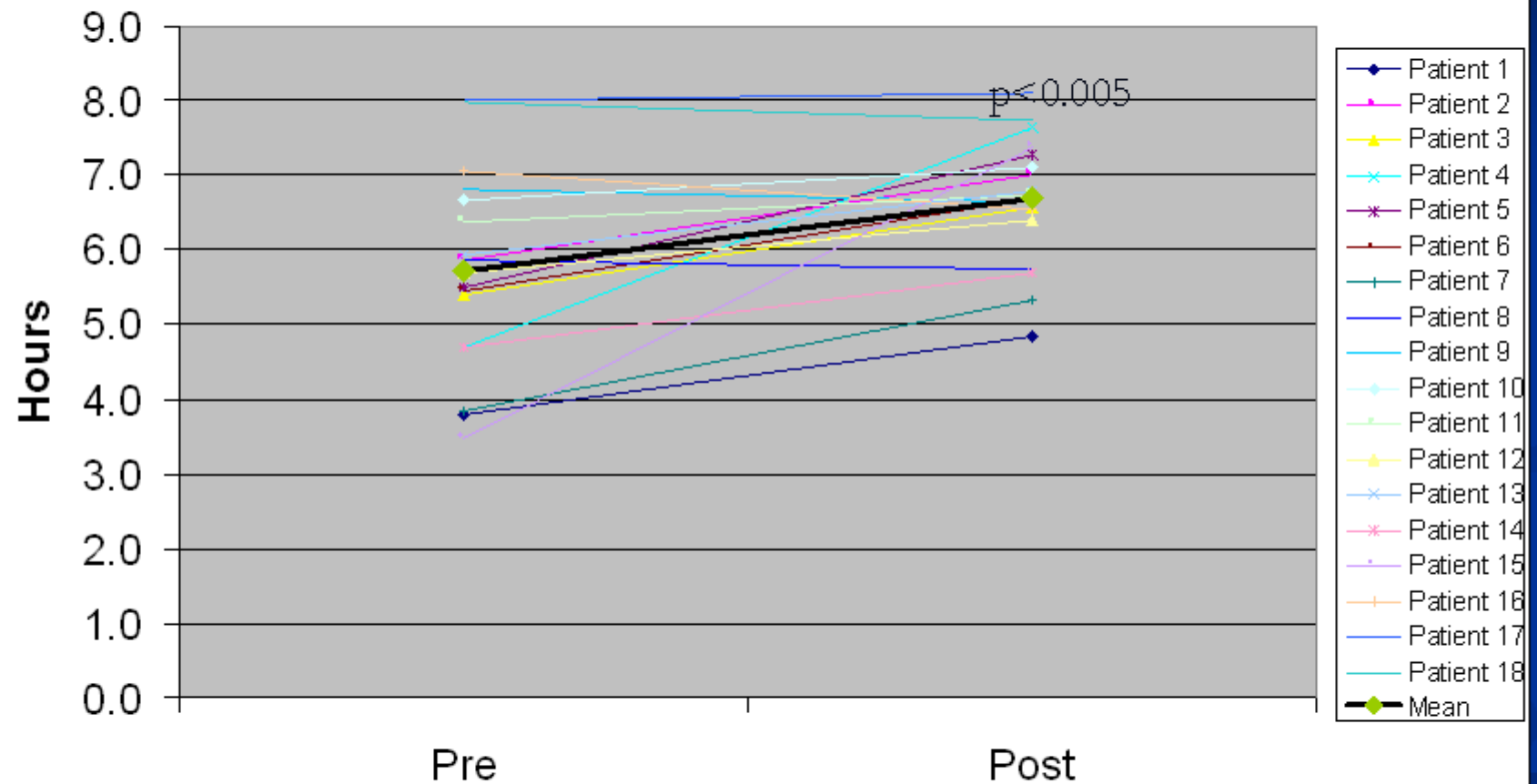


Fig 3. Increase in Mean TST (5.7hr to 6.7hr)

Sleep Efficiency

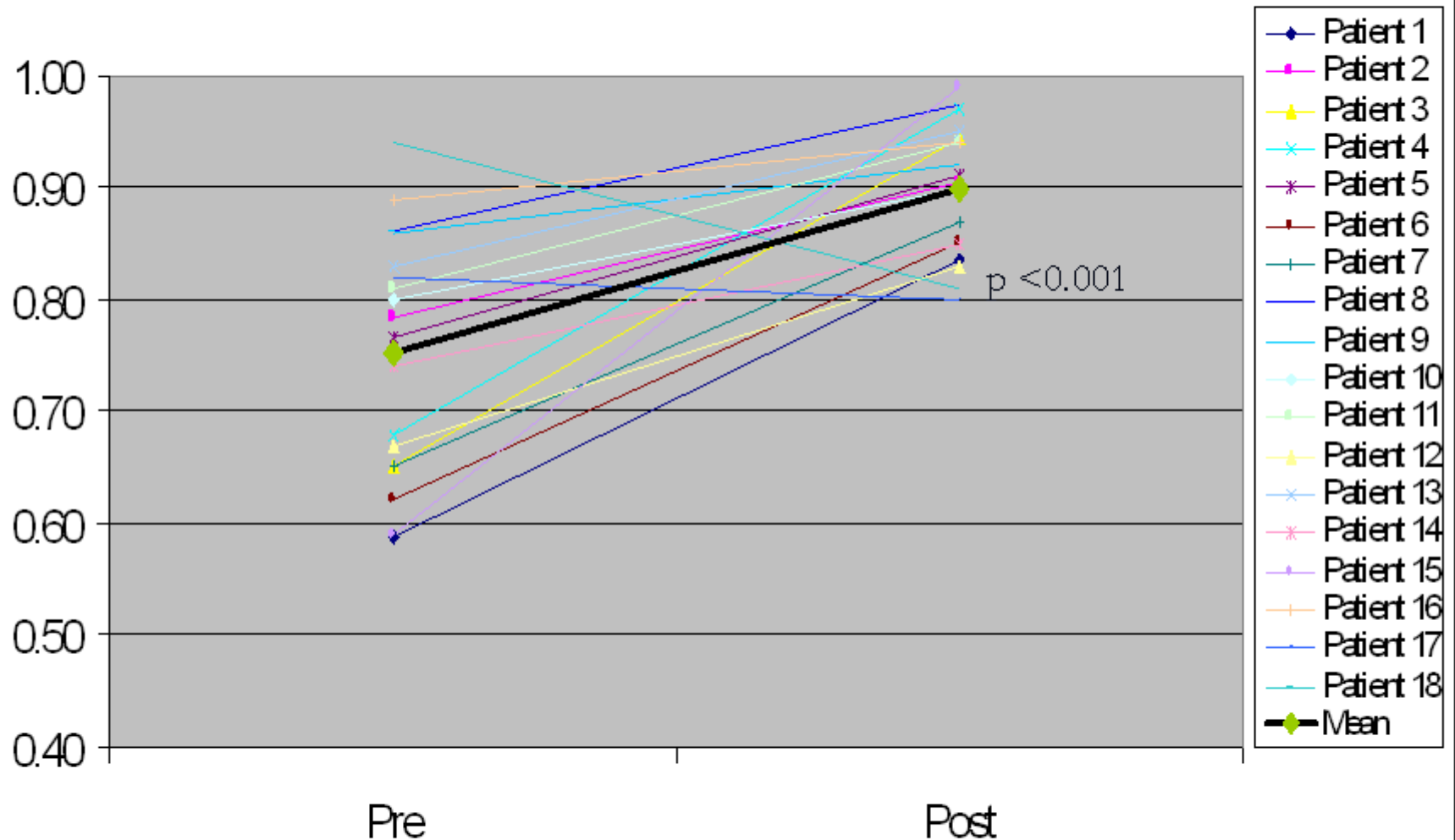


Fig 4. Increase Mean SE (75% to 90%)

Conclusions/Future Research

Neurofeedback:

- is an effective tool in the management of chronic insomnia
- may enhance or be used in place of CBT-I
- may prove effective as monotherapy

Need to Evaluate:

- randomized, sham-controlled clinical trial to determine efficacy as monotherapy (currently underway)
- long term effectiveness

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