

**BRAIN STIMULATION IMPROVES COGNITION AND MOOD
OF PATIENT WITH DEMENTIA**

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Abstract

Photic and auditory stimulation of the brain has led to improved IQ scores among learning disabled children. This study was designed to assess if similar stimulation procedures could improve cognition & mood of demented Patients.

Methods: 15 geriatric patients of mixed type dementia were randomized into 3 groups: audiovisual stimulation, attention control given relaxation tape, & a control group without intervention. The treatment group received 20 hours of photic and auditory stimulation using AVS 1000. Stimulation rate was synchronized and regulated by the patient's dominant EEG frequency. Mattis Dementia Rating Scale (DRS) and Profile of Mood States (POMS) were given at baseline & at the end of treatment.

Results	Dementia Rating Scale		POMS
	Attention	Total	Total POMS
AVS vs. AC	4.89***	-0.30	-2.29*
AVS vs. NC	5.10***	5.19**	-2.82*
AC vs. NC	-0.19	3.68**	-0.18

Number of subjects for AVS = 7, for AC = 4, for NC = 4, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. DRS memory & total DRS scores improved but were not statistically significant. No side effects were noted.

Conclusions: Preliminary analysis appear to support the hypothesis that EEG-driven synchronized photic and auditory stimulation could improve mood and cognition of geriatric patients suffering from mild to moderate dementia.

Background

Evidence of structural changes resulting from stimulation of the brain has been found at the neuronal level and supported microscopically and behaviorally by animal research. Significant increases in the level of brain functioning in humans, in response to the challenge of learning control over levels of EEG have likewise been reported. In humans, the increase in the level of brain function appear to be related to the stimulation of learning, photic and auditory centers, and practicing the complex task of self-regulating the EEG amplitude and frequency of direct electrical stimulation of the brain.

The theoretical basis for using audiovisual stimulation (AVS) is that the presentation of a visual /auditory stimulus to the brain elicits a visual/auditory evoked response. The presentation of continuous photic or auditory or combined stimuli elicit a response called entrainment in which the frequency of EEG activity matches itself to the frequency of the stimuli. Thus the AVS permits the experimenter to stimulate the brain at a chosen frequency for a specific period of time.

The use of AVS with learning disabled children has resulted in measurable improvements in cognitive functioning in the form of significant increases in IQ scores in the lower functioning hemisphere. Recovery of IQ scores has also been reported for a post stroke patient after extensive stimulation with AVS and EEG biofeedback.

The mechanism by which brain stimulation leads to improvement in attention is unclear. It may be related to the increase in cerebral blood flow which in turn increases activation of the brain responsible for attention and STM.

Study Design

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graph LR; A[Study Design] --> B[Study sample: 15 mild to moderate dementia (MMSE 15-23) No history of seizures]; B --> C[Audiovisual stimulation: Synchronized photic and auditory stimulation driven by patient dominant EEG frequency delivered through goggles and ear phones, 20 minute sessions, 2x/day, 5x/week for 6 weeks]; B --> D[Attention Group: Relaxation tapes through ear phones, 20 min sessions, 2x/day, 5x/week for 6 weeks]; B --> E[Control group: No intervention];
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Study sample:

15 mild to moderate dementia

(MMSE 15-23)

No history of seizures

Audiovisual stimulation

Synchronized photic and auditory stimulation driven by patient dominant EEG frequency delivered through goggles and ear phones, 20 minute sessions, 2x/day, 5x/week for 6 weeks

Attention Group

Relaxation tapes through ear phones, 20 min sessions, 2x/day, 5x/week for 6 weeks

Control group

No intervention

Study Endpoints: Mattis Dementia Rating Scale

Attention	Digit Span (0-8) Two successive and single Commands (0-6) Imitation (0-4)
Initiation and Preservation	Complex & Simple Verbal Initiation and preservation (0-28) Consonant Preservation (0-1) Vowel Preservation (0-1) Double alternating movements (0-3) Graphomotor Design (0-4)
Construction	Construction Designs 1 and 2. (0-6)
Conceptualization	Identities and Oddities (0-16) Similarities (0-22) Verbal Recall (0-1)
Memory	Orientation (0-9) Counting Distraction 1 and 2 (0-11) Verbal Recall, reading (0-4), and initiation (0-3) Verbal reading (0-3) and recognition (0-5) Visual matching (0-4) Visual memory (0-4)

Study Endpoints: Profile of Mood Scale (*Likert scale*)

Friendly
Tense
Angry
Worn out
Unhappy
Clear headed
Lively
Confused
Sorry for things done
Shaky
Listless
Peeved
Considerate
Sad
Active
On edge
Grouchy
Blue
Energetic
Panicky
Hopeless
Relaxed

Unworthy
Spiteful
Sympathetic
Uneasy
Restless
Unable to concentrate
Fatigued
Helpful
Annoyed
Discouraged
Resentful
Nervous
Lonely
Miserable
Muddled
Cheerful
Bitter
Exhausted
Anxious
Ready to fight
Good natured
Gloomy

Desperate
Sluggish
Rebellious
Helpless
Weary
Bewildered
Alert
Deceived
Furious
Efficient
Trusting
Full of pep
Bad tempered
Worthless
Forgetful
Carefree
Terrified
Guilty
Vigorous
Uncertain about things
Bushed

Results Conclusions

P O M S T o t a l	B e g i n i n g	E n
A u d i o v i s u a l	2 4 1 . 3 1 ± 1 0 . 3 2	1 8 9 . 4 3
R e l a x a t i o n t a p e	2 3 1 . 7 5 ± 1 0 . 7 9	1 9 4 . 0 0
C o n t r o l	2 1 8 . 8 6 ± 8 . 1 6	1 8 2 . 2 9

Results: T score for within group comparisons

Group	Dementia Rating Scale (DRS)		POMS
	Attention	Total	Total
AVS vs. AC	4.89***	-0.30	-2.29*
AVS vs. NC	5.10***	5.19**	-2.82*
AC vs. NC	-0.19	3.68**	-0.18

n for AVS = 7, n for AC = 4, n for NC = 4
 * p < 0.05, ** p < 0.01, *** p < 0.001

Results

DRS Attention	Beginning	End
Audiovisual	25.14 \pm 1.13	25.57 \pm 1.13
Relaxation tape	28.00 \pm 1.42	22.75 \pm 1.42
Control	27.86 \pm 1.27	22.85 \pm 1.49

DRS Total	Beginning	End
Audiovisual	79.86 \pm 3.69	84.43 \pm 3.69
Relaxation tape	77.00 \pm 4.89	76.65 \pm 4.89
Control	86.80 \pm 4.37	75.83 \pm 5.12

Conclusions

- **Photic and auditory stimulation of the brain is very safe and not associated with any side effects.**
- **Photic and auditory stimulation is associated with improvements in the attention subscale in the Dementia Rating Scale.**
- **Photic and auditory stimulation is associated with improvements in mood as reflected in the Profile of Mood States.**
- **Larger randomized trials are needed to determine the long term benefits of photic and auditory stimulation.**